UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

INSTRUCTIONS
FOR
AIRWAY METEOROLOGICAL SERVICE

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[*Fifth Edition*]

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WEATHER BUREAU

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

ERRATA

Circular "N," 5th Edition 1941, Chapter 31-R, Effective July 1, 1948

Corrections to Chapter 31-R should be made as follows:

1. Page 98-R, paragraph 31100, last line, read "..... in paragraphs 31101 to 31115."

2. Page 115k, paragraph 31454.1, line 2, read "$H_sH_sM_sP_sD_s$."

3. Page 115m, paragraph 31469, next to last line, read "in amounts of 0.05 inch or less ....."

4. Page 115q, Figure 8,

   (a) 0728 Observation, Columns 28 and 32, read "9."
   (b) 1328 Observation, Column 26, read "↖."

5. Page 115s, Figure 10,

   (a) Example 3, column 23, read "^{c}Ac."
   (b) Example 9, column 24, read "MO."
   (c) Example 10, column 24, read "MO."
   (d) Example 11, column 27, read "E50."

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Amendment 5 - 10/1/43
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Amendment 7 - 10/1/44
Amendment 8 - 2/15/45
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Amendment 10 - 6/15/46
Amendment 11 - 12/11/46

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Correction, effective 6-15-46
Condensed table of critical values
Errata, effective July 1, 1948

PREFACE

This general circular, fifth edition, covering instructions for the airway meteorological service will become effective November 1, 1941, and supersedes the fourth edition of Circular N and all amendments thereto.

This edition is published in loose-leaf form for the use of Weather Bureau stations and others closely connected with the airway meteorological service. In order that one loose-leaf copy may serve for various functions, for example, at the forecast and the observation desks, the circular has been divided into four sections, namely, Organization and Administration, Observations, Forecasts and Analyses, and Instruments, thus permitting the Observation Section to be retained on the observation desk and the Forecasts and Analyses Section on the forecast or map desk.

The loose-leaf copies will be kept up to date at all times by issuing any changes in instructions relating thereto in a loose-leaf form for insertion in the circular. Bound copies of this circular are available for distribution to the general public.

Effort has been made to insure that all instructions contained herein are as clear as possible. However, in case any of these are not understood, the matter will be brought to the attention of the Central Office—through proper channels, when necessary—for interpretation. Weather Bureau field officials shall not issue such interpretations without the prior approval of the Central Office.

NOTE.—The term "Central Office," as used throughout this circular, refers to the main office of the Weather Bureau at Washington, D. C.

Section I

ORGANIZATION AND ADMINISTRATION

PART I.—THE WEATHER BUREAU'S METEOROLOGICAL SERVICE IN AID OF AIR NAVIGATION

CHAPTER I

AUTHORITY FOR THE SERVICE

1–100. By authority of the Air Commerce Act of 1926, and the Civil Aeronautics Act of 1938, the Weather Bureau is charged with the responsibility of furnishing an adequate meteorological service for aviation in order "to promote the safety and efficiency of air navigation in the United States and above the high seas."

CHAPTER II

AIRWAY WEATHER SERVICE

1–101. A successful solution of the weather problem for aviation requires, first of all, a dense network of surface and upper-air observation stations, manned by trained observers, and the rapid transmission of frequent reports from these. Secondly, it requires a technical staff of employees at terminal airports to prepare frequent weather maps, upper-air charts, and diagrams from which a picture of the changing weather situations may be presented; and, thirdly, it requires competent meteorologists to analyze the current weather conditions, anticipate the development of new situations, compute the movement of pressure systems, and to issue, on the basis of these, short-period forecasts for the route to be flown. In constantly endeavoring to maintain as complete a service as possible the Weather Bureau has established several hundred stations at fairly regular distances apart along the civil airways in the United States, Alaska, and Hawaii, and, in addition, a large number of stations rather uniformly distributed off the airways for reporting weather. Reports are collected by teletype and radio from airway stations and by telegraph and telephone from off-airway stations, and are relayed to required points along the airways by the Civil Aeronautics Administration radio and teletype systems. There are well-distributed stations, equipped for taking upper-air wind observations, and additional stations at which upper-air observations are made by airplanes and by instruments which are carried aloft by balloons and report conditions through the medium of radio signals (radiosonde). At important airway terminals, qualified meteorologists of the Weather Bureau are on duty 24 hours a day charting and analyzing weather reports and discussing the meteorological conditions with pilots.

1–102. Supervision of the airway weather service in the field is exercised by general supervising stations, each one of which has a certain district for which it issues forecasts, maintains an inspectional service, and has general authority in regard to supervision of stations in that district, while the central office at Washington, D. C., has administrative control and exercises supervision of the service as a whole.

CHAPTER III

SURFACE WEATHER OBSERVATIONS

1–103. Weather observations are taken hourly throughout the 24 hours at most of the stations located on civil airways. Special observations are taken at these stations whenever marked changes in weather conditions occur. At stations located off the airways, observations are taken every 6 hours, and every 3 hours at a number designated

to do this. Reports from ships at sea, made 4 times daily, are also available. Observations generally consist of ceiling (height of cloud layer above the ground) in feet; sky conditions; visibility in miles; weather conditions (including precipitation, squalls, etc.); obstruction to vision (fog, haze, etc.); temperature; dew point; wind direction and velocity; barometric pressure; pressure change tendency; amount, type, and direction of clouds, and miscellaneous information (thunderstorms, line-squalls, etc.). To facilitate the transmission of the reports, they are put into a symbol, word, or figure code, depending upon the type of observation and whether the station making the report is on an airway, is an "off-airway" station, or a ship at sea.

CHAPTER IV

UPPER-AIR OBSERVATIONS

1–104. Weather Bureau first-order stations at airway terminals and a number of stations off the airways are equipped to take observations of directions and velocities of upper-air winds. These are called "pilot-balloon observations." They are made at 6-hour intervals and are accomplished by means of a strong, but light, rubber balloon, which is inflated with the proper amount of helium to make it rise at a known rate of speed. This balloon is released and its progress in the upper air followed by means of a theodolite, which is a special telescope devised to enable the reading of the horizontal and vertical angles from the observer of the object being sighted. These angles, representing the path of the balloon, are read at regular intervals until the balloon passes from sight, or bursts, due to the excess of internal over external pressure acting on the thin rubber walls of the balloon in the upper air. The readings thus obtained, when computed in connection with the rate of ascent, readily give the velocity and direction of the wind at the various desired altitudes. Such information is broadcast by radio to pilots. It is also transmitted by figure code on teletype and radio circuits and, when charted for a number of stations, gives the pilot a picture of the winds he will encounter.

1–105. Upper-air observations are also made by means of airplanes at a few stations in the United States, through cooperation of the Weather Bureau and Navy Department. In most cases the flights are made daily. The airplanes carry a self-registering instrument (aerometeorograph) which records the barometric pressure, temperature, and humidity throughout the flight. The records made by the instrument are coordinated with the conditions observed by the pilot (icing, precipitation, etc.), and the information obtained is transmitted in a code form by teletype and radio and is useful in identifying air masses, tracing their movement, and defining their boundaries, as well as indicating stability, water vapor content of the air, likelihood of clouds, or precipitation, etc. These observations also give pilots information regarding the height of the top of cloud layers, regions of icing conditions, etc.

1–106. Observations of conditions in the upper air are made daily at a number of stations by means of the radiosonde. This is a lightweight instrument, with a radio transmitter, which, after being attached to a balloon and released, will transmit a record by radio of the barometric pressure, temperature, and relative humidity as it ascends. Such information is used in the same way as reports from airplane observations.

1–107. Upper-air observations, made by air-line pilots in flight, are received by the Weather Bureau stations and used in completing cross sections of the atmosphere and in perfecting their analyses of meteorological conditions.

CHAPTER V

COMMUNICATIONS

1–108. A system of teletype and radio circuits is provided by the Civil Aeronautics Administration for the rapid collection and distribution of weather information. Such a communication system is essential for an effective airway weather service. The weather observations are collected in sequences each hour, beginning with the first station on each circuit and continuing station after station, in their proper order along

the airway, until all reports of that circuit are collected. The reports of each circuit are then automatically relayed to such other circuits as require them. Complete weather information is thus made available at every important airway terminal as soon as the sequence collections and relays have been completed, which is only a few minutes after the meteorological observations represented by the report have been made. The reports are broadcast by radio to pilots in the air, posted on Weather Bureau bulletin boards, entered on meteorological charts and maps, and disseminated by telephone and interphone systems as they are received, so that pilots and air-line dispatchers have a constant knowledge of the latest developments in meteorological conditions.

1–109. Stations off the airways report by telephone and telegraph and these reports are collected at designated centers and relayed to teletype circuits for distribution to all stations where required.

CHAPTER VI

WEATHER MAPS AND CHARTS

1–110. In order that the information received from a collection of hundreds of weather reports may be transformed from a picture of instantaneous weather conditions at each station to a picture of the general conditions over a large area, the reports are entered on maps, covering large areas of the country and adjacent regions, and are also plotted on various other meteorological charts. From these maps, drawn for surface observations and charts plotted from the information received from airplane, radiosonde, and pilot-balloon observations, the trained meteorologist is enabled to make his analysis of weather conditions pertinent to aviation, including determining the characteristics and boundaries of the various types of air masses present.

CHAPTER VII

AIRWAY FORECASTS

1–111. From careful study and analysis of meteorological charts and maps the forecasts are made. Airway forecasters are on duty 24 hours a day at the general supervising stations, which are also forecast centers for their respective districts. At these stations airway forecasts are made every 6 hours for periods of 8 hours in advance for all airways and all terminals within the district. Such forecasts include ceiling heights, visibility, sky conditions, precipitation, fog, smoke, haze, icing, thunderstorms, squalls, etc., expected to occur over the airways or at the terminal within the district during the period of the forecast. Special forecasts are issued when conditions change rapidly. In some instances, forecasts for a period longer than 8 hours in advance are made, when required, for long cross-country flights.

CHAPTER VIII

MISCELLANEOUS SERVICES RENDERED

1–112. The Weather Bureau has also special and miscellaneous duties in regard to aviation, such as maintaining meteorological service for air meets, air races, massed flights of Army and Navy planes, etc. In addition, meteorological data are compiled for air line and aircraft companies and Government agencies, to be used in helping to solve the problems of aviation as affected by the weather. Pilots or operators may consult with trained meteorologists for information concerning their weather problems. This consultation service is available at important airway terminals at all hours of the day or night.

Chapter IX

ALASKAN SERVICE

1–113. Special mention should be made of the Weather Bureau's service to air navigation in Alaska because of the importance and rapid growth of aviation in that territory. While a large part of its area covered by airways presents no more serious weather conditions for flying than are experienced in the United States, there are localities where fog at subfreezing temperatures, which deposits ice on exposed objects, rolls in from open inlets in a matter of minutes. Fully realizing the need for an adequate system of frequent weather reports to safeguard this rapidly developing air transportation in Alaska, the Weather Bureau maintains a network of hourly and 6-hourly (three times daily at present) reporting stations, and in addition a number of "on-call" stations from which observations may be obtained as needed. At certain selected stations, radiosonde and pilot-balloon observations are made daily in order that upper-air conditions may be determined. Airway forecast centers have been established at Juneau and Fairbanks to provide adequate meteorological forecasts for the more than 3,000 miles of airways of Alaska. At present all transmission of weather reports is by radio, railroad telegraph, or telephone. Most of the reports are collected for broadcast to aircraft from radio stations. New weather-reporting and radio stations are being established in cooperation with the Civil Aeronautics Administration and Coast Guard as funds become available.

Chapter X

THE WEATHER SERVICE BEHIND THE SCENES

1–114. The workings of the service can probably best be illustrated by an actual example. Let us suppose, therefore, that we were passengers en route on an air-line plane from New York City to Chicago. If we could look behind the scenes we would see a large force of men busy at the work of guiding and guarding the plane in its flight. One of the most important factors of such service would be to determine weather conditions and to make certain that all available information was used to the best advantage. We would find that long before we left New York City the air line's dispatcher had been checking with the Weather Bureau meteorologists there to determine whether the weather conditions would be such as to make it advisable to plan the flight. Since, up to an hour or so before the scheduled departure, clouds had been low on the mountains in New York and Pennsylvania, and the ceiling was below landing limits at Cleveland, it was necessary to have a forecast prepared by the Weather Bureau meteorologists, based on hundreds of reports, to determine whether the flight should be attempted. From a study of the current weather map and supplementary charts the meteorologists determined that the ceiling at Cleveland would rise, and, from a study of airplane and radiosonde observations, they found that the pilot could fly above the clouds blanketing the mountains without having to ascend to a point of discomfort to the passengers or poor operation of the plane. Therefore, the plan for the flight was made and our reservation accepted for seats on the plane. The consultations between meteorologists and the dispatcher were not complete, however, because of the requirement of a clearance sheet for the flight showing the weather at various terminals and intermediate airports, as well as the winds aloft, the latter based on the latest pilot-balloon observations. Also, the requirement of the entry of the latest available forecast for the airway and the terminal on the clearance sheet had to be fulfilled. Before the take-off the pilot checked with the Weather Bureau on the wind and weather at New York City, the conditions over the mountains and at Cleveland, and made sure that conditions all along the route could be flown satisfactorily and with safety. Also, he studied the winds-aloft map, which had been prepared from numerous pilot-balloon observations, in order to take advantage of any favorable winds or to mitigate the effects of adverse ones. After the take-off he would receive, by radio, the latest forecasts and weather reports for the air line ahead. All of these things would be done for many other planes and their passengers while we would ride comfortably and securely, served by a Federal weather service, which is doing everything possible within the limits of available appropriations to make air navigation safe and efficient.

PART II.—ADMINISTRATION OF THE SERVICE

CHAPTER I

REGULATIONS

1–200. Topics and Personnel.—This publication is issued monthly by the Central Office and is a means of presenting to the service any topics of current interest and instructions pertinent to general administration, such as opening and closing of stations, changes in personnel, etc. Topics and Personnel copies shall be preserved in a loose-leaf file until the end of the year, when they shall be bound by means of round-head paper fasteners, in heavy paper covers, which will be furnished for the purpose by the Central Office upon request. Indexes for Topics and Personnel are furnished by the Central Office at the end of each year and these should be bound with the file. Instructions contained in Topics and Personnel have the same importance as other instructions issued from the Central Office; therefore, a card index should be kept of Topics and Personnel in order that administration as directed by this publication may be effectively carried out.

1–201. Circular Letters and Printed Instructions Received.—Circular letters and printed instructions shall be preserved until the end of the year in loose-leaf files and then bound separately in the same manner as Topics and Personnel, except that circular letters which remain in effect during the subsequent year will be kept together and filed separate from the bound file and in a convenient manner for ready reference.

1–202. Letters Received Containing More or Less Permanent Instructions.—Letters received containing instructions of a permanent nature shall be initialed by all members of the station force and filed with circulars after suitable entry has been made in correspondence files to show the receipt and disposition of such letters.

1–203. Circulars Issued.—At stations where circular letters are issued a file of such letters shall be preserved. These will be indexed and bound, as provided in the case of printed instructions and circulars issued from the Central Office.

1–204. Station Regulations.—These are regulations for the conduct of the Weather Bureau, which are published for the information and guidance of all concerned. Station regulations are bound in loose-leaf form in order that any amendments may be inserted. The regulations must be kept up to date and must be rigidly adhered to. The procedure, as outlined in paragraph 314 of Station Regulations, is to be followed in reporting aircraft accidents.

1–205. Department Regulations.—These are regulations for the conduct of the Department of Agriculture. For instructions relative to the continued use of these regulations by the Weather Bureau since its transfer to the Department of Commerce, see article entitled "Maintenance of the Regulations of the Department of Agriculture" in the June 1940 issue of Topics and Personnel.

1–206. Government Travel Regulations.—These are regulations to be observed by anyone on official Government travel. They must be carefully studied by anyone contemplating travel at Government expense and/or on Government business.

CHAPTER II

ADMINISTRATION AND SUPERVISION OF AIRWAY WEATHER SERVICE

1–207. General and Direct Supervision.—General supervision of airway service is assigned to 13 centers, namely, Albuquerque, N. Mex., Arlington, Va. (Washington National Airport), Atlanta, Ga., Billings, Mont., Chicago, Ill., Cleveland, Ohio, Fort Worth, Tex., Kansas City, Mo., New Orleans, La., New York, N. Y., San Francisco, Calif., Seattle, Wash., and Salt Lake City, Utah. The assignments of general

supervision to these stations are made directly from the Central Office, and the districts as of March 15, 1941 (New Orleans district created after March 15) are shown on the Airway Meteorological Service map inserted at the end of this circular. General supervision of the airway service in Alaska is assigned to Juneau and in the Hawaiian Islands to Honolulu.

1–208. Duties of General Supervising Stations.—The general supervising station will be responsible for organizing, administering, and coordinating the service over the airways and the district assigned to them for general supervision in such a way as best to meet the needs of the air traffic using the airways. In general, this means that they will perform the following functions:

(*a*) *Recommendations.*—Make recommendations to the Central Office and carry out the project upon receipt of approval for—

1. Opening and closing of substations.
2. Additional reports involving commercial tolls.
3. Increased or decreased compensation to airway observers.
4. Disposition of instruments of closed stations.
5. Instrumental equipment for new stations or additions to that of stations already established.
6. Additions or reductions in personnel at airport or airway stations in their districts.
7. Administration of the checking system for 6-hourly observational forms.
8. Other such matters as may arise and require such action.

(*b*) *Inspections.*—Make inspections of airways or individual stations in the district.

(*c*) *Certificates of authority.*—Issue certificates of authority for taking airway weather observations. These certificates are to be issued after an observer passes a suitable examination given by a supervising official.

(*d*) *Correspondence with other stations or the Central Office.*—Conduct correspondence with other first-order or airport stations, or with substations, as may be required by circumstances. When referring to stations under the general supervision of another station, the correspondence shall be sent through that station. Also, when referring to substations under the direct supervision of a first-order or airport station, the matter shall be taken up through that station. If matters are of joint concern to more than one general supervising station, correspondence on these will be referred to each one concerned; recommendations thereon to the Central Office will have endorsements of all general supervising stations involved.

(*e*) *Correspondence with regional supervisors.*—Conduct all correspondence with the regional supervisors of the Civil Aeronautics Administration. Stations other than general supervision stations are not authorized to do this. Questions arising at those points and requiring such action should be referred to the general supervising station.

NOTE—Copies of correspondence as outlined above will be sent to the Central Office when the matter is considered to be of sufficent importance.

(*f*) *Reports and recommendations regarding air traffic and airways.*—Advise the Central Office of general increases or decreases of air traffic or necessity for service over the airways assigned. This does not mean the reporting of the elimination or addition of one or two schedules, or substitution of one for another, etc., but rather changes of some magnitude affecting the service as a whole, such as discontinuance of airways, new airways, proposed new airways, rerouting of old airways, etc.

(*g*) *Recommendations from direct supervising stations.*—Consider recommendations, requests, etc., of direct supervising stations as concerns airway matters, indicating concurrence or nonconcurrence.

(*h*) *Property accountability at C. A. A. stations.*—Assume property accountability for all Weather Bureau property located at stations manned by Civil Aeronautics Administration personnel, except when, in the opinion of the general supervising official, this may be handled best by a local weather bureau office or airport station. The final arrangement will be presented to the Central Office for approval before becoming effective.

1–209. Procedure in Connection with Correspondence by Direct Supervising Officials.—Weather Bureau Offices in each district will send in duplicate all recommendations, correspondence, etc., *concerning airway service of any nature* to the Central Office through the official in charge of the general supervising stations, who will indicate by proper indorsement his approval or disapproval of the matter, except that in cases of emergency the matter may be forwarded directly to the Central Office and a copy of the correspondence, or advice as to action taken, forwarded to the general supervising station. When the action is recommended, the general supervising station official may so indicate by writing the word "Recommended" at the head of the letter and initialing under this; if disapproved, proper typewritten indorsement will be forwarded to the Central Office with the correspondence and a copy sent to the originating station. The Central Office will not consider recommendations made by other than general supervising stations through other than these channels.

1–210. Direct Supervision of Stations Manned by C. A. A. Personnel.—Unless direct supervision is delegated to some other station, the general supervising station will have the direct supervision of any or all intermediate weather-reporting stations on the airways assigned to their general supervision at which stations reports are made by employees of the Civil Aernoautics Administration, and there is Civil Aeronautics Administration teletype or radio. In this connection, and that of the transfer of general supervision, when required, attention is called to the necessity for the former general supervising station to request authority from the Central Office, through channels as outlined in paragraph 1–209 to transfer property at such stations from their accountability to that of the new general supervising station, except that, if recommended by the general supervising station and approved by the Central Office, this accountability may be held by a local Weather Bureau Office or airport station. Officials concerned are to make certain that the regular procedure covering such transfers is conformed with.

1–211. Direct Supervision of Stations Manned by Weather Bureau Personnel.—The direct supervision of each individual Weather Bureau airway station, which includes the carrying of property accountability, preparation of pay rolls, rendering of WB Form 4076 for appointment of new observers or resignation of old, and other administrative matters concerning the station, will be under the first-order or airport station to which this has been assigned.

1–212. Responsibilities Entailed by General Supervision.—The responsibility delegated to the general supervising stations under the foregoing procedure makes it imperative that officials having charge of these stations work with the best interests of the Bureau in mind at all times. Requests for service or changes in service should be considered carefully from this viewpoint. Further, this responsibility requires that the officials exercising it use judgment in connection with matters transmitted to the Central Office. In some cases these are received containing no definite recommendations and shifting the entire matter from the general supervising station concerned to the Central Office, which, in the large majority of instances, has no detailed knowledge of the matter. This, of course, results in delay and additional correspondence. The Central Office is an extremely busy place and the details to be handled and remembered are numerous, with the result that such procedure on the part of station officials badly aggravates the situation.

1–213. Delegation of Duties by General Supervising Stations.—The general supervising station may delegate any of the duties outlined under paragraph 1–208, except correspondence with other general supervising stations or with Civil Aeronautics Administration district managers, to an important airport station on the airway concerned, such delegation to have the prior approval of the Central Office. These latter stations would of course, address all letters through the general supervising station.

1–214. Visits to Substations by Direct Supervising Officials.—Visits to individual airway stations for purposes of installing equipment, obtaining new observers, etc., will be made when necessary and advisable by the personnel of the direct supervising station upon specific authority. Recommendations for such visits will be made on WB Form 4067 and will be sent through the general supervising station for the airway concerned, except in case of emergency not permitting delay.

1–215. Changes in Direct Supervision.—Changes in the direct supervision of Weather Bureau airway stations as may be considered advisable and necessary under the terms of this section will be given consideration at the Central Office upon receipt of recommendations from the general supervising station.

1–216. Supervision of 6-Hourly Work.—The 6-hourly weather-reporting work at Weather Bureau first-order or airport stations telegraphing such reports will be under the supervision of the general supervising station for the district in which they are located. Any airway work at any other type of station will be under the supervision of the general supervising station in whose district they are located, unless the delegation of this to some other first-order or airport station is approved.

1–217. Areas and Airways Included in General Supervising Districts.—The areas of, and stations and airways included in, each of the general supervising districts are shown on the Weather Bureau Airway Meterological Service maps, new issues of which are published from time to time as required. The outlines of the districts shown on these maps will in all cases be regarded as the official delimitations of the districts.

1–218. Inspection Service.—The making of regular inspections of all airway, 6-hourly, airport, etc., stations in the various districts is highly important and is a function of the general supervising station for the district concerned. Detailed instructions in regard to making inspections are not suited to this circular, but will be treated as special instructions to be forwarded to the stations concerned.

CHAPTER III

PERSONNEL

1–219. Hours of Duty.—The normal workweek for Weather Bureau employees is composed of at least 39 hours. Officials in charge of airport stations shall plan a schedule of work for a period of at least 2 weeks in advance. This schedule must detail at least 39 hours work each week to each employee and, if it is necessary for employees to work over this limit, the extra time must be equally divided among all personnel of the station. Assignment of hours of duty must be fair and impartial. Because of necessity of maintaining a 24-hour service, *it is to be desired that the hours of night duty be evenly distributed.* Officials in charge may designate a responsible assistant to arrange the hours of duty at any airport station, but work schedules so planned must have prior approval of the official in charge before being put into operation. Copies of the schedules worked will be kept in the station files for a period of one year or until the next visit of the airway inspector, at which time they may be disposed of with his approval.

1–220. Commissioned Employees.—Commissioned personnel of the Weather Bureau are appointed from civil-service registers after having passed a civil-service examination for the position to which they desire appointment. After serving a probationary period of 6 months they are eligible for permanent appointment if their record is satisfactory. During the probationary period an appointee shall be instructed in all the duties pertaining to his position. Appointees to the airway service must be thoroughly familiar with all phases of weather-reporting procedure before they are allowed to take official observations.

1–221. Airway Observers.—Observers in this category are not required to pass a civil-service examination but are appointed under Schedule A, paragraph 11, subdivision 11 or section I, paragraph 6 of the Rules and Regulations of the Civil Service Commission. They must have certain qualifications and abilities, and be able to pass oral or written tests. Airway observers are paid widely varying rates of salary, depending on the number and character of the observations required, and also whether the observers are assigned responsibility for teletype and communications work. Recommendations for appointment of these observers shall be made to the Central Office on WB Form 4076 by supervising officials. Airway observers should study this Circular N thoroughly and be given instruction at a Weather Bureau airport station or by an airway inspector of the Weather Bureau. After passing an examination, called the "Airway Meteorological Service Test," which examination shall be taken under the supervision of a commissioned Weather Bureau employee, the observer shall be issued a "Certificate

of Authority to Take Airway Observations." In cases of emergency, when the observer can satisfy an examiner that he is capable of taking observations, a "Twenty-Day Letter of Authority" for taking airway observations shall be issued by the supervising official.

1–222. Pay Rolls for Airway Observers.—Pay rolls for payment of airway observers shall be submitted by the supervising station to the Central Office on WB Form 1013D and 1013E.

1–223. C. A. A. Personnel Required to Hold "Certificates of Authority."—Commissioned employees of the Civil Aeronautics Administration who are assigned the responsibility for taking airway weather observations shall be subject to the same requirements as airway observers regarding the obtaining and holding of "Certificates of Authority to Take Airway Weather Observations" or "Twenty-Day Letters of Authority."

CHAPTER IV

OFFICE ADMINISTRATION

1–224. Correspondence.—Officials in charge of airport stations at which Weather Bureau commissioned personnel are assigned are authorized to conduct correspondence direct with the Central Office, or other Weather Bureau station officials. When correspondence involves a matter of policy of the Weather Bureau, however, it must be conducted through the general supervising station. Letters addressed to or mailed from airport stations will be sent in duplicate (original and carbon) in one envelope, except that in letters addressed to the Central Office only the original copy will be mailed. An official in charge of an airport station will be responsible for mailing copies of sufficiently important correspondence written or received by him to the official in charge of any local city office for his information. Carbon copies of all letters written shall be prepared for the station's files and, when appropriate, also for the information of all stations not provided for in the foregoing, including the proper general supervising station and the Central Office. In the preparation of letters, paragraph 136 of Station Regulations should be adhered to.

1–225. Filing System for Correspondence.—All correspondence will be filed in accordance with the detailed instructions given in the pamphlet entitled "Weather Bureau Correspondence Files." For filing purposes, administrative telegrams and radiograms will be treated in all respects as letters.

1–226. Procedure When Letters Permanently Removed from File.—When a letter is permanently removed from the file a memorandum slip, showing its file number, date, subject, action taken, and disposition, must be filed in its place.

1–227. Procedure Concerning Letters of Routine Nature.—Letters of a purely routine nature and of only transient value, may, in the discretion of the official in charge, be acted on and filed without entry. Authority to destroy such letters may be obtained from the Central Office when they become sufficiently numerous to crowd available filing space.

1–228. General Care of Office and Station.—The manner in which airport stations are conducted must reflect credit on the Weather Bureau. Therefore, officials in charge are directed, in administering their stations, to take action which assures that the office shall be kept neat and presentable, the instruments clean and in efficient condition, the files in order, and that there shall be "a place for everything and everything in its place".

1–229. Maintenance of "Log of Pilot Contacts".—All first-order stations that have been instructed to do so shall prepare and maintain a log on WB Form 1139 of all contacts made with pilots in accordance with instructions on the reverse side of the form.

Section II
OBSERVATIONS

PART I.—INSTRUCTIONS FOR MAKING AIRWAY WEATHER OBSERVATIONS

CHAPTER I

PURPOSE AND IMPORTANCE OF OBSERVATIONS

2–100. The establishment of weather-reporting stations along the airways is dictated primarily by the necessity for obtaining accurate, current weather data for use in connection with flights over such airways. It follows, therefore, that the most important function of such reporting stations is the rendering of accurate, reliable, up-to-the-minute observations of weather conditions observed at that place, and it is desired to impress upon all observers the fundamental importance of this. Accordingly, at stations where duties other than observational are assigned to observers, such duties, except possibly the preparation of weather maps and charts, or others absolutely essential to the work of the station, should be deferred during periods of low ceilings and visibilities so that the observer may devote practically his entire time to watching the weather and filing observations as may be required. The work thus deferred may then be performed during periods of good weather when so much of the observer's time will not be required in connection with taking weather observations.

2–101. All statements following are to be regarded as instructions to observers and such instructions will be adhered to by all concerned when taking, entering on forms, or transmitting airway weather observations.

CHAPTER II

DEFINITION OF "AIRWAY WEATHER OBSERVATION"

2–102. An "airway weather observation" is an observation of existing weather conditions made in accordance with the provisions and instructions of this circular, at a station *on an airway*, the primary purpose of which is to provide immediate information for transport and itinerant flying over the airway on which the reporting station is located.

CHAPTER III

TYPES OF AIRWAY OBSERVATIONS REQUIRED AT STATIONS LOCATED ON TELETYPE OR RADIO CIRCUITS

2–103. In order that the weather information from any *hourly* weather-reporting station equipped with teletype or radio will be up to date at all times and that no important change will miss being reported, the observations required at such stations are divided into "Record observations," "Check observations," "Special observations," and "Local extra observations," definitions, descriptions, and instructions for the rendering of which follow:

(*a*) *Record observation.* (See pars. 2–120 and 2–174 for examples.)—The record observation is the hourly observation taken to conform with National Communications Schedules for radio or teletype. It is regularly the first observation transmitted in each 60-minute period beginning at 30 minutes past the hour. A "record" airway observation shall include, in the order shown, the elements listed below, insofar as the instrumental equipment of the station rendering the report, or other circumstances, will permit:

CLASSIFICATION OF REPORT (when the station at which observation is taken is within a "controlled" zone).

CEILING (when other than "unlimited").

SKY (except when precipitation or obstructions to vision reduce the ceiling to zero and/or the visibility to less than ⅛ mile and make the sky unobservable).

VISIBILITY (when less than 10 miles).

WEATHER (when such conditions are present).

OBSTRUCTIONS TO VISION (when such conditions are present).

SEA LEVEL BAROMETRIC PRESSURE (millibars, when station is equipped with approved mercurial barometer).

TEMPERATURE (° F. when station is equipped with an approved thermometer).

DEW POINT (°F. when station is equipped with an approved psychrometer).

WIND DIRECTION, VELOCITY, and CHARACTER (to be estimated when station is not equipped with wind-measuring instruments).

ALTIMETER SETTING (inches, when station is equipped with approved mercurial barometer).

REMARKS (pertinent information not contained elsewhere in the report).

(*b*) *Check observation.*—A comparison by actual observation of the present existing values of ceiling, sky, visibility, weather, obstructions to vision, wind, and altimeter setting with those currently reported and in use; made at designated times between the hourly "record" observations, in conformity with the Civil Aeronautics Administration schedule of local broadcasts, to determine whether there has been any change in these elements and to bring the data up to date. If no change has occurred, the current observation will continue to be used in broadcasts with the time designated as that of the "check" observation. If the "check" observation indicates that conditions have changed, but not enough to warrant a designation of "special" observation, then these changed values will be used in place of those given in the current report in subsequent broadcasts until the next "record," or "special" observation. If conditions have changed enough to warrant a "special" observation, the observation will be so designated when entered on WB Form 1130, when broadcast locally, and/or transmitted by teletype or radio. Whether change has occurred or not, such observations will be entered separately on WB Form 1130 (as specifically prescribed further on in these instructions).

(*c*) *Special observation.* (See pars. 2–120 and 2–174 for examples.)—A new observation taken when a *marked* change in weather conditions (as defined in paragraph 2–105) from those reported in the previous "record" or "special" observation occurs. If such a change occurs at the time of the "record" observation, the "record" observation will then be designated as a "special" observation for all purposes. Since the large majority of "special" observations will be made at times other than those of "record" observations, and weather changes requiring the filing of the "special" may not involve temperature, dew point, altimeter setting, and barometric pressure, these data, as included in the "special" report, may have the same value as in the last previous "record," "check," or "special" observation unless one or more of the following changes occur, in which case the new values will be reported:

1. Temperature rises or falls at the rate of 10° or more per hour.
2. Altimeter setting is 0.02 of an inch or more different from that reported in the last "record," "check," or "special" observation. (For special observations required specifically by a change in pressure, see paragraph 2–105 (i).)
3. Dew-point changes 3° or more from the value reported in the last "record," "check," or "special" observation. (In this connection it will not be necessary to take a psychrometric reading for each "special" to check for a 3° or more change unless such change is suspected; however, a change of this type should always be anticipated in connection with the sudden formation (or moving in) of fog or the passage of a front indicating a change from one type of air mass to another.)

If the "special" coincides with a "record" observation, such an observation must include the new values for temperature, dew point, altimeter setting, and barometer, even though these have not changed as specified above.

CEILING (when other than "unlimited").

SKY (except when precipitation or obstructions to vision reduce the ceiling to zero and/or the visibility to less than ¼ mile and make the sky unobservable).

VISIBILITY (when less than 10 miles).

WEATHER (when such conditions are present).

OBSTRUCTIONS TO VISION (when such conditions are present).

SEA LEVEL BAROMETRIC PRESSURE (millibars, when station is equipped with approved mercurial barometer).

TEMPERATURE (° F. when station is equipped with an approved thermometer).

DEW POINT (°F. when station is equipped with an approved psychrometer).

WIND DIRECTION, VELOCITY, and CHARACTER (to be estimated when station is not equipped with wind-measuring instruments).

ALTIMETER SETTING (inches, when station is equipped with approved mercurial barometer).

REMARKS (pertinent information not contained elsewhere in the report).

(*b*) *Check observation.*—A comparison by actual observation of the present existing values of ceiling, sky, visibility, weather, obstructions to vision, wind, and altimeter setting with those currently reported and in use; made at designated times between the hourly "record" observations, in conformity with the Civil Aeronautics Administration schedule of local broadcasts, to determine whether there has been any change in these elements and to bring the data up to date. If no change has occurred, the current observation will continue to be used in broadcasts with the time designated as that of the "check" observation. If the "check" observation indicates that conditions have changed, but not enough to warrant a designation of "special" observation, then these changed values will be used in place of those given in the current report in subsequent broadcasts until the next "record," or "special" observation. If conditions have changed enough to warrant a "special" observation, the observation will be so designated when entered on WB Form 1130, when broadcast locally, and/or transmitted by teletype or radio. Whether change has occurred or not, such observations will be entered separately on WB Form 1130 (as specifically prescribed further on in these instructions).

(*c*) *Special observation.* (See pars. 2–120 and 2–174 for examples.)—A new observation taken when a *marked* change in weather conditions (as defined in paragraph 2–105) from those reported in the previous "record" or "special" observation occurs. If such a change occurs at the time of the "record" observation, the "record" observation will then be designated as a "special" observation for all purposes. Since the large majority of "special" observations will be made at times other than those of "record" observations, and weather changes requiring the filing of the "special" may not involve temperature, dew point, altimeter setting, and barometric pressure, these data, as included in the "special" report, may have the same value as in the last previous "record," "check," or "special" observation unless one or more of the following changes occur, in which case the new values will be reported:

1. Temperature rises or falls at the rate of 10° or more per hour.

2. Altimeter setting is 0.02 of an inch or more different from that reported in the last "record," "check," or "special" observation. (For special observations required specifically by a change in pressure, see paragraph 2–105 (i).)

3. Dew-point changes 3° or more from the value reported in the last "record," "check," or "special" observation. (In this connection it will not be necessary to take a psychrometric reading for each "special" to check for a 3° or more change unless such change is suspected; however, a change of this type should always be anticipated in connection with the sudden formation (or moving in) of fog or the passage of a front indicating a change from one type of air mass to another.)

If the "special" coincides with a "record" observation, such an observation must include the new values for temperature, dew point, altimeter setting, and barometer, even though these have not changed as specified above.

CEILING (when other than "unlimited").

SKY (except when precipitation or obstructions to vision reduce the ceiling to zero and/or the visibility to less than 1/4 mile and make the sky unobservable).

VISIBILITY (when less than 10 miles).

WEATHER (when such conditions are present).

OBSTRUCTIONS TO VISION (when such conditions are present).

SEA LEVEL BAROMETRIC PRESSURE (millibars, when station is equipped with approved mercurial barometer).

TEMPERATURE (° F. when station is equipped with an approved thermometer).

DEW POINT (° F. when station is equipped with an approved psychrometer).

WIND DIRECTION, VELOCITY, and CHARACTER (to be estimated when station is not equipped with wind-measuring instruments).

ALTIMETER SETTING (inches, when station is equipped with approved mercurial barometer).

REMARKS (pertinent information not contained elsewhere in the report).

(b) Check observation.—A comparison by actual observation of the present existing values of ceiling, sky, visibility, weather, obstructions to vision, wind, and altimeter setting with those currently reported and in use; made at designated times between the hourly "record" observations, in conformity with the Civil Aeronautics Administration schedule of local broadcasts, to determine whether there has been any change in these elements and to bring the data up to date. If no change has occurred, the current observation will continue to be used in broadcasts with the time designated as that of the "check" observation. If the "check" observation indicates that conditions have changed, but not enough to warrant a designation of "special" observation, then these changed values will be used in place of those given in the current report in subsequent broadcasts until the next "record," or "special" observation. If conditions have changed enough to warrant a "special" observation, the observation will be so designated when entered on WB Form 1130, when broadcast locally, and/or transmitted by teletype or radio. Whether change has occurred or not, such observations will be entered separately on WB Form 1130 (as specifically prescribed further on in these instructions).

(c) Special observations.—(See pars. 2-120 and 2-174 for examples.)—An observation taken when there is a marked change in weather conditions (as defined in par. 2-105) from those reported in the previous "record" or "special" observation. Except as indicated in (1), (2) or (3), below, the special report will include the following elements: classification (at controlled airports), ceiling, sky, visibility, weather, obstructions to vision, and remarks (if pertinent).

1. Wind or altimeter setting may be included if a change in either requires filing a special under the rules for that element.

2. In the interest of making a prompt report the phenomena outlined in par. 2-105 (f), (h) and (i) may be reported without other elements.

3. If the change requiring the special occurs at the time of a record observation, it will for all purposes be designated as a "special" but must contain all the elements included in a record observation.

CEILING (when other than "unlimited").
SKY
VISIBILITY
WEATHER (when reportable conditions are present).
OBSTRUCTIONS TO VISION (when reportable conditions are present).
SEA LEVEL BAROMETRIC PRESSURE (millibars, when station is equipped with approved mercurial barometer).
TEMPERATURE (° F. when station is equipped with an approved thermometer).
DEW POINT (° F. when station is equipped with an approved psychrometer).
WIND DIRECTION, VELOCITY, and CHARACTER (to be estimated when station is not equipped with wind-measuring instruments).
ALTIMETER SETTING (inches, when station is equipped with approved mercurial barometer).
REMARKS (pertinent information not contained elsewhere in the report).

(b) Check Observation.--An observation of ceiling, sky, visibility, weather, obstructions to vision, wind, altimeter setting, and remarks (if required) made at designated times between "record" observations. If a check observation indicates that conditions have changed enough to warrant a "special" observation, the observation will be so designated.

(c) Special Observation.--(See pars. 2-120 and 2-174 for examples.) An observation taken for the purpose of reporting a marked change in weather conditions (as defined in par. 2-105) from those reported in the previous record or special observation. Except as indicated in (1) and (2) below, a special observation will include the following elements: ceiling, sky, visibility, wind, and remarks if required; weather and obstructions to vision, if reportable.

1. Altimeter setting will be included if a change in it requires filing a special under the rules for that element.

2. The phenomena outlined in par. 2-105(f), (h), and (i) may be reported alone, i.e., without other elements.

CEILING (when other than "unlimited").
SKY
VISIBILITY
WEATHER (when reportable conditions are present).
OBSTRUCTIONS TO VISION (when reportable conditions are present).
SEA LEVEL BAROMETRIC PRESSURE (millibars, when station is equipped with approved mercurial barometer).
TEMPERATURE (°F. when station is equipped with an approved thermometer).
DEW POINT (°F. when station is equipped with an approved psychrometer).
WIND DIRECTION, VELOCITY, and CHARACTER (to be estimated when station is not equipped with wind-measuring instruments).
ALTIMETER SETTING (inches, when station is equipped with approved mercurial barometer).
REMARKS (pertinent information not contained elsewhere in the report).

(b) Check Observation.—An observation of ceiling, sky, visibility, weather, obstructions to vision, wind, altimeter setting, and remarks (if required) made at designated times between "record" observations. If a check observation indicates that conditions have changed enough to warrant a "special" observation, the observation will be so designated.

(c) Special Observation.—(See paragraphs 2-120 and 2-174 for examples.) An observation taken to report a marked change* in weather conditions from those reported in the previous record or special observation. Except as indicated in (1), (2), and (3), below, a special observation will include: ceiling, sky, visibility, weather or obstructions to vision, wind, and remarks.

1. Altimeter setting will be included if it is changing at a rate requiring a special or if the special coincides with a check observation.

2. The phenomena listed in paragraph 2-105(f), (h), and (i) may be reported without other elements.

3. A special coinciding with a record observation will contain all elements of a record observation and will be designated as a "record-special."

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* See paragraph 2-105.

(*d*) *Local extra observation.*—(See par. 2–174 for example.) List of stations given in Supplement I (end)

1. These observations shall be taken at terminal and intermediate airports where the Weather Bureau maintains weather-reporting stations manned by Weather Bureau commissioned or airway-observer personnel. The stations to take such observations have been and will be so designated by notification from the Central Office.

2. At these stations "local extra observations" shall be made each 15 minutes, beginning with the first 15 minutes following a "record," "check," or "special" observation which shows a ceiling of less than 600 feet or a visibility of less than 1¼ miles, and continuing until an observation shows a ceilng of 600 feet or more and a visibility of 1¼ miles or more.

3. "Local extra observations" will include only the classification, ceiling, sky, visibility, weather, obstructions to vision, and remarks, and will be entered on WB Form 1130 in proper chronological order with such "record," check," or "special" observations as are made in accordance with instructions. The time of the observations will be the time of the filing of the report in cases where a filing takes place, either directly on the local teletype or interphone system, or by delivery to a Civil Aeronautics Administration communications station, and in other cases will be the time of completion of the entries on WB Form 1130, such entries being made immediately following the observation of the weather elements. Cancelled 7-1-45.

4. If any "local extra observation" shows a change, either increase or decrease, from the values in the immediately preceding observation amounting to as much as to require reporting the ceiling 100 feet higher or lower, or the visibility one-fourth mile higher or lower, or both, the observation shall be given to the local Civil Aeronautics Administration communications station (by the means usually effective in filing weather reports) for local broadcast, placing on the local teletype circuit, and/or giving to the local traffic-control officer or station. Lacking this facility, the observation will be given directly to the local traffic-control officer or station by the usual means of communication. Lacking this facility, the observation will be filed on the local teletype circuit and/or placed on the local interphone system by the observer. Lacking any of the above facilities, the observation will be telephoned or otherwise communicated to the local airline, airport, aviation charter, or private flying officials who have indicated that they will wish to be informed of such changes during periods when they are expecting landings or departures of aircraft in which they are concerned at that point. "Local extra observations" will not, as such, be transmitted on the long-line teletype circuits.

5. At terminal or intermediate airports, at which there are no Civil Aeronautics Administration teletype or radio and there are airway observers or commissioned Weather Bureau personnel on duty continuously over the periods when aircraft are due to land or depart, the procedure outlined above for hourly reporting stations will apply at such stations for those periods.

6. When the observation indicates a change from reported values in the last "record" or "special" observation which warrants a "special," a "special" shall, of course, be filed and treated as directed by instructions herein.

7. When special observations are called for by airlines, War or Navy Department officials, or private flyers, or others, for bona fide landings or departures, even though the weather conditions do not warrant a "special" or "local extra," the observation requested shall be taken and handled in the same way as a "local extra". In this case the reason for taking the "local extra" shall be entered in parentheses under the "remarks" column on WB Form 1130, thus: (Local extra for Eastern Airlines), (Local extra for United Airlines, trip 6), (Local extra for War Department plane), etc.

8. In transmissions made over a local teletype circuit the character of "local extra observations" shall be indicated by the use of "LCL" immediately preceding the time of observation.

(d) Local Extra Observations.—(See paragraph 2-174 for example.) Local extra observations are given local distribution only. When an observation indicates a change from values in the preceding record or special observation and this change requires a special in accordance with instructions in paragraph 2-105, the local extra observation will be designated as a special and treated accordingly. If a local extra coincides with a check observation, all the elements normally included in a check observation will be reported in the local extra observation.

1. At stations designated by the Regional Offices local extra observations will be taken at 15-minute intervals when the conditions specified below obtain. The first observation will be taken (a) whenever the ceiling or visibility decreases to a value equal to or less than that of the highest aircraft minimum* applying to the airport at which the station is situated, or (b) whenever the ceiling decreases to 500 feet or less or the visibility to 1 mile or less. The observations will be discontinued after values of ceiling and visibility higher than those specified above have been reported. Record and special observations taken within the 15-minute interval will also serve as local extra observations, and the next 15-minute interval will begin at the filing time of the record or special. The local extra observation will include the following elements: ceiling, sky, visibility, weather, obstructions to vision, remarks.

2. Local extra observations comprising one or more elements will be taken at all stations when requested for aircraft arrivals or departures regardless of whether the stations are designated by the Regional Offices in accordance with (1) above. In this case the reason for taking the local extra will be noted on Form 1130A under "Remarks" thus: (For AAF).

3. At stations equipped with ceiling lights or ceilometers, an observation of ceiling and sky will be taken whenever a pilot reports a ceiling height differing from a "measured" ceiling value.

4. A local extra observation of all elements ordinarily included in a record observation will be taken immediately following any aircraft accident within two miles of the boundaries of the airport where the weather-observing station is situated.

5. When a local extra observation reveals a change of 100 feet or more in ceiling or 1/4 mile or more in visibility, it will be distributed by local interphone, teletype, or telephone to all operating agencies unless the agencies request modification of these instructions. Whenever possible, acknowledgment of receipt of the observation will be secured from representatives of the agencies to which it is transmitted with especial reference to agencies whose operations might be affected by the information.

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*The minimum referred to here applies to specified aircraft operated by aircarriers at specified airports. Personnel at all stations affected by these instructions will determine from local aircarrier representatives the minimum values of ceiling and visibility applying to the aircraft operated at the airport.

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(*d*) *Local extra observation.*—(See par. 2–174 for example.)

1. These observations shall be taken at terminal and intermediate airports where the Weather Bureau maintains weather-reporting stations manned by Weather Bureau commissioned or airway-observer personnel. The stations to take such observations have been and will be so designated by notification from the Central Office.

2. At these stations "local extra observations" shall be made each 15 minutes, beginning with the first 15 minutes following a "record," "check," or "special" observation which shows a ceiling of less than 600 feet or a visibility of less than 1¼ miles, and continuing until an observation shows a ceiling of 600 feet or more and a visibility of 1¼ miles or more.

3. "Local extra observations" will include only the classification, ceiling, sky, visibility, weather, obstructions to vision, and remarks, and will be entered on WB Form 1130 in proper chronological order with such ' record," check," or "special" observations as are made in accordance with instructions. The time of the observations will be the time of the filing of the report in cases where a filing takes place, either directly on the local teletype or interphone system, or by delivery to a Civil Aeronautics Administration communications station, and in other cases will be the time of completion of the entries on WB Form 1130, such entries being made immediately following the observation of the weather elements.

4. If any "local extra observation" shows a change, either increase or decrease, from the values in the immediately preceding observation amounting to as much as to require reporting the ceiling 100 feet higher or lower, or the visibility one-fourth mile higher or lower, or both, the observation shall be given to the local Civil Aeronautics Administration communications station (by the means usually effective in filing weather reports) for local broadcast, placing on the local teletype circuit, and/or giving to the local traffic-control officer or station. Lacking this facility, the observation will be given directly to the local traffic-control officer or station by the usual means of communication. Lacking this facility, the observation will be filed on the local teletype circuit and/or placed on the local interphone system by the observer. Lacking any of the above facilities, the observation will be telephoned or otherwise communicated to the local airline, airport, aviation charter, or private flying officials who have indicated that they will wish to be informed of such changes during periods when they are expecting landings or departures of aircraft in which they are concerned at that point. "Local extra observations" will not, as such, be transmitted on the long-line teletype circuits.

5. At terminal or intermediate airports, at which there are no Civil Aeronautics Administration teletype or radio and there are airway observers or commissioned Weather Bureau personnel on duty continuously over the periods when aircraft are due to land or depart, the procedure outlined above for hourly reporting stations will apply at such stations for those periods.

6. When the observation indicates a change from reported values in the last "record" or "special" observation which warrants a "special," a "special" shall, of course, be filed and treated as directed by instructions herein.

7. When special observations are called for by airlines, War or Navy Department officials, or private flyers, or others, for bona fide landings or departures, even though the weather conditions do not warrant a "special" or "local extra," the observation requested shall be taken and handled in the same way as a "local extra". In this case the reason for taking the "local extra" shall be entered in parentheses under the "remarks" column on WB Form 1130, thus: (Local extra for Eastern Airlines), (Local extra for United Airlines, trip 6), (Local extra for War Department plane), etc.

8. In transmissions made over a local teletype circuit the character of "local extra observations" shall be indicated by the use of "LCL" immediately preceding the time of observation.

CHAPTER IV

RULES GOVERNING ALLOWABLE TIME AT HOURLY WEATHER REPORTING STATIONS BETWEEN THE TAKING OF OBSERVATIONS AND THEIR USE IN SEQUENCES AND BROADCASTS

2-104. The following will govern the period at hourly reporting stations between the taking of the observation and its use in sequences and broadcasts:

(*a*) *Purpose and use of record observations.*—One record observation will be taken each hour at stations where teletype or radio are located during the period these facilities are normally in operation. The observation shall be the one taken for use in the regular sequence beginning at 30 minutes past each hour.

(*b*) *Time of taking record observations.*—The *record observation* shall be taken within the 10-minute period immediately preceding its placing in the sequence, except that in case special data, such as mercurial barometer readings, pressure change, clouds, etc., are required these may be obtained immediately prior to the beginning of this 10-minute period. The use of ceiling balloons will require additional time and this work may be started 15 minutes before the determining of other data regularly included in the report.

(*c*) *Observations required at stations where no broadcasts are made.*—At stations where no broadcasts are made by radio, the *record observation* is the only observation required to be taken, except that *special observations* will be taken and reported as required by conditions. In this latter connection, the importance of all personnel being alert to report special observations cannot be overemphasized, and omissions in this regard will not be tolerated. Failures to take *special observations* will be reported by direct supervising officials through the general supervising station to the Central Office for corrective action when, in their judgment, this is warranted.

(*d*) *Observations required at stations where broadcasts are made.*—At stations located where broadcasts of local weather are made by Civil Aeronautics Administration radio the *record observation* will be taken as directed in (a) above, and this may be used, unless conditions require a *special observation* or a *local extra observation*, for the sequences and broadcasts for the following 15 minutes. The local weather included in any local broadcast shall have been taken or completely checked *not more* than 15 minutes prior to the time at which it is broadcast. Exceptions to the rules above for making *check observations* are permissible when only one man is on duty and he is engaged in observing the flight of a pilot balloon. In this case he should request the radio operator on duty to use the last observation filed in all broadcasts and to give the time of the observation as that of the broadcast made, unless a new observation is filed by the observer. If weather conditions change sufficiently to require a *special*, this *special* must be taken and filed, even though to do so would require the observer to cut short the observing of the pilot balloon.

CHAPTER V

RULES FOR TAKING AND FILING SPECIAL OBSERVATIONS

2-105. The foregoing will not eliminate the necessity for maintaining a constant watch of conditions so that *special observations* may be filed when required by changed conditions. A *special observation* will be taken and filed without fail at all hourly weather-reporting stations whenever the following changes, or combinations of them, occur:

(*a*) *Special observations required in connection with changes in classification of reports.*—At stations in control zones, whenever the weather changes so as to result in a changed classification from that last reported.

(*b*) *Special observations required in connection with precipitation.*—Precipitation begins or ends, indicating a change from a period of no precipitation to one with continuous or intermittent precipitation, and vice versa. Under showery conditions it

CHAPTER IV

RULES GOVERNING ALLOWABLE TIME AT HOURLY WEATHER REPORTING STATIONS BETWEEN THE TAKING OF OBSERVATIONS AND THEIR USE IN SEQUENCES AND BROADCASTS

2-104. The following will govern the period at hourly reporting stations between the taking of the observation and its use in sequences and broadcasts:

(*a*) *Purpose and use of record observations.*—One record observation will be taken each hour at stations where teletype or radio are located during the period these facilities are normally in operation. The observation shall be the one taken for use in the regular sequence beginning at 30 minutes past each hour.

(*b*) *Time of taking record observations.*—The *record observation* shall be taken within the 10-minute period immediately preceding the beginning of the sequence, except that in case special data, such as mercurial barometer readings, pressure change, clouds, etc., are required these may be obtained immediately prior to the beginning of this 10-minute period. The use of ceiling balloons will require additional time and this work may be started 15 minutes before the determining of other data regularly included in the report.

(*c*) *Time of taking check observations.*—The *check* observations shall be taken within the 5-minute period immediately preceding the hour for which the check is to be made, i.e. the check observation for 1300 E.S.T. will be taken between 1255 E.S.T. and 1300 E.S.T. The use of ceiling balloons will require additional time and this work may be started 10 minutes before determining other data regularly included in the report.

(*d*) *Temporarily cancelled.*

CHAPTER V

RULES FOR TAKING AND FILING SPECIAL OBSERVATIONS

2-105. The foregoing will not eliminate the necessity for maintaining a constant watch of conditions so that *special observations* may be filed when required by changed conditions. A *special observation* will be taken and filed without fail at all hourly weather-reporting stations whenever the following changes, or combinations of them, occur:

(*a*) *Special observations required in connection with changes in classification of reports.*—At stations in control zones, whenever the weather changes so as to result in a changed classification from that last reported.

(*b*) *Special observations required in connection with precipitation.*—Precipitation begins or ends, indicating a change from a period of no precipitation to one with continuous or intermittent precipitation, and vice versa. Under showery conditions it

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

CHAPTER IV

TIME AND DISTRIBUTION OF OBSERVATIONS

2-104. GENERAL.—Observations at hourly reporting stations will be taken and distributed in accordance with the following instructions (see also Chapters III, V, VI, X, XII):

(a) Record observation.—One record observation will be taken each hour. This will be used in the collection sequence, and started just sufficiently in advance of the filing time to permit of accurate evaluation of all the elements in the observation.

(b) Observations required at stations having broadcast facilities.—Stations having broadcast facilities will take record, special, check, and in certain cases (see par. 2-103(d)) local extra, observations. The observations used in sequences and broadcasts must be the most recent and have been taken within the preceding 15 minutes. However, this requirement is waived when the observer is taking a pilot balloon observation and a check observation is required for broadcast purposes. Under these circumstances the assumption will be that, in the absence of a special observation, there have been no significant changes in weather and the latest observation filed with Civil Aeronautics Administration may therefore be used for broadcast purposes. Special and local extra observations will be taken as required in pars. 2-103(c) and (d), and 2-105.

(c) Observations required at stations not having broadcast facilities.—Record and special observations only are required at these stations.

(d) Distribution of observations by local interphone.—All types of airway observations will be transmitted promptly to Airway Traffic Control towers having interphone communication (or equivalent) with the Weather Bureau offices. The provisions of this paragraph will be taken to qualify instructions elsewhere in this manual dealing with distribution of observations.

CHAPTER V

RULES FOR TAKING AND FILING SPECIAL OBSERVATIONS

2-105. The foregoing will not eliminate the necessity for maintaining a constant watch of conditions so that special observations may be filed when required by changed conditions. A special observation will be taken and filed without fail at all hourly weather-reporting stations whenever the following changes, or combinations of them, occur:

(a) Special observations required in connection with changes in classification of reports.—At stations in control zones, whenever the weather changes so as to result in a changed classification from that last reported.

(b) Special observations required in connection with precipitation.—Precipitation begins or ends, indicating a change from a period of no precipitation to one with continuous or intermittent precipitation, and vice versa. Under showery conditions it

CHAPTER IV

TYPES AND DISTRIBUTION OF OBSERVATIONS

2-104. GENERAL. Observations at hourly reporting stations will be taken and distributed in accordance with the following instructions. (See also Chapters III, V, VI, X, and XII.)

(a) Scheduled observations.--

1. The record observation for use in the teletype collection sequence will be started just sufficiently in advance of the filing time to permit of accurate evaluation of all the elements in the observation.

2. First-order Weather Bureau Airport Stations and such other stations as are designated will take a check observation approximately thirty minutes after the filing time of the record observation.

Add at the end of paragraph 2-104(b):

"Stations having only scheduled broadcasts between 28 and 43 minutes past the hour will make a check observation approximately on the hour. (Broadcasts in this paragraph refer to scheduled broadcasts as distinguished from radio contacts.)" 3/5/45

weather reports.

2. Observations used in broadcasts must be the most recent and have been taken within the preceding fifteen minutes. However, the fifteen-minute requirement is waived when the observer is observing a pilot balloon. Under these circumstances, the assumption will be that, in the absence of a special observation, there have been no significant changes in weather and the latest observation filed with the Civil Aeronautics Administration may therefore be used in scheduled broadcasts.

3. Record and special observations will be transmitted by Civil Aeronautics Administration teletype in accordance with Federal Airways Manual of Operations III-B-6-1 or as specifically instructed.

CHAPTER V

RULES FOR TAKING AND FILING SPECIAL OBSERVATIONS

2-105. A special observation will be taken and filed at all hourly weather-reporting stations whenever the following changes, or combinations of them, occur:

(a) Precipitation.--

1. Any type of precipitation begins or ends, whether or not another type is occurring at the same time. It will not be necessary to report each beginning and ending of showery or intermittent precipitation unless the intervals between periods of precipitation are longer than fifteen minutes. A suitable entry will be made under "Remarks" to indicate the variable character of intermittent precipitation. In a like manner, frequent fluctuations between types will be indicated under "Remarks."

2. Hail occurs (special at beginning and ending). The hailstone size will be reported in remarks of any observation reporting hail, except that if determining the size will result in a delay in reporting the beginning of hail, the size will be omitted and reported in another special filed as soon as practicable. Size shall be interpreted to mean the diameter, in inches, of the largest normally-shaped hailstone.

(b) Thunderstorms.--A thunderstorm begins, shows marked increase in intensity, or ends.

(c) Sky conditions.--

1. A change in total cloudiness below 9,751 feet from clear to broken or from scattered to overcast and vice versa. An increase or decrease of high cloudiness will not require a special observation. Reporting the lowering of high broken or high overcast clouds to 9,750 feet or lower will be governed by paragraph 2-105(d)1.

CHAPTER IV

TYPES AND DISTRIBUTION OF OBSERVATIONS

2-104. GENERAL. Observations at hourly reporting stations will be taken and distributed in accordance with the following instructions. (See also Chapters III, V, VI, X, and XII.)

(a) Scheduled observations.--

1. The record observation for use in the teletype collection sequence will be started just sufficiently in advance of the filing time to permit of accurate evaluation of all the elements in the observation.

2. First-order Weather Bureau Airport Stations and such other stations as are designated will take a check observation approximately thirty minutes after the filing time of the record observation.

(b) Unscheduled observations.--The time of taking local extra and special observations is determined by conditions outlined in pars. 2-103(d) and 2-105, respectively.

(c) Distribution of observations.--

1. Except at stations where Civil Aeronautics Administration authorities request otherwise, all types of airway observations will be transmitted promptly to Airport Traffic Control Towers having interphone communications (or equivalent) with the Weather Bureau Office. The provisions of this paragraph will be taken to qualify instructions elsewhere in this manual dealing with the distribution of airway weather reports.

2. Observations used in broadcasts must be the most recent and have been taken within the preceding fifteen minutes. However, the fifteen-minute requirement is waived when the observer is observing a pilot balloon. Under these circumstances, the assumption will be that, in the absence of a special observation, there have been no significant changes in weather and the latest observation filed with the Civil Aeronautics Administration may therefore be used in scheduled broadcasts.

3. Record and special observations will be transmitted by Civil Aeronautics Administration teletype in accordance with Federal Airways Manual of Operations III-B-6-1 or as specifically instructed.

CHAPTER V

RULES FOR TAKING AND FILING SPECIAL OBSERVATIONS

2-105. A special observation will be taken and filed at all hourly weather-reporting stations whenever the following changes, or combinations of them, occur:

(a) Precipitation.--

1. Any type of precipitation begins or ends, whether or not another type is occurring at the same time. It will not be necessary to report each beginning and ending of showery or intermittent precipitation unless the intervals between periods of precipitation are longer than fifteen minutes. A suitable entry will be made under "Remarks" to indicate the variable character of intermittent precipitation. In a like manner, frequent fluctuations between types will be indicated under "Remarks."

2. Hail occurs (special at beginning and ending). The hailstone size will be reported in remarks of any observation reporting hail, except that if determining the size will result in a delay in reporting the beginning of hail, the size will be omitted and reported in another special filed as soon as practicable. Size shall be interpreted to mean the diameter, in inches, of the largest normally-shaped hailstone.

(b) Thunderstorms.--A thunderstorm begins, shows marked increase in intensity, or ends.

(c) Sky conditions.--

1. A change in total cloudiness below 9,751 feet from clear to broken or from scattered to overcast and vice versa. An increase or decrease of high cloudiness will not require a special observation. Reporting the lowering of high broken or high overcast clouds to 9,750 feet or lower will be governed by paragraph 2-105(d)1.

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

CHAPTER IV

TYPES AND DISTRIBUTION OF OBSERVATIONS

2-104. GENERAL. Observations at hourly reporting stations will be taken and distributed in accordance with the following instructions. (See also Chapters III, V, VI, X, and XII.)

(a) Scheduled observations.--

1. Record observation. The record observation for use in the teletype collection sequence will be started just sufficiently in advance of the filing time to permit of accurate evaluation of all the elements in the observation. It may be used in local scheduled broadcasts beginning within twenty minutes of the time of the observation provided no important changes in meteorological conditions have occurred. However, the twenty-minute requirement is waived when the observer is observing a pilot balloon. Under these circumstances, the assumption will be that, in the absence of a special observation, there have been no significant changes in weather and the record observation reflects current conditions at the time of the broadcast.

2. Check observation. When the record observation cannot be used in a local scheduled broadcast (see sub-paragraph 1, above), a check observation will be taken and furnished to the Civil Aeronautics Administration to insure that an accurate report of weather conditions is available at the time of the broadcast.

(b) Unscheduled Observations.--Local extra: par. 2-103(d). Specials: par. 2-104(c). Specials will also be distributed similarly to local extras. See par. 2-103(d)5.

(c) Distribution of observations.--

1. Interphone. Except at stations where Civil Aeronautics Administration authorities request otherwise, all types of airway observations will be transmitted promptly to Airway Traffic Control Towers having interphone communications (or equivalent) with the Weather Bureau office. The provisions of this paragraph will be taken to qualify instructions elsewhere in this manual dealing with the distribution of airway weather reports.

2. Broadcasts. Observations will be furnished to the Civil Aeronautics Administration for local scheduled broadcasts in accordance with the provisions of sub-paragraphs 2-104(a)1 and 2, above.

3. Teletype. Record and special observations will be filed for transmission by teletype or as specifically instructed.

CHAPTER V

RULES FOR TAKING AND FILING SPECIAL OBSERVATIONS

2-105. A special observation will be taken and filed at all hourly weather-reporting stations whenever the following changes, or combinations of them, occur:

(a) Precipitation.--

1. Any type of precipitation begins or ends, whether or not another type is occurring at the same time. It will not be necessary to report each beginning and ending of showery or intermittent precipitation unless the intervals between periods of precipitation are longer than fifteen minutes. A suitable entry will be made under "Remarks" to indicate the variable character of intermittent precipitation. In a like manner, frequent fluctuations between types will be indicated under "Remarks."

2. Hail occurs (special at beginning and ending). The hailstone size will be reported in remarks of any observation reporting hail, except that if determining the size will result in a delay in reporting the beginning of hail, the size will be omitted and reported in another special filed as soon as practicable. Size shall be interpreted to mean the diameter, in inches, of the largest normally-shaped hailstone.

(b) Thunderstorms.--A thunderstorm begins, shows marked increase in intensity, or ends.

(c) Sky conditions.--

1. A change in total cloudiness below 9,751 feet from clear to broken or from scattered to overcast and vice versa. An increase or decrease of high cloudiness will not require a special observation. Reporting the lowering of high broken or high overcast clouds to 9,750 feet or lower will be governed by paragraph 2-105(d)1.

Chapter IV

RULES GOVERNING ALLOWABLE TIME AT HOURLY WEATHER REPORTING STATIONS BETWEEN THE TAKING OF OBSERVATIONS AND THEIR USE IN SEQUENCES AND BROADCASTS

2–104. The following will govern the period at hourly reporting stations between the taking of the observation and its use in sequences and broadcasts:

(*a*) *Purpose and use of record observations.*—One record observation will be taken each hour at stations where teletype or radio are located during the period these facilities are normally in operation. The observation shall be the one taken for use in the regular sequence beginning at 30 minutes past each hour.

(*b*) *Time of taking record observations.*—The *record observation* shall be taken within the 10-minute period immediately preceding its placing in the sequence, except that in case special data, such as mercurial barometer readings, pressure change, clouds, etc., are required these may be obtained immediately prior to the beginning of this 10-minute period. The use of ceiling balloons will require additional time and this work may be started 15 minutes before the determining of other data regularly included in the report.

(*c*) *Observations required at stations where no broadcasts are made.*—At stations where no broadcasts are made by radio, the *record observation* is the only observation required to be taken, except that *special observations* will be taken and reported as required by conditions. In this latter connection, the importance of all personnel being alert to report special observations cannot be overemphasized, and omissions in this regard will not be tolerated. Failures to take *special observations* will be reported by direct supervising officials through the general supervising station to the Central Office for corrective action when, in their judgment, this is warranted.

(*d*) *Observations required at stations where broadcasts are made.*—At stations located where broadcasts of local weather are made by Civil Aeronautics Administration radio the *record observation* will be taken as directed in (a) above, and this may be used, unless conditions require a *special observation* or a *local extra observation*, for the sequences and broadcasts for the following 15 minutes. The local weather included in any local broadcast shall have been taken or completely checked *not more* than 15 minutes prior to the time at which it is broadcast. Exceptions to the rules above for making *check observations* are permissible when only one man is on duty and he is engaged in observing the flight of a pilot balloon. In this case he should request the radio operator on duty to use the last observation filed in all broadcasts and to give the time of the observation as that of the broadcast made, unless a new observation is filed by the observer. If weather conditions change sufficiently to require a *special*, this *special* must be taken and filed, even though to do so would require the observer to cut short the observing of the pilot balloon.

See Amend. 7 P. 15 R

Chapter V

RULES FOR TAKING AND FILING SPECIAL OBSERVATIONS

2–105. The foregoing will not eliminate the necessity for maintaining a constant watch of conditions so that *special observations* may be filed when required by changed conditions. A *special observation* will be taken and filed without fail at all hourly weather-reporting stations whenever the following changes, or combinations of them, occur:

(*a*) *Special observations required in connection with changes in classification of reports.*—At stations in control zones, whenever the weather changes so as to result in a changed classification from that last reported.

(*b*) *Special observations required in connection with precipitation.*—Precipitation begins or ends, indicating a change from a period of no precipitation to one with continuous or intermittent precipitation, and vice versa. Under showery conditions it

will not be necessary to report each beginning or ending unless the period between showers is longer than 15 minutes, suitable entry concerning showers occurring at 15-minute intervals, or less, to be made under "Remarks" of any observation.

Any *definite* change from one to the other of periods of rain, snow, freezing rain, or ice pellets, or any *definite* change from one type of precipitation to combinations of these types, or *definite* changes from one combination to another. (Frequent fluctuations between types to be explained under "Remarks.")

Hail occurs ("special" at beginning and ending).

(*c*) *Special observations required in connection with thunderstorms.*—A thunderstorm not previously reported occurs, or one previously reported shows marked increase in intensity. Also, the cessation of a thunderstorm previously reported.

(*d*) *Special observations required in connection with sky conditions and ceilings.*—1. A change in cloudiness below 10,000 feet from "less than 1/10 clouds to broken clouds" or from "scattered clouds to overcast," and vice versa. That is, if there were no clouds or only a few present below 10,000 feet at the last previous record or special observation, a special will be filed upon the development of broken clouds below 10,000 feet; similarly, if there were scattered clouds below 10,000 feet at the last previous record or special observation, a special will be filed upon the development of an overcast below 10,000 feet, or the reverse of these changes in amount. (A special observation is not required as a result of an increase or decrease of high cloudiness, and also the presence or lack of high clouds does not in any way affect the requirements for special observations in connection with a change in amount of cloudiness below 10,000 feet.)

2. A change in cloudiness *below 900 feet* from "scattered to broken," and vice versa, except that at *stations located within controlled zones* a change in cloudiness *below 1,500 feet* from "scattered to broken" and vice versa. Frequent fluctuations between scattered and broken clouds should be reported under "Remarks," and when so reported, a special for each brief change need not be filed.

3. The ceiling,[1] whenever 6,000 feet or more at the last previous record or special observation, lowers to 3,000 feet or less.

4. The ceiling,[1] whenever less than 6,000 feet at the last previous record or special observation, lowers by one-half or more.

5. The ceiling,[1] whenever 3,000 feet or less at the last previous record or special observation rises to a height two or more times that reported in the last previous record or special observation.

6. In addition to subparagraphs 3, 4, and 5 above, whenever the ceiling lowers to *below 500 feet* or rises to *above 500 feet* sufficiently to require the reporting of a value of 400 feet or less, or 600 feet or more. If the ceiling is fluctuating so rapidly between ceiling values of 400 and 600 feet that the filing of a special covering each individual change is impracticable then the ceiling may be characterized as "variable" in the report as outlined in paragraph 2–134 (i) hereinafter.

(*e*) *Special observations required in connection with fog.*—1. Beginning or ending of fog, ground fog, or ice fog.

2. Beginning or ending of thick or dense ground fog, thick or dense ice fog, or thick or dense fog. (A change from thick to dense or the reverse of the same type fog need not require a special.)

3. A change from one type of fog to another type of fog, for example, ground fog to fog, ice fog to fog, fog to ground fog, etc.

(*f*) *Special observations required in connection with wind-shifts, tornadoes, etc.*—A wind shift passes the station.

Tornadoes, sandstorms, duststorms, *specials* at beginnings and endings if observed within 7 miles of the station.

(*g*) *Special observations required in connection with visibility.*—1. The visibility whenever 7 miles or more at the last previous record or special observation, lowers to 3 miles or less.

[1] When the sky condition goes from scattered below 10,000 feet to broken or the reverse and the clouds remain at practically the same height, the ceiling thereby goes from *unlimited* to the height of the clouds, or vice versa, this condition is regarded as a change in amount of cloudiness and of a degree insufficient to require a special unless the height of the clouds is below that specified in subparagraph 2 above.

will not be necessary to report each beginning or ending unless the period between showers is longer than 15 minutes, suitable entry concerning showers occurring at 15-minute intervals, or less, to be made under "Remarks" of any observation.

Any *definite* change from one to the other of periods of rain, snow, freezing rain, or ice pellets, or any *definite* change from one type of precipitation to combinations of these types, or *definite* changes from one combination to another. (Frequent fluctuations between types to be explained under "Remarks.")

Hail occurs ("special" at beginning and ending).

(*c*) *Special observations required in connection with thunderstorms.*—A thunderstorm not previously reported occurs, or one previously reported shows marked increase in intensity. Also, the cessation of a thunderstorm previously reported.

(*d*) *Special observations required in connection with sky conditions and ceilings.*—1. A change in cloudiness below 10,000 feet from "less than 1/10 clouds to broken clouds" or from "scattered clouds to overcast," and vice versa. That is, if there were no clouds or only a few present below 10,000 feet at the last previous record or special observation, a special will be filed upon the development of broken clouds below 10,000 feet; similarly, if there were scattered clouds below 10,000 feet at the last previous record or special observation, a special will be filed upon the development of an overcast below 10,000 feet, or the reverse of these changes in amount. (A special observation is not required as a result of an increase or decrease of high cloudiness, and also the presence or lack of high clouds does not in any way affect the requirements for special observations in connection with a change in amount of cloudiness below 10,000 feet.)

2. A change in cloudiness *below 900 feet* from "scattered to broken," and vice versa, except that at *stations located within controlled zones* a change in cloudiness *below 1,500 feet* from "scattered to broken" and vice versa. Frequent fluctuations between scattered and broken clouds should be reported under "Remarks," and when so reported, a special for each brief change need not be filed.

3. The ceiling,[1] whenever 6,000 feet or more at the last previous record or special observation, lowers to 3,000 feet or less.

4. The ceiling,[1] whenever less than 6,000 feet at the last previous record or special observation, lowers by one-half or more.

5. The ceiling,[1] whenever 3,000 feet or less at the last previous record or special observation rises to a height two or more times that reported in the last previous record or special observation.

6. In addition to subparagraphs 3, 4, and 5 above, whenever the ceiling lowers to *below 500 feet* or rises to *above 500 feet* sufficiently to require the reporting of a value of 400 feet or less, or 600 feet or more. If the ceiling is fluctuating so rapidly between ceiling values of 400 and 600 feet that the filing of a special covering each individual change is impracticable then the ceiling may be characterized as "variable" in the report as outlined in paragraph 2-134 (i) hereinafter.

(*e*) *Special observations required in connection with fog.*—1. Beginning or ending of fog, ground fog, or ice fog.

2. Beginning or ending of heavy fog, heavy ground fog, or heavy ice fog.

3. A change from one type of fog to another type of fog, for example, ground fog to fog, ice fog to fog, fog to ground fog, etc.

(*f*) *Special observations required in connection with wind-shifts, tornadoes, etc.*—A wind shift passes the station.

Tornadoes, sandstorms, duststorms, *specials* at beginnings and endings if observed within 7 miles of the station.

(*g*) *Special observations required in connection with visibility.*—1. The visibility whenever 7 miles or more at the last previous record or special observation, lowers to 3 miles or less.

[1] When the sky condition goes from scattered below 10,000 feet to broken or the reverse and the clouds remain at practically the same height, the ceiling thereby goes from *unlimited* to the height of the clouds, or vice versa, this condition is regarded as a change in amount of cloudiness and of a degree insufficient to require a special unless the height of the clouds is below that specified in subparagraph 2 above.

will not be necessary to report each beginning or ending unless the period between showers is longer than 15 minutes. *A suitable entry concerning showers occurring at 15-minute intervals or less will be made under "Remarks".*

Any definite change from one to the other of periods of rain, snow, freezing rain, or ice pellets; or any definite change from one type of precipitation to combinations of these types; or a definite change from one combination to another. *Frequent fluctuations between types should be explained under "Remarks".*

Hail occurs *(special at beginning and ending).*

(c) Special observations required in connection with thunderstorms. A thunderstorm not previously reported occurs; or one previously reported shows marked increase in intensity; or a previously reported thunderstorm ceases.

(d) Special observations required in connection with sky conditions and ceilings.

1. A change in cloudiness below 9,751 feet from "clear to broken" or from "scattered to overcast" and vice versa. *An increase or decrease of high cloudiness will not require a special observation. Reporting the lowering of "high broken" or "high overcast" clouds to 9,750 feet or lower will be governed by paragraph 2-105(d)3.*

2. A change in cloudiness below 900 feet (1,500 feet at stations located within control zones) from "scattered to broken" and vice versa. *Frequent fluctuations between scattered and broken clouds should be reported under "Remarks".*

3. Whenever the ceiling lowers by one-half or more from that reported in the last previous record or special observation *(unlimited ceilings considered as 10,000 feet).* #

4. Whenever the ceiling rises to a height two or more times that reported in the last previous record or special observation *(unlimited ceilings considered as 10,000 feet).* #

(e) Special observations required in connection with fog.

1. Beginning or ending of fog, ground fog, or ice fog.

2. Beginning or ending of heavy fog, heavy ground fog, or heavy ice fog.

3. A change from one type of fog to another, such as ground fog to fog, fog to ice fog, etc.

(f) Special observations required in connection with wind shifts, tornadoes, etc.

1. A wind shift passes the station.

2. Tornado, sandstorm, duststorm *(special at beginning and ending if observed within 7 miles of the station).*

(g) Special observations required in connection with visibility.

1. Whenever the visibility decreases by one-half or more from that reported in the last previous record or special observation *(unlimited visibilities considered as 10 miles).*

2. Whenever the visibility increases to a value two or more times that reported in the last previous record or special observation *(unlimited visibilities considered as 10 miles).*

Whenever cloudiness below 10,000 feet changes from scattered to broken or the reverse and the clouds remain at practically the same height, the ceiling thereby goes from "unlimited" to the height of the clouds, or vice versa. Such a change is insufficient to require a special observation unless the height of the clouds is below that specified in paragraph 2-105(d)2.

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will not be necessary to report each beginning or ending unless the period between showers is longer than 15 minutes. *A suitable entry concerning showers occurring at 15-minute intervals or less will be made under "Remarks."*

Any definite change from one to the other of periods of rain, snow, freezing rain, or ice pellets; or any definite change from one type of precipitation to combinations of these types; or a definite change from one combination to another. *Frequent fluctuations between types should be explained under "Remarks."*

Hail occurs *(special at beginning and ending)*. The hailstone size will be reported in remarks of any observation reporting hail, except, that if determining the size will result in a delay in reporting the beginning of hail the size will be omitted and reported in another special filed as soon as practicable. Size shall be interpreted to mean the diameter, in inches, of the largest normally-shaped hailstone.

(c) Special observations required in connection with thunderstorms. A thunderstorm not previously reported occurs; or one previously reported shows marked increase in intensity; or a previously reported thunderstorm ceases.

(d) Special observations required in connection with sky conditions and ceilings.

1. A change in total cloudiness below 9,751 feet from "clear to broken" or from "scattered to overcast" and vice versa. *An increase or decrease of high cloudiness will not require a special observation. Reporting the lowering of "high broken" or "high overcast" clouds to 9,750 feet or lower will be governed by paragraph 2-105(d)3.*

2. A change in cloudiness below 1,500 feet from "scattered to broken" and vice versa. At stations where contact operating minima are above 1,500 feet, special observations will be filed whenever the sky condition at or below this minimum changes from "scattered to broken" and vice versa.

3. Whenever the ceiling lowers by one-half or more from that reported in the last previous record or special observation *(unlimited ceilings considered as 10,000 feet)*.

4. Whenever the ceiling rises to a height two or more times that reported in the last previous record or special observation *(unlimited ceilings considered as 10,000 feet)*.

(e) Special observations required in connection with fog.

1. Beginning and ending of fog, ground fog, or ice fog.

2. A change from one type of fog to another, such as ground fog, to fog, fog to ice fog, etc.

(f) Special observations required in connection with wind shifts, tornadoes, etc.

1. A wind shift passes the station.

2. Tornado, sandstorm, duststorm *(special at beginning and ending if observed within 7 miles of the station)*.

(g) Special observations required in connection with visibility.

1. Whenever the visibility decreases by one-half or more from that reported in the last previous record or special observation (unlimited visibilities considered as 10 miles).

2. Whenever the visibility increases to a value two or more times that reported in the last previous record or special observation (unlimited visibilities considered as 10 miles).

2. A change in cloudiness below 1,500 feet from scattered to broken and vice versa. At stations where operating minimums are above 1,500 feet, special observations will be filed whenever the sky condition at or below these minimums changes from scattered to broken and vice versa.

▼ (d) Ceilings.--

1. The ceiling lowers by one-half or more than one-half of that reported in the last previous record or special observation (unlimited ceilings considered as 10,000 feet).

2. The ceiling rises to a height two or more times that reported in the last previous record or special observation (unlimited ceilings considered as 10,000 feet).

3. The ceiling decreases to 1,000 feet or less, or increases to more than 1,000 feet.

4. The ceiling decreases to less than 500 feet or increases to 500 feet or more. ▲

(e) Fog.--

1. Beginning and ending of fog, ground fog, or ice fog.

2. A change from one type of fog to another, such as ground fog to fog, fog to ice fog, etc.

(f) Wind shifts, tornadoes, etc.--

1. A wind shift passes the station.

2. Tornado, sandstorm, duststorm (special at beginning and ending if observed within seven miles of the station).

▼ (g) Visibility.--

1. The visibility, having been reported on the last record or special observation as more than ten miles, lowers to five miles or less.

2. The visibility, having been reported on the last record or special observation as ten miles or less, decreases by one-half or more.

3. The visibility, having been reported on the last record or special observation as five miles or less, increases by 100% or more.

4. The visibility decreases to a value below three miles or increases to three miles or more.

5. The visibility decreases to a value below one mile or increases to one mile or more. ▲

2. A change in cloudiness below 1,500 feet from scattered to broken and vice versa. At stations where operating minimums are above 1,500 feet, special observations will be filed whenever the sky condition at or below these minimums changes from scattered to broken and vice versa.

(d) Ceiling.—

The ceiling:

1. Lowers by one-half, or more than one-half, of that reported in the previous record or special observation (unlimited ceilings considered as 10,000 feet).

2. Rises to a height two or more times that reported in the previous record or special observation (unlimited ceilings considered as 10,000 feet).

▶ 3. Decreases from 1,000 feet or more to less than 1,000 feet.

▶ 4. Increases from less than 1,000 feet to 1,000 feet or more.

5. Decreases from 500 feet or more to less than 500 feet.

6. Increases from less than 500 feet to 500 feet or more.

(e) Fog.—

1. Beginning and ending of fog, ground fog, or ice fog.

2. A change from one type of fog to another, such as ground fog to fog, fog to ice fog, etc.

(f) Wind Shifts, Tornadoes, etc.—

1. A wind shift passes the station.

2. Tornado, sandstorm, duststorm (special at beginning and ending if observed within seven miles of the station).

(g) Visibility.—

The visibility:

1. Decreases from ten miles or more to five miles or less.

2. When ten miles or less, decreases by one-half or more.

3. When five miles or less, increases by 100 per cent or more.

4. Decreases from three miles or more to less than three miles.

5. Increases from less than three miles to three miles or more.

6. Decreases from one mile or more to less than one mile.

7. Increases from less than one mile to one mile or more.

2. The visibility whenever *less* than 7 miles at the last previous record or special observation, lowers by one-half or more. (A change in visibility from ⅛ mile to zero will not require a special.)

3. The visibility whenever originally less than 4 miles increases to a value two or more times that in the previous record or special observation. (A change in visibility from zero to ⅛ mile will not require a special.)

4. (*a*) During hours of *daylight* whenever the observed visibility lowers to less than 1 mile, or rises to 1 mile or more. (*b*) During hours of *darkness* whenever the observed visibility lowers to less than 2 miles, or rises to 2 miles or more.

In respect to cases of daytime visibility values fluctuating rapidly within the range of ¾ to 1¼ miles, inclusive, or nighttime visibility values fluctuating rapidly within the range of 1¾ to 2¼ miles, inclusive, so that the filing of a special for each brief change is impracticable, "variable" will be applicable. [See subparagraph 2–142 (e).]

(*h*) *Special observations required in connection with wind.*—Sudden and definite marked increase in wind velocity—a doubling of velocity when the increases are to velocities exceeding **30** miles an hour; marked shift in wind direction, particularly from east or south to west or north, accompanied by an increase in velocity.

(*i*) *Special observations required in connection with altimeter setting.*—A change in "station pressure" since the previous record or special observation "at the rate" of 0.08 inch (2 and ⅔ mb.) or more per hour. Special observations due exclusively to rapid changes in pressure as specified above will be filed at 15-minute intervals following the previous *special* or *record* observation as long as this rate of pressure change persists.

(*j*) *Special observations required but not specifically covered by instructions.*—The foregoing will not, of course, cover all conditions under which a *special observation* should be filed, and this is left to the judgment of the observer as to whether it should be done when conditions not specifically covered in the foregoing occur. For example, it is held that a *special observation* should be filed if the ceiling should lower from 1,000 to say 600 feet, but not reaching 500 feet, even though this is not specifically covered for airway-reporting stations not in controlled zones. The intention is that any change of importance to the safety of air traffic will be reported as soon as it occurs.

Chapter VI

INSTRUCTIONS GOVERNING "TIME OF OBSERVATION"

2–106. The time of observation will be determined in accordance with the following:

(*a*) *Time to be ascribed to record, check, local extra, and special observations.*—The time given to a *record* or *check* observation at points where teletype or radio are located and hourly observations are taken throughout the 24 hours, or any portion of them, will be the time of the *beginning* of the sequence or broadcast in which it is first used. For example, if used first in the sequence beginning at 3:30 a. m., it will be given the time of 0330E (C. M. P.). In order that the operator may have sufficient time for punching out the observation on the perforator prior to transmission on the long lines, *record observations* will be filed 2 minutes in advance of the time of sequence beginning. The time of a *special observation* or a *local extra observation* will be that of the filing of the report.

(*b*) *Basis and standard of time to be used.*—The time ascribed to the observations will be on the 24-hour-clock system, local standard time. For example, 1:30 a. m., E. S. T., would be 0130E; 3:30 p. m., C. S. T., would be 1530C; 11:30 p. m., P. S. T., would be 2330P, etc.

(*c*) *Time to be ascribed to reports sent by telephone or telegraph.*—At points from which observations are telephoned or telegraphed to another point to be placed in the sequences, the time of observation will be that of the filing of the message.

2. The visibility whenever *less* than 7 miles at the last previous record or special observation, lowers by one-half or more.

3. The visibility whenever originally less than 4 miles increases to a value two or more times that in the previous record or special observation.

4. (*a*) During hours of *daylight* whenever the observed visibility lowers to less than 1 mile, or rises to 1 mile or more. (*b*) During hours of *darkness* whenever the observed visibility lowers to less than 2 miles, or rises to 2 miles or more.

In respect to cases of daytime visibility values fluctuating rapidly within the range of ¾ to 1¼ miles, inclusive, or nighttime visibility values fluctuating rapidly within the range of 1¾ to 2¼ miles, inclusive, so that the filing of a special for each brief change is impracticable, "variable" will be applicable. [See subparagraph 2–142 (e).]

(*h*) *Special observations required in connection with wind.*—Sudden and definite marked increase in wind velocity—a doubling of velocity when the increases are to velocities exceeding **30** miles an hour; marked shift in wind direction, particularly from east or south to west or north, accompanied by an increase in velocity.

(*i*) *Special observations required in connection with altimeter setting.*—A change in "station pressure" since the previous record or special observation "at the rate" of 0.08 inch (2 and ⅝ mb.) or more per hour. Special observations due exclusively to rapid changes in pressure as specified above will be filed at 15-minute intervals following the previous *special* or *record* observation as long as this rate of pressure change persists.

(*j*) *Special observations required but not specifically covered by instructions.*—The foregoing will not, of course, cover all conditions under which a *special observation* should be filed, and this is left to the judgment of the observer as to whether it should be done when conditions not specifically covered in the foregoing occur. For example, it is held that a *special observation* should be filed if the ceiling should lower from 1,000 to say 600 feet, but not reaching 500 feet, even though this is not specifically covered for airway-reporting stations not in controlled zones. The intention is that any change of importance to the safety of air traffic will be reported as soon as it occurs.

CHAPTER VI

INSTRUCTIONS GOVERNING "TIME OF OBSERVATION"

2–106. The time of observation will be determined in accordance with the following:

(*a*) *Time to be ascribed to record, check, local extra, and special observations.*—The time given to a *record* or *check* observation at points where teletype or radio are located and hourly observations are taken throughout the 24 hours, or any portion of them, will be the time of the *beginning* of the sequence or broadcast in which it is first used. For example, if used first in the sequence beginning at 3:30 a. m., it will be given the time of 0330E (C. M. P.). In order that the operator may have sufficient time for punching out the observation on the perforator prior to transmission on the long lines, *record observations* will be filed 2 minutes in advance of the time of sequence beginning. The time of a *special observation* or a *local extra observation* will be that of the filing of the report.

(*b*) *Basis and standard of time to be used.*—The time ascribed to the observations will be on the 24-hour-clock system, local standard time. For example, 1:30 a. m., E. S. T., would be 0130E; 3:30 p. m., C. S. T., would be 1530C; 11:30 p. m., P. S. T., would be 2330P, etc.

(*c*) *Time to be ascribed to reports sent by telephone or telegraph.*—At points from which observations are telephoned or telegraphed to another point to be placed in the sequences, the time of observation will be that of the filing of the message.

(*h*) *Special observations required in connection with wind.*—Sudden and definite marked increase in wind velocity—a doubling of velocity when the increases are to velocities exceeding 30 miles an hour; marked shift in wind direction, particularly from east or south to west or north, accompanied by an increase in velocity.

(*i*) *Special observations required in connection with altimeter setting.*—A change in "station pressure" since the previous record or special observation "at the rate" of 0.08 inch (2 and ⅔ mb.) or more per hour. Special observations due exclusively to rapid changes in pressure as specified above will be filed at 15-minute intervals following the previous *special* or *record* observation as long as this rate of pressure change persists.

(*j*) *Special observations required but not specifically covered by instructions.*—The foregoing will not, of course, cover all conditions under which a *special observation* should be filed, and this is left to the judgment of the observer as to whether it should be done when conditions not specifically covered in the foregoing occur. For example, it is held that a *special observation* should be filed if the ceiling should lower from 1,000 to say 600 feet, but not reaching 500 feet, even though this is not specifically covered for airway-reporting stations not in controlled zones. The intention is that any change of importance to the safety of air traffic will be reported as soon as it occurs.

CHAPTER VI

INSTRUCTIONS GOVERNING "TIME OF OBSERVATION"

2-106. The time of observation will be determined in accordance with the following:

(*a*) *Time to be ascribed to record, check, local extra, and special observations.*—The time given to a *record* or *check* observation at points where teletype or radio are located and hourly observations are taken throughout the 24 hours, or any portion of them, will be the time of the *beginning* of the sequence or broadcast in which it is first used. For example, if used first in the sequence beginning at 3:30 a. m., it will be given the time of 0330E (C. M. P.). In order that the operator may have sufficient time for punching out the observation on the perforator prior to transmission on the long lines, *record observations* will be filed 2 minutes in advance of the time of sequence beginning. The time of a *special observation* or a *local extra observation* will be that of the filing of the report.

(*b*) *Basis and standard of time to be used.*—The time ascribed to the observations will be on the 24-hour-clock system, local standard time. For example, 1:30 a. m., E. S. T., would be 0130E; 3:30 p. m., C. S. T., would be 1530C; 11:30 p. m., P. S. T., would be 2330P, etc.

(*c*) *Time to be ascribed to reports sent by telephone or telegraph.*—At points from which observations are telephoned or telegraphed to another point to be placed in the sequences, the time of observation will be that of the filing of the message.

(*h*) *Special observations required in connection with wind.*—Sudden and definite marked increase in wind velocity—a doubling of velocity when the increases are to velocities exceeding 30 miles an hour; marked shift in wind direction, particularly from east or south to west or north, accompanied by an increase in velocity.

(*i*) *Special observations required in connection with pressure.*—A change in "station pressure" since the previous record or special observation "at the rate" of 0.08 inch (2 and 2/3 mb.) or more per hour. Special observations due exclusively to rapid changes in pressure as specified above will be filed at 15-minute intervals following the previous *special* or *record* observation as long as this rate of pressure change persists. Whenever the pressure falls and then rises rapidly thus producing a marked "V" on the barogram, appropriate remarks will be included which give (1) the lowest sea-level pressure (in millibars—giving only tens, units and tenths) and (2) the time of the lowest pressure. Example: LWST PRES 990 AT 2146C.

(*j*) *Special observations required but not specifically covered by instructions.*—The foregoing will not, of course, cover all conditions under which a special observation should be filed and this is left to the judgment of the observer as to whether it should be done when conditions not specifically covered in the foregoing occur. The intention is that *any change of importance to the safety of air traffic will be reported as soon as it occurs.*

CHAPTER VI

INSTRUCTIONS GOVERNING "TIME OF OBSERVATION"

As specified below, the time of an observation will be the actual time of the last moment in which it would be possible for the observer to make a change or correction to the observation recorded on Form 1130. It will be the observer's responsibility to make a last minute check of the visual elements of the observation so that the weather at filing time is accurately expressed in that observation.

2-106. The time of observation will be determined as follows:

(*a*) *Time to be ascribed to record observations.*—The time given to a *record observation* will be the time of filing with the CAA communication station and should be as close as practicable to, but not after, 28 minutes past the hour. At stations where observations are taken and transmitted by the same person, the time of filing will be considered to be the time of making the last entry on Form 1130. Any changes in the weather requiring a special observation and occurring between the time of filing of the record observation and its entry in the sequence will be noted in a "special" to be filed as soon as possible.

(*b*) *Time to be ascribed to special observations.*—The time given to a *special observation* will be the time of *first* filing, either by interphone (ATC or local) with the CAA communication station, or making the last entry on Form 1130 (to be used only at stations where observations are taken and transmitted by the same person and where no other dissemination of specials is made).

(*c*) *Time to be ascribed to local extra observations.*—The time given to a *local extra observation* will be the time of filing on the interphone (ATC or local—if such dissemination is made); otherwise, it will be the time of making the last entry on Form 1130.

(*d*) *Time to be ascribed to check observations.*—The time given to a *check observation* will be the time of making the last entry on Form 1130—normally within 2 minutes of the hour. For example, the time which might be ascribed to the 1400 E.S.T. check observation is 1358, 1359, 1400, 1401, or 1402.

(*e*) *Basis and standard of time to be used.*—The time ascribed to observations will be on the 24-hour-clock system, local standard time.# For example, 1:28 a.m. E.S.T., would be 0128E; 3:28 p.m., C.S.T., would be 1528C; 11:28 p.m., P.S.T., would be 2328P, etc.# "0000" will be beginning of the day and in no case will "2400" be used.

(*f*) *Time to be ascribed to reports sent by telephone or telegraph.*—At points from which observations are telephoned or telegraphed to another point to be placed in the sequences, the time of observation will be the time of filing the message.

#War-time is being used for the duration.

(h) Special observations required in connection with wind.—Sudden and definite marked increase in wind velocity—a doubling of velocity when the increases are to velocities exceeding 30 miles an hour; marked shift in the wind direction, particularly from east or south to west or north, accompanied by an increase in velocity.

(i) Special observations required in connection with altimeter setting.—A change in altimeter setting, as shown by a change in station pressure, since the previous record or special observation at the rate of 0.08 inch (2.7 mbs.) or more per hour. Special observations due exclusively to rapid changes in pressure as specified above will be filed at 15-minute intervals as long as this rate of change persists. (See par. 2-403 for reporting barogram "V".)

(j) Special observations required but not specifically covered by instructions.—The foregoing will not, of course, cover all conditions under which a special observation should be filed and this is left to the judgment of the observer as to whether it should be done when conditions not specifically covered in the foregoing occur. The intention is that any change of importance to the safety of air traffic will be reported as soon as it occurs.

CHAPTER VI

INSTRUCTIONS GOVERNING "TIME OF OBSERVATION"

As specified below, the time of an observation will be the actual time of the last moment in which it would be possible for the observer to make a change or correction to the observation recorded on Form 1130B. It will be the observer's responsibility to make a last minute check of the visual elements of the observation so that the weather at filing time is accurately expressed in that observation.

2-106. The time of observation will be determined as follows:

(a) Time to be ascribed to record observations.—The time given to a record observation will be the time of filing with the CAA communication station and should be as close as practicable to, but not after, 28 minutes past the hour. At stations where observations are taken and transmitted by the same person, the time of filing will be considered to be the time of making the last entry on Form 1130B. Any changes in the weather requiring a special observation and occurring between the time of filing of the record observation and its entry in the sequence will be noted in a "special" to be filed as soon as possible.

(b) Time to be ascribed to special observations.—The time given to a special observation will be the time of first filing, either by interphone (ATC or local) with the CAA communication station, or making the last entry on Form 1130B (to be used only at stations where observations are taken and transmitted by the same person and where no other dissemination of specials is made).

(c) Time to be ascribed to local extra observations.—The time given to a local extra observation will be the time of filing on the interphone (ATC or local—if such dissemination is made); otherwise, it will be the time of making the last entry on Form 1130B.

(d) Time to be ascribed to check observations.—The time given to a check observation will be the time of making the last entry on Form 1130B.

(e) Basis and standard of time to be used.—The time ascribed to observations will be on the 24-hour-clock system, local standard time.* For example, 1:28 a.m. E.S.T., would be 0128E; 3:28 p.m., C.S.T., would be 1528C; 11:28 p.m., P.S.T., would be 2328P, etc.* "0000" will be beginning of the day and in no case will "2400" be used.

(f) Time to be ascribed to reports sent by telephone or telegraph.—At points from which observations are telephoned or telegraphed to another point to be placed in the sequences, the time of observation will be the time of filing the message.

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*War-time is being used for the duration.

CHAPTER VII

INSTRUCTIONS FOR ENTRY OF OBSERVATIONS ON WB FORM 1130

2–107. All *record*, *check*, *local extra*, and *special observations* will be entered in chronological order on WB Form 1130 at the time of taking the observations, using ditto marks, except in *record* and *special observations*, whenever the preceding data in a column are the same. The different classes of observations will be designated in the second column of the form by the letter "R" for "record," a check mark for "check," the letter "L" for "local extra," and the letter "S" for "special." In order that the *check observation* may be indicated, the *record observation* will be entered with its proper time, and immediately below this will be entered the *check observation* with the time. When a *special* or *local extra observation* is made and entered on the form, this will be followed by a *check observation* at any ensuing checking period. If a *check observation* indicates changes or conditions requiring a *special* or *local extra*, it shall be designated as the type required and treated according to instructions for *specials* or *local extras*. (The entry of individual elements on WB Form 1130 will be treated in chapter II, part VI of this section.) The actual entry of observations on WB Form 1130 will be different for the two general classes of observations, as follows:

(*a*) *Entries on WB Form 1130 at teletype and radio points.*—At teletype and radio points, entries will be made in authorized teletype symbols and authorized English abbreviations so that the record will be in the same form as the subsequent teletype or radio transmission of the report, except that each element of the report will be entered in the column assigned for it.

(*b*) *Entries on WB Form 1130 at stations reporting by telegraph or telephone.*—At points from which observations are transmitted by telegraph or telephone, the entries will be in authorized English abbreviations and figures, with each element placed in the proper column.

2–108. Inspection of WB Form 1130.—The official in charge of airport and first-order stations furnishing reports on an hourly basis, or someone designated by him, shall inspect the forms daily. If it is indicated from such inspections that observations are not made as required or that other laxity in the carrying out of the program is evident, he shall inquire into the circumstances thoroughly and, if necessary, caution the observer, or observers responsible.

CHAPTER VIII

PROCEDURE IN CASES OF LAXITY IN OBSERVATIONAL WORK

2–109. If laxity in the observational work at any Weather Bureau intermediate point becomes apparent, the general supervising official for the airway will take up the matter with the direct supervising station for corrective action, or direct with the airway observers if the general supervising station is also the direct supervising station. If a station manned by Civil Aeronautics Administration employees is involved, the general supervising official will take up the matter with the district manager concerned.

CHAPTER IX

PROCEDURE IN CASES OF FAILURE OF COMMUNICATIONS FACILITIES

2–110. The following shall govern procedure in cases of failure of communications facilities:

(*a*) *Teletype and radio.*—In the event that the transmission of reports by radio or teletype is not practicable from any particular reporting station, due to the failure of these facilities, the next hourly report following the breakdown will be telegraphed, using the check "WEA," or telephoned, collect, to another station on the airway which will be designated by the general supervising official to receive it, and thereafter at 25 minutes past the hours of 1 and 7 a. m. and p. m., E. S. T. (4 and 10 a. m. and p. m., P. S. T.; 5 and 11 a. m. and p. m., M. S. T.; 6 and 12 a. m. and p. m., C. S. T.), so

CHAPTER VII

INSTRUCTIONS FOR ENTRY OF OBSERVATIONS ON WB FORMS 1130A AND 1130B

2-107. All weather reporting stations will use WB Forms 1130A and 1130B for entry of all observations in accordance with instructions in Part VI of this circular.

2-108. Inspection of WB Form 1130.--The official in charge of airport and first-order stations furnishing reports on an hourly basis, or someone designated by him, will inspect the forms daily. If it is indicated from such inspections that observations are not made as required or that other laxity in the carrying out of the program is evident, he will inquire into the circumstances thoroughly and, if necessary, caution the observer or observers responsible.

CHAPTER VIII

PROCEDURE IN CASES OF LAXITY IN OBSERVATIONAL WORK

2-109. If laxity in the observational program at any Weather Bureau station becomes apparent, the Regional Director will take corrective action. If a station manned by Civil Aeronautics Administration employees is involved, the Weather Bureau Regional Office will refer the case to the Civil Aeronautics Administration Regional Administrator.

CHAPTER IX

PROCEDURE IN CASES OF FAILURE OF COMMUNICATIONS FACILITIES

2-110. In the event of the breakdown of the normal transmission facilities the next hourly report following the breakdown will be telegraphed, using the check "GOVT," or telephoned, collect, to another station which will be designated by the Regional Office to receive it; thereafter, reports will be telephoned or telegraphed at 25 minutes past the hours of 1 and 7 a.m. and p.m., E.S.T. (12 noon and midnight and 6 a.m. and p.m., C.S.T., 11 and 5 a.m. and p.m., M.S.T., 10 and 4 a.m. and p.m., P.S.T.) as long as the failure continues. Observational records on WB Form 1130A and 1130B will be kept as usual during such periods. Special observations will be telegraphed or telephoned as required by conditions.

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CHAPTER VII

INSTRUCTIONS FOR ENTRY OF OBSERVATIONS ON WB FORM 1130

2–107. All *record, check, local extra,* and *special observations* will be entered in chronological order on WB Form 1130 at the time of taking the observations, using ditto marks, except in *record* and *special observations*, whenever the preceding data in a column are the same. The different classes of observations will be designated in the second column of the form by the letter "R" for "record," a check mark for "check," the letter "L" for "local extra," and the letter "S" for "special." In order that the *check observation* may be indicated, the *record observation* will be entered with its proper time, and immediately below this will be entered the *check observation* with the time. When a *special* or *local extra observation* is made and entered on the form, this will be followed by a *check observation* at any ensuing checking period. If a *check observation* indicates changes or conditions requiring a *special* or *local extra,* it shall be designated as the type required and treated according to instructions for *specials* or *local extras.* (The entry of individual elements on WB Form 1130 will be treated in chapter II, part VI of this section.) The actual entry of observations on WB Form 1130 will be different for the two general classes of observations, as follows:

(*a*) *Entries on WB Form 1130 at teletype and radio points.*—At teletype and radio points, entries will be made in authorized teletype symbols and authorized English abbreviations so that the record will be in the same form as the subsequent teletype or radio transmission of the report, except that each element of the report will be entered in the column assigned for it.

(*b*) *Entries on WB Form 1130 at stations reporting by telegraph or telephone.*—At points from which observations are transmitted by telegraph or telephone, the entries will be in authorized English abbreviations and figures, with each element placed in the proper column.

2–108. Inspection of WB Form 1130.—The official in charge of airport and first-order stations furnishing reports on an hourly basis, or someone designated by him, shall inspect the forms daily. If it is indicated from such inspections that observations are not made as required or that other laxity in the carrying out of the program is evident, he shall inquire into the circumstances thoroughly and, if necessary, caution the observer, or observers responsible.

CHAPTER VIII

PROCEDURE IN CASES OF LAXITY IN OBSERVATIONAL WORK

2–109. If laxity in the observational work at any Weather Bureau intermediate point becomes apparent, the general supervising official for the airway will take up the matter with the direct supervising station for corrective action, or direct with the airway observers if the general supervising station is also the direct supervising station. If a station manned by Civil Aeronautics Administration employees is involved, the general supervising official will take up the matter with the district manager concerned.

CHAPTER IX

PROCEDURE IN CASES OF FAILURE OF COMMUNICATIONS FACILITIES

2–110. The following shall govern procedure in cases of failure of communications facilities:

(*a*) *Teletype and radio.*—In the event that the transmission of reports by radio or teletype is not practicable from any particular reporting station, due to the failure of these facilities, the next hourly report following the breakdown will be telegraphed, using the check "WEA," or telephoned, collect, to another station on the airway which will be designated by the general supervising official to receive it, and thereafter at 25 minutes past the hours of 1 and 7 a. m. and p. m., E. S. T. (4 and 10 a. m. and p. m., P. S. T.; 5 and 11 a. m. and p. m., M. S. T.; 6 and 12 a. m. and p. m., C. S. T.), so

long as the failures continue. Hourly records on WB Form 1130 will be kept as usual during such periods. "Special" observations will be telegraphed or telephoned as required by conditions.

(*b*) *Telephone and telegraph.*—Stations rendering airway reports regularly by telephone or telegraph will follow the above procedure with regard to the entry of observations.

CHAPTER X

OBSERVATIONS TO BE TAKEN AT STATIONS REPORTING BY TELEPHONE OR TELEGRAPH

2–111. Practically all obervations at stations reporting by telephone or telegraph are classed as "record," with the same rules for the taking of this type of observation at hourly stations also applying at these stations. No "check" observations are to be taken, and "special" observations will be taken only in accordance with specific instructions issued by the supervising Weather Bureau station.

CHAPTER XI

AUTHORITY OF GENERAL SUPERVISING OFFICIALS TO CALL FOR SPECIAL OBSERVATIONS FROM STATIONS REPORTING BY TELEPHONE OR TELEGRAPH

2–112. The general supervising official will have authority to issue instructions to airway stations, either directly or through a direct supervising official, to render special observations at such times and under such conditions as he may deem advisable for providing the greatest measure of efficient meteorological service to flights over the airway.

CHAPTER XII

INSTRUCTIONS REGARDING WITHHOLDING OF REPORTS UNDER SPECIAL CONDITIONS FROM STATIONS REPORTING BY TELEPHONE OR TELEGRAPH

2–113. Stations reporting ty telephone and telegraph, and where *specifically* instructed to do so by the Weather Bureau general supervising official for the airway, who must have received prior Central Office approval for such action, will forward reports only when one or more of the following conditions prevail at the time of observation:

(*a*) *Ceiling and sky.*—When over 5/10 of the sky is obscured by clouds at an altitude of 9,750 feet or lower above the station.

(*b*) *Precipitation.*—Precipitation is occurring at the station or is observed in the vicinity thereof.

(*c*) *Squalls, thunderstorms, etc.*—Thunderheads, thunderstorms, squalls, or other conditions tending to hamper or endanger flying are occurring at, or are observable from, the station.

(*d*) *Visibility.*—The visibility 4 is miles or less.

(*e*) *Dew point.*—The temperature of the dew point (at stations furnishing this datum) is 3° or less below the current temperature.

2–114. At the discretion of the responsible Weather Bureau official, any or all of the reports that would normally be withheld can be called for by him when, in his opinion, conditions warrant such action, and, in fact, the system of withholding reports will only be placed into effect at the discretion of the general supervising official after prior approval therefor has been obtained from the Central Office.

2–115. The observations will be taken and entered on WB Form 1130 by the observers just the same as if the reports were transmitted during such periods. The letters "NF" should be entered in the second column on WB Form 1130 for such observations as are made but "not filed" for transmission. False entries on these

forms for the purpose of avoiding the taking of observations at the regular times are easily detected by comparison with surrounding station reports and when verified may occasion the immediate dismissal of the responsible observer.

CHAPTER XIII

TRANSMISSION OF AIRWAY WEATHER REPORTS

2-116. It is necessary, of course, that airway observations be transmitted from the station at which they are made to other points where the information is needed. At many points this is done by placing the observations on the teletype or radio circuits of the Civil Aeronautics Administration, while at others it is done by forwarding them by commercial telephone or telegraph, thus requiring different methods of composing the observations for transmission.

A. Instructions for the Transmission of Airway Weather Reports by Teletype and Radio

2-117. In order to shorten transmissions of reports over the teletype and radio circuits as much as possible, there has been developed a system of symbolizing the observational data therein. This system is to be used invariably when reports are transmitted by teletype and radio, and all concerned should therefore be thoroughly familiar with the use and translation of the symbols. Symbols to be used for the various elements of an airway observation are as follows:

(*a*) *Station designator.*—This is to be indicated by use of the proper group of two or three letters representing the name of the station at which the report originated.

(*b*) *Classification of report.*—This is to be indicated by use of one of the proper letters assigned for this purpose when conditions at a controlled airport in a controlled zone fall within the classification standards. No classifying letter is sent by stations not in controlled zones.

(*c*) *Type of report.*—This is to be indicated by the letters "SPL" meaning "special observation" when such type of report is being transmitted. "Local extra observations," the transmission of which is limited to local teletype circuits, will be indicated on such circuits by "LCL".

(*d*) *Time of report.*—This is to be indicated (in "special" and "local extra" observations only) by a group of figures representing the time on the 24-hour clock followed without space or oblique by a letter representing the time zone in which the station rendering the report is located, e. g., "1354E" indicates 1:54 p. m., E. S. T.; "0022P" indicates 12:22 a. m., P. S. T.; etc.

(*e*) *Ceiling.*—1. "Unlimited" ceiling is to be indicated by the absence of a symbol or figures for this element.

2. The height of the ceiling up to and including 9,750 feet above the station is to be indicated by figures representing the proper number of *hundreds* of feet which apply, e. g., "35" indicates 3,500; "8" indicates 800; "95" indicates 9,500, etc.

3. When the ceiling is zero, the figure naught (0) is to be used.

4. When the ceiling height is estimated, the letter "E" for "estimated" is to be placed immediately preceding the figures. This is to be used only in connection with heights estimated to be between 50 and 9,751 feet above the station and is never applied to the height of scattered clouds given preceding the sky condition, when appropriate.

5. When a ceiling balloon is blown out of sight before reaching the clouds, a plus sign is to be entered preceding the ceiling figures, which represent the last observed height of the balloon. For example, "+14" would indicate that the ceiling was "over" 1,400 feet, this figure being the last observed height of the balloon.

6. When the ceiling is *below* 2,000 feet and is changeable with respect to height, this may be indicated by entering the letter "V" immediately following the ceiling value. For example, "E5V——." For complete instructions in this connection see subparagraph 2-134(i).

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(a) Station designator. This is to be indicated by use of the proper group of two or three letters representing the station at which the report originated.

(b) Classification of report. This is to be indicated by use of one of the proper letters assigned for this purpose when conditions at a controlled airport in a controlled zone fall within the classification standards. No classifying letter is sent by stations not in controlled zones.

(c) Type of report. This is to be indicated by the letters "SPL" meaning "special observation" when such type of report is being transmitted. "Local extra observations," the transmission of which is limited to local teletype circuits, will be indicated on such circuits by "LCL".

(d) Time of report. This is to be indicated (in "special" and "local extra" observations only) by a group of figures representing the time on the 24-hour clock followed without space or oblique by a letter representing the time zone in which the station rendering the report is located, e.g., "1354E" indicates 1:54 p.m., E.S.T.; "0022P" indicates 12:22 a.m., P.S.T.; etc.

(e) Ceiling. 1. "Unlimited" ceiling is to be indicated by the absence of a symbol or figures for this element.

2. The height of the ceiling up to and including 9,750 feet above the station is to be indicated by figures representing the proper number of *hundreds* of feet which apply, e.g., "35" indicates 3,500; "8" indicates 800; "95" indicates 9,500, etc.

3. When the ceiling is zero, the figure naught (0) is to be used.

4. Ceiling heights will, except as noted in paragraph 2-117*(e)*5, <u>always</u> be preceded by one of the following letters:

"M" for measured ceilings.
"E" for estimated ceilings.
"Z" for indefinite ceilings.
"P" for precipitation ceilings.
"A" for ceilings reported from aircraft.

5. When a ceiling measuring balloon is blown out of sight before reaching the clouds, a plus sign (+) will be entered in place of the ceiling classification letter, preceding the figures which represent the last observed height of the balloon. For example, "+14" would indicate that the ceiling is *over* 1,400 feet, this figure being the last observed height of the balloon.

6. When the ceiling is *below* 2,000 feet and is changeable with respect to height, this may be indicated by entering the letter "V" immediately following the ceiling value. For example, "M5V---." For complete instructions in this connection see paragraph 2-134*(i)*.

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(c) Type of report. This is to be indicated by the letters "SPL" meaning "special observation" when such type of report is being transmitted. "Local extra observations," the transmission of which is limited to local teletype circuits, will be indicated on such circuits by "LCL".

(d) Time of report. This is to be indicated (in "special" and "local extra" observations only) by a group of figures representing the time on the 24-hour clock followed without space or oblique by a letter representing the time zone in which the station rendering the report is located, e.g., "1354E" indicates 1:54 p.m., E.S.T.; "0022P" indicates 12:22 a.m., P.S.T.; etc.

(e) Ceiling. 1. "Unlimited" ceiling is to be indicated by the absence of a symbol or figures for this element.

2. The height of the ceiling up to and including 9,750 feet above the station is to be indicated by figures representing the proper number of *hundreds* of feet which apply, e.g., "35" indicates 3,500; "8" indicates 800; "95" indicates 9,500, etc.

3. When the ceiling is zero, the figure naught (0) is to be used.

4. Ceiling heights will, except as noted in paragraph 2-117*(e)*5, <u>always</u> be preceded by one of the following letters:

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"W" for indefinite ceilings.
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6. When the ceiling is *below* 2,000 feet and is changeable with respect to height, this may be indicated by entering the letter "V" immediately following the ceiling value. For example, "M5V---." For complete instructions in this connection see paragraph 2-134*(i)*.

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(*d*) *Time of report.* This is to be indicated (in "special" and "local extra" observations only) by a group of figures representing the time on the 24-hour clock followed without space or oblique by a letter representing the time zone in which the station rendering the report is located, e.g., "1354E" indicates 1:54 p.m., E.S.T.; "0022P" indicates 12:22 a.m., P.S.T.; etc.

(*e*) *Ceiling.* 1. "Unlimited" ceiling is to be indicated by the absence of a symbol or figures for this element.

2. The height of the ceiling up to and including 9,750 feet above the station is to be indicated by figures representing the proper number of *hundreds* of feet which apply, e.g., "35" indicates 3,500; "8" indicates 800; "95" indicates 9,500, etc.

3. When the ceiling is zero, the figure naught (0) is to be used.

4. Ceiling heights will, except as noted in paragraph 2-117(*e*)5, *always* be preceded by one of the following letters:

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5. When a ceiling measuring balloon is blown out of sight before reaching the clouds, a plus sign (+) will be entered in place of the ceiling classification letter, preceding the figures which represent the last observed height of the balloon. For example, "+14" would indicate that the ceiling is *over* 1,400 feet, this figure being the last observed height of the balloon.

6. When the ceiling is *below* 2,000 feet and is changeable with respect to height, this may be indicated by entering the letter "V" immediately following the ceiling value. For example, "M5V---." For complete instructions in this connection see paragraph 2-134(*i*).

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A. Instructions for the Transmission of Airway Weather Reports by Teletype and Radio:

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(a) Station designator. This is to be indicated by use of the proper group of two or three letters representing the station at which the report originated.

(b) Classification of report. This is to be indicated by use of one of the proper letters assigned for this purpose when conditions at a controlled airport in a controlled zone fall within the classification standards. No classifying letter is sent by stations not in controlled zones.

(c) Type of report. This is to be indicated by the letters "SPL" meaning "special observation" when such type of report is being transmitted. "Local extra observations," the transmission of which is limited to local teletype circuits, will be indicated on such circuits by "LCL."

(d) Time of report. This is to be indicated (in "special" and "local extra" observations only) by a group of six figures representing the day of the month and the time on the 24-hour clock followed without space or oblique by a letter representing the time zone in which the station rendering the report is located, e. g., "151354E" indicates 1:54 p.m., E.S.T.* on the 15th day of the month; "100022P" indicates 12:22 a.m., P.S.T.* on the 10th day of the month.

(e) Ceiling. 1. "Unlimited" ceiling is to be indicated by the absence of a symbol or figures for this element.

2. The height of the ceiling up to and including 9,750 feet above the station is to be indicated by figures representing the proper number of hundreds of feet which apply, e.g., "35" indicates 3,500; "8" indicates 800; "95" indicates 9,500, etc.

3. When the ceiling is zero, the figure naught (0) is to be used.

4. Ceiling heights will, except as noted in paragraph 2-117 (e)5, always be preceded by one of the following letters:

"M" for measured ceilings.	"B" for balloon ceilings.
"E" for estimated ceilings.	"P" for precipitation ceilings.
"W" for indefinite ceilings.	"A" for ceilings reported from aircraft.

5. When a ceiling measuring balloon is blown out of sight before reaching the clouds, a plus sign (+) will be entered in place of the ceiling classification letter, preceding the figures which represent the last observed height of the balloon. For example, "+14" would indicate that the ceiling is over 1,400 feet, this figure being the last observed height of the balloon.

*War-time is being used for the duration.

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A. Instructions for the Transmission of Airway Weather Reports by Teletype and Radio

2-117. In order to shorten transmissions of reports over the teletype and radio circuits as much as possible, there has been developed a system of symbolizing the observational data therein. This system is to be used invariably when reports are transmitted by teletype and radio, and all concerned should therefore be thoroughly familiar with the use and translation of the symbols. Symbols to be used for the various elements of an airway observation are as follows:

(a) Station designator.--This is to be indicated by use of the proper group of two or three letters representing the station at which the report originated.

(b) (Cancelled)

(c) Type of report.--Special observations will be indicated in transmissions by use of the letter "S" followed by the serial number of the special observation. Serial numbers will be assigned by the observer, who will number consecutively the specials for each day, beginning at midnight (clock time), the first special being designated "S1," the second "S2," etc. Local extra observations, the transmission of which is limited to local teletype circuits, will be indicated on such circuits by "LCL."

(d) Time of report.--This is to be indicated (in special and local extra observations only) by a group of four figures representing the time on the 24-hour clock followed without space or oblique by a letter representing the time zone in which the station rendering the report is located; e.g., "1354E" indicates 1:54 p.m., E.S.T.*; "0022P" indicates 12:22 a.m., P.S.T.*

(e) Ceiling.--

1. Unlimited ceiling is to be indicated by the absence of a symbol or figures for this element.

2. The height of the ceiling up to and including 9,750 feet above the station is to be indicated by figures representing the proper number of hundreds of feet which apply; e.g., "35" indicates 3,500, "8" indicates 800, "95" indicates 9,500, etc.

3. When the ceiling is zero, the figure naught (0) is to be used.

4. Ceiling heights will, except as noted in par. 2-117(e)5, always be preceded by one of the following letters:

"M" for measured ceilings.	"B" for balloon ceilings.
"E" for estimated ceilings.	"P" for precipitation ceilings.
"W" for indefinite ceilings.	"A" for ceilings reported from aircraft.

5. When a ceiling measuring balloon is blown out of sight before reaching the clouds, a plus sign (+) will be entered in place of the ceiling classification letter, preceding the figures which represent the last observed height of the balloon. For example, "+14" would indicate that the ceiling is over 1,400 feet, this figure being the last observed height of the balloon.

*War-time is being used for the duration.

CHAPTER XIII

TRANSMISSION OF AIRWAY WEATHER REPORTS

2-116. Airway observations are transmitted either on teletype and radio circuits operated by the Civil Aeronautics Administration or by commercial telephone and telegraph companies.

A. Instructions for the Transmission of Airway Weather Reports by Teletype and Radio

2-117. Use the following symbols when preparing airway weather reports for transmission over teletype and radio circuits.

(a) Station Identification.—Use the two- or three-letter identification symbol denoting the station at which the report originated.

(b) (Cancelled)

(c) Type of Report.—Indicate special and record-special observations in transmissions by "S" followed by the serial number of the special. Number the specials (including record-specials) consecutively, beginning at midnight (clock time) each day. Designate the first special "S1," the second "S2," etc. Designate local extra observations "LCL."

(d) Time of Report.—

1. Omit from reports, including record-specials, that are transmitted in sequence collections.

2. In all other reports use a group of four figures and one letter. The figures will denote the time of the observation to the nearest minute, 24-hour clock. The letter will denote the time zone in which the station is situated. Example: "1345E" denotes 1:45 p. m., e. s. t.

(e) Ceiling.—

1. Omit the symbol or figures when the ceiling is unlimited.

2. Report the height of the ceiling up to and including 9,750 feet above the station in hundreds of feet; e. g., "35" for 3,500, "8" for 800, "95" for 9,500, etc.

3. When the ceiling is zero, the figure naught (0) is used.

4. Ceiling heights will, except as noted in paragraph 2-117(e)5, always be preceded by one of the following letters:

"M" for measured ceilings.	"B" for balloon ceilings.
"E" for estimated ceilings.	"P" for precipitation ceilings.
"W" for indefinite ceilings.	"A" for ceilings reported from aircraft.

5. When a ceiling-measuring balloon is blown out of sight before reaching the clouds, a plus sign (+) will be used in place of the ceiling classification letter, and will precede the figures which denote the last observed height of the balloon. For example, "+14" indicates that the ceiling is over 1,400 feet, which is the last observed height of the balloon.

6. When the ceiling is variable and less than 2,000 feet, enter "V" following the ceiling value. For example, "W5V." (See also paragraph 2-134(i)).

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6. ~~When the ceiling is below 2,000 feet and is changeable with respect to height, this may be indicated by entering the letter "V" immediately following the ceiling value. For example, "W5V---."~~ For complete instructions ~~in~~ this connection see paragraph 2-134(i).

Cancelled 6/15/46

(*f*) *Sky.*—1. The sky condition, when observable, is to be indicated by the following symbols:

○	Clear.
⦶	Scattered clouds.
◍	Broken clouds.
⊕	Overcast.
⦶/	High scattered clouds.
◍/	High broken clouds.
⊕/	High overcast.
⊕/◍	High overcast, lower broken clouds.
⊕/⦶	High overcast, lower scattered clouds.
◍/◍	High broken, lower broken clouds.
◍/⦶	High broken, lower scattered clouds.
⦶/◍	High scattered, lower broken clouds.
⦶/⦶	High scattered, lower scattered clouds.
⊕ ◍	Overcast, lower broken clouds.
⊕ ⦶	Overcast, lower scattered clouds.
◍ ◍	Broken, lower broken clouds.
◍ ⦶	Broken, lower scattered clouds.
⦶ ◍	Scattered, lower broken clouds.
⦶ ⦶	Scattered, lower scattered clouds.

2. The plus (+) or minus (—) sign preceding cloudiness symbols will be used to indicate "dark" and "thin," respectively.

3. Whenever the "scattered clouds" symbol occurs as the last symbol in a sky condition report (the slant mark is considered as a symbol), whether used singly or in combination, the height of such scattered clouds is to be indicated by the insertion of the proper figure or figures *preceding* the symbol, without space or oblique.

4. When the sky condition cannot be determined due to the presence of dense fog, thick dust, heavy rain, heavy snow, etc., or any combinations of precipitation and obstructions to vision, no report of the sky condition, as such, will be made; that is, it will be omitted. The reason for omission in such cases will be apparent from the weather and/or obstructions to vision reported.

(*g*) *Visibility.*—1. A visibility of 10 miles or more is to be indicated by the *absence of a value* for this element. If between 9 and 10 miles, the visibility is reported as 9 miles. When the visibility is omitted from a report this element is broadcast by Civil Aeronautics Administration radio operators as "visibility more than 9 miles" and should be so interpretated when reading airway weather reports. *This interpretation in no way effects the rule that a visibility of more than 9 miles but less than 10 will be recorded as "9" in the report.*

2. Visibilities from zero up to but not including 10 miles are to be indicated by the proper figures representing the values in miles and/or fractions thereof [as prescribed in paragraph 2–142 (*b*)], e. g., "0" indicates a zero visibility; "1¼" indicates a visibility of 1¼ miles; "3" indicates a visibility of 3 miles, etc.

3. If the visibility is 2 miles or less and is changeable or fluctuating, this may be indicated by entry of the letter "V" immediately following the value. For example, "E6V⊕11/2V——" For complete instructions in this connection see subparagraph 2-142(e).

(*f*) *Sky.*—1. The sky condition, when observable, is to be indicated by the following symbols:

○ Clear.
⦶ Scattered clouds.
◍ Broken clouds.
⊕ Overcast.
⦶/ High scattered clouds.
◍/ High broken clouds.
⊕/ High overcast.
⊕/◍ High overcast, lower broken clouds.
⊕/⦶ High overcast, lower scattered clouds.
◍/◍ High broken, lower broken clouds.
◍/⦶ High broken, lower scattered clouds.
⦶/◍ High scattered, lower broken clouds.
⦶/⦶ High scattered, lower scattered clouds.
⊕ ◍ Overcast, lower broken clouds.
⊕ ⦶ Overcast, lower scattered clouds.
◍ ◍ Broken, lower broken clouds.
◍ ⦶ Broken, lower scattered clouds.
⦶ ◍ Scattered, lower broken clouds.
⦶ ⦶ Scattered, lower scattered clouds.

2. The plus (+) or minus (—) sign preceding cloudiness symbols will be used to indicate "dark" and "thin," respectively.

3. Whenever the "scattered clouds" symbol occurs as the last symbol in a sky condition report (the slant mark is considered as a symbol), whether used singly or in combination, the height of such scattered clouds is to be indicated by the insertion of the proper figure or figures *preceding* the symbol, without space or oblique.

4. When the sky condition cannot be determined due to the presence of heavy fog, heavy dust, heavy rain, heavy snow, etc., or any combinations of precipitation and obstructions to vision, no report of the sky condition, as such, will be made; that is, it will be omitted. The reason for omission in such cases will be apparent from the weather and/or obstructions to vision reported.

(*g*) *Visibility.*—1. A visibility of 10 miles or more is to be indicated by the *absence of a value* for this element. If between 9 and 10 miles, the visibility is reported as 9 miles. When the visibility is omitted from a report this element is broadcast by Civil Aeronautics Administration radio operators as "visibility more than 9 miles" and should be so interpretated when reading airway weather reports. *This interpretation in no way effects the rule that a visibility of more than 9 miles but less than 10 will be recorded as "9" in the report.*

2. Visibilities from zero up to but not including 10 miles are to be indicated by the proper figures representing the values in miles and/or fractions thereof [as prescribed in paragraph 2–142 (*b*)], e. g., "0" indicates a zero visibility; "1¼" indicates a visibility of 1¼ miles; "3" indicates a visibility of 3 miles, etc.

3. If the visibility is 2 miles or less and is changeable or fluctuating, this may be indicated by entry of the letter "V" immediately following the value. For example, "E6V⊕11/2V——" For complete instructions in this connection see subparagraph 2-142(e).

(f) Sky.—1. The sky condition, when observable, is to be indicated by the following symbols:

○ Clear.

◐ Scattered clouds.

◑ Broken clouds.

⊕ Overcast.

◐/ High scattered clouds.

◑/ High broken clouds.

⊕/ High overcast.

⊕/◑ High overcast, lower broken clouds.

⊕/◐ High overcast, lower scattered clouds.

◑/◑ High broken, lower broken clouds.

◑/◐ High broken, lower scattered clouds.

◐/◑ High scattered, lower broken clouds.

◐/◐ High scattered, lower scattered clouds.

⊕◑ Overcast, lower broken clouds.

⊕◐ Overcast, lower scattered clouds.

◑◑ Broken, lower broken clouds.

◑◐ Broken, lower scattered clouds.

◐◑ Scattered, lower broken clouds.

◐◐ Scattered, lower scattered clouds.

2. The plus (+) or minus (-) sign preceding cloudiness symbols will be used to indicate "dark" and "thin" respectively.

3. Whenever the "scattered clouds" symbol occurs as the last symbol in a sky condition report (the slant mark is considered as a symbol), whether used singly or in combination, the height of such scattered clouds is to be indicated by the insertion of the proper figure or figures preceding the symbol, without space or oblique.

4. When the sky condition cannot be determined due to the presence of heavy fog, heavy dust, heavy rain, heavy snow, etc., or any combinations of precipitation and obstructions to vision, no report of the sky condition, as such, will be made; that is, it will be omitted. The reason for omission in such cases will be apparent from the weather and/or obstructions to vision reported.

(g) Visibility.—1. Except in Alaskan reports, a visibility of 10 miles or more is to be indicated by the absence of a value for this element. If between 9 and 10 miles, the visibility is reported as 9 miles. When the visibility is omitted from the report this element is broadcast by Civil Aeronautics Administration radio operators as "visibility more than 9 miles" and should be so interpreted when reading airway weather reports. This interpretation in no way affects the rule that a visibility of more than 9 miles but less than 10 will be recorded as "9" in the report.

2. Visibilities from zero up to but not including 10 miles are to be indicated by the proper figures representing the values in miles and/or fractions thereof [as prescribed in paragraph 2-142(b)] , e.g., "0" indicates a zero visibility; "1 1/4" indicates a visibility of 1 1/4 miles; "3" indicates a visibility of 3 miles, etc.

3. If the visibility is 2 miles or less and is changeable or fluctuating, this may be indicated by entry of the letter "V" immediately following the value. For example, "E6V⊕11/2V——" For complete instructions in this connection see subparagraph 2-142(e).

(f) Sky.--

1. The sky condition is to be indicated by the following symbols and combinations:

X	Sky obscured.
O	Clear.
◐	Scattered clouds.
◑	Broken clouds.
⊕	Overcast.
◐/	High scattered clouds.
◑/	High broken clouds.
⊕/	High overcast.
⊕/◑	High overcast, lower broken clouds.
⊕/◐	High overcast, lower scattered clouds.
◑/◑	High broken, lower broken clouds.
◑/◐	High broken, lower scattered clouds.
◐/◑	High scattered, lower broken clouds.
◐/◐	High scattered, lower scattered clouds.
⊕ ◑	Overcast, lower broken clouds.
⊕ ◐	Overcast, lower scattered clouds.
◑ ◑	Broken, lower broken clouds.
◑ ◐	Broken, lower scattered clouds.
◐ ◑	Scattered, lower broken clouds.
◐ ◐	Scattered, lower scattered clouds.

2. The plus (+) or minus (-) sign preceding cloudiness symbols will be used to indicate "dark" and "thin" respectively.

3. Whenever the "scattered clouds" symbol occurs as the last symbol in a sky condition report (the slant mark is considered as a symbol), whether used singly or in combination, the height of such scattered clouds is to be indicated by the insertion of the proper figure or figures preceding the symbol, without space or oblique.

▼ 4. Whenever the sky condition cannot be determined because of precipitation or obstruction to vision, the symbol "X" will be used as a sky condition symbol to indicate "sky obscured."

(g) Visibility.--

1. Visibility will be indicated by the proper figures representing the values in miles and/or fractions thereof as prescribed in par. 2-142(b).

2. If the visibility is less than two miles and is changing or fluctuating, the letter "V" will immediately follow the value. For complete instructions in this ▲ connection see par. 2-142(e).

(*h*) *Weather.*—The "weather" element of the report is to be indicated, when appropriate, by the following symbols:

R—	Light rain.	AP—	Light small hail.
R	Moderate rain.	AP	Moderate small hail.
R+	Heavy rain.	AP+	Heavy small hail.
S—	Light snow.	SP—	Light snow pellets.
S	Moderate snow.	SP	Moderate snow pellets.
S+	Heavy snow.	SP+	Heavy snow pellets.
ZR—	Light freezing rain.	T	Thunderstorm.
ZR	Moderate freezing rain.	T+	Heavy thunderstorm.
ZR+	Heavy freezing rain.	SQ—	Mild snow squall.
L—	Light drizzle.	SQ	Moderate snow squall.
L	Moderate drizzle.	SQ+	Severe snow squall.
L+	Heavy drizzle.	RQ—	Mild rain squall.
ZL—	Light freezing drizzle.	RQ	Moderate rain squall.
ZL	Moderate freezing drizzle.	RQ+	Severe rain squall.
ZL+	Heavy freezing drizzle.	SW—	Light snow showers.
E—	Light sleet.	SW	Moderate snow showers.
E	Moderate sleet.	SW+	Heavy snow showers.
E+	Heavy sleet.	RW—	Light rain showers.
A—	Light hail.	RW	Moderate rain showers.
A	Moderate hail.	RW+	Heavy rain showers.
A+	Heavy hail.		
TORNADO (always to be written out in full).			

(Caution.—The symbols SP—, SP, and SP+ will never be interpreted as "sprinkling.")

Wind shifts are to be indicated by entry immediately following the last element of the *wind data* of the report, by use of a direction arrow showing direction of wind prior to shift to 8 points of the compass, followed by the local time, the local time zone, and indication of intensity by entry of minus and plus signs for "mild" and "severe," respectively, and the symbols named foregoing alone for "moderate," e. g., "↖1513E—," "↑0053P+," "→1822M," etc.

(*i*) *Obstructions to vision.*—The "obstructions to vision" element of the reports is to be indicated, when appropriate, by the following symbols:

F— —	Damp haze.	BS—	Light blowing snow.
F—	Light fog.	BS	Moderate blowing snow.
F	Moderate fog.	BS+	Thick blowing snow.
F+	Thick fog.	GS—	Light drifting snow.
FF	Dense fog.	GS	Moderate drifting snow.
GF—	Light ground fog.	GS+	Thick drifting snow.
GF	Moderate ground fog.	BD—	Light blowing dust.
GF+	Thick ground fog.	BD	Moderate blowing dust.
GFF	Dense ground fog.	BD+	Thick blowing dust.
H	Hazy. (Dry haze).	BN—	Light blowing sand.
K—	Light smoke.	BN	Moderate blowing sand.
K	Moderate smoke.	BN+	Thick blowing sand.
K+	Thick smoke.	IF—	Light ice fog.
D—	Light dust.	IF	Moderate ice fog.
D	Moderate dust.	IF+	Thick ice fog.
D+	Thick dust.	IFF	Dense ice fog.

(*h*) *Weather.*—The "weather" element of the report is to be indicated, when appropriate, by the following symbols:

R—	Light rain.	AP—	Light small hail.
R	Moderate rain.	AP	Moderate small hail.
R+	Heavy rain.	AP+	Heavy small hail.
S—	Light snow.	SP—	Light snow pellets.
S	Moderate snow.	SP	Moderate snow pellets.
S+	Heavy snow.	SP+	Heavy snow pellets.
ZR—	Light freezing rain.	T	Thunderstorm.
ZR	Moderate freezing rain.	T+	Heavy thunderstorm.
ZR+	Heavy freezing rain.	SQ—	Light snow squall.
L—	Light drizzle.	SQ	Moderate snow squall.
L	Moderate drizzle.	SQ+	Heavy snow squall.
L+	Heavy drizzle.	RQ—	Light rain squall.
ZL—	Light freezing drizzle.	RQ	Moderate rain squall.
ZL	Moderate freezing drizzle.	RQ+	Heavy rain squall.
ZL+	Heavy freezing drizzle.	SW—	Light snow showers.
E—	Light sleet.	SW	Moderate snow showers.
E	Moderate sleet.	SW+	Heavy snow showers.
E+	Heavy sleet.	RW—	Light rain showers.
A—	Light hail.	RW	Moderate rain showers.
A	Moderate hail.	RW+	Heavy rain showers.
A+	Heavy hail.		
TORNADO (always to be written out in full).			

(Caution.—The symbols SP—, SP, and SP+ will never be interpreted as "sprinkling.")

Wind shifts are to be indicated by entry immediately following the last element of the *wind data* of the report, by use of a direction arrow showing direction of wind prior to shift to 8 points of the compass, followed by the local time, the local time zone, and indication of intensity by entry of minus and plus signs for "light" and "heavy," respectively, and the symbols named foregoing alone for "moderate," e. g., "↖1513E—," "↑0053P+." "→1822M," etc.

(*i*) *Obstructions to vision.*—The "obstructions to vision" element of the reports is to be indicated, when appropriate, by the following symbols:

F— —	Damp haze.	BS—	Light blowing snow.
F—	Light fog.	BS	Moderate blowing snow.
F	Moderate fog.	BS+	Heavy blowing snow.
F+	Heavy fog.	GS—	Light drifting snow.
GF—	Light ground fog.	GS	Moderate drifting snow.
GF	Moderate ground fog.	GS+	Heavy drifting snow.
GF+	Heavy ground fog.	BD—	Light blowing dust.
H	Hazy. (Dry haze).	BD	Moderate blowing dust.
K—	Light smoke.	BD+	Heavy blowing dust.
K	Moderate smoke.	BN—	Light blowing sand.
K+	Heavy smoke.	BN	Moderate blowing sand.
D—	Light dust.	BN+	Heavy blowing sand.
D	Moderate dust.	IF—	Light ice fog.
D+	Heavy dust.	IF	Moderate ice fog.
		IF+	Heavy ice fog.

(h) Weather.—The "weather" element of the report is to be indicated, when appropriate, by the following symbols:

R-	Light rain.	AP-	Light small hail.
R	Moderate rain.	AP	Moderate small hail.
R+	Heavy rain.	AP+	Heavy small hail.
S-	Light snow.	SP-	Light snow pellets.
S	Moderate snow.	SP	Moderate snow pellets.
S+	Heavy snow.	SP+	Heavy snow pellets.
ZR-	Light freezing rain.	T	Thunderstorm.
ZR	Moderate freezing rain.	T+	Heavy thunderstorm.
ZR+	Heavy freezing rain.	SQ-	Light snow squall.
L-	Light drizzle.	SQ	Moderate snow squall.
L	Moderate drizzle.	SQ+	Heavy snow squall.
L+	Heavy drizzle.	RQ-	Light rain squall.
ZL-	Light freezing drizzle.	RQ	Moderate rain squall.
ZL	Moderate freezing drizzle.	RQ+	Heavy rain squall.
ZL+	Heavy freezing drizzle.	SW-	Light snow showers.
E-	Light sleet.	SW	Moderate snow showers.
E	Moderate sleet.	SW+	Heavy snow showers.
E+	Heavy sleet.	RW-	Light rain showers.
A-	Light hail.	RW	Moderate rain showers.
A	Moderate hail.	RW+	Heavy rain showers.
A+	Heavy hail.		
TORNADO (always to be written out in full).			

(Caution.—The symbols SP-, SP, and SP+ will never be interpreted as "sprinkling.")

(i) Obstructions to vision.—The "obstructions to vision" element of the reports is to be indicated, when appropriate, by the following symbols:

F- -	Damp haze.	BS-	Light blowing snow.
F-	Light fog.	BS	Moderate blowing snow.
F	Moderate fog.	BS+	Heavy blowing snow.
F+	Heavy fog.	GS-	Light drifting snow.
GF-	Light ground fog.	GS	Moderate drifting snow.
GF	Moderate ground fog.	GS+	Heavy drifting snow.
GF+	Heavy ground fog.	BD-	Light blowing dust.
H	Hazy. (Dry haze).	BD	Moderate blowing dust.
K-	Light smoke.	BD+	Heavy blowing dust.
K	Moderate smoke.	BN-	Light blowing sand.
K+	Heavy smoke.	BN	Moderate blowing sand.
D-	Light dust.	BN+	Heavy blowing sand.
D	Moderate dust.	IF-	Light ice fog.
D+	Heavy dust.	IF	Moderate ice fog.
		IF+	Heavy ice fog.

(*h*) *Weather.*—The "weather" element of the report is to be indicated, when appropriate, by the following symbols:

R—	Light rain.
R	Moderate rain.
R+	Heavy rain.
S—	Light snow.
S	Moderate snow.
S+	Heavy snow.
ZR—	Light freezing rain.
ZR	Moderate freezing rain.
ZR+	Heavy freezing rain.
L—	Light drizzle.
L	Moderate drizzle.
L+	Heavy drizzle.
ZL—	Light freezing drizzle.
ZL	Moderate freezing drizzle.
ZL+	Heavy freezing drizzle.
E—	Light sleet.
E	Moderate sleet.
E+	Heavy sleet.
A—	Light hail.
A	Moderate hail.
A+	Heavy hail.
TORNADO (always to be written out in full).	
AP—	Light small hail.
AP	Moderate small hail.
AP+	Heavy small hail.
SP—	Light snow pellets.
SP	Moderate snow pellets.
SP+	Heavy snow pellets.
T	Thunderstorm.
T+	Heavy thunderstorm.
SQ—	Mild snow squall.
SQ	Moderate snow squall.
SQ+	Severe snow squall.
RQ—	Mild rain squall.
RQ	Moderate rain squall.
RQ+	Severe rain squall.
SW—	Light snow showers.
SW	Moderate snow showers.
SW+	Heavy snow showers.
RW—	Light rain showers.
RW	Moderate rain showers.
RW+	Heavy rain showers.

(Caution.—The symbols SP—, SP, and SP+ will never be interpreted as "sprinkling.")

Wind shifts are to be indicated by entry immediately following the last element of the *wind data* of the report, by use of a direction arrow showing direction of wind prior to shift to 8 points of the compass, followed by the local time, the local time zone, and indication of intensity by entry of minus and plus signs for "mild" and "severe," respectively, and the symbols named foregoing alone for "moderate," e. g., "↖1513E—," "↑0053P+," "→1822M," etc.

(*i*) *Obstructions to vision.*—The "obstructions to vision" element of the reports is to be indicated, when appropriate, by the following symbols:

F— —	Damp haze.
F—	Light fog.
F	Moderate fog.
F+	Thick fog.
FF	Dense fog.
GF—	Light ground fog.
GF	Moderate ground fog.
GF+	Thick ground fog.
GFF	Dense ground fog.
H	Hazy. (Dry haze).
K—	Light smoke.
K	Moderate smoke.
K+	Thick smoke.
D—	Light dust.
D	Moderate dust.
D+	Thick dust.
BS—	Light blowing snow.
BS	Moderate blowing snow.
BS+	Thick blowing snow.
GS—	Light drifting snow.
GS	Moderate drifting snow.
GS+	Thick drifting snow.
BD—	Light blowing dust.
BD	Moderate blowing dust.
BD+	Thick blowing dust.
BN—	Light blowing sand.
BN	Moderate blowing sand.
BN+	Thick blowing sand.
IF—	Light ice fog.
IF	Moderate ice fog.
IF+	Thick ice fog.
IFF	Dense ice fog.

(*j*) *Barometric pressure.*—The barometric pressure is to be indicated by a group of three figures, the first two of which represent the tens and units of millibars and the last of which represents the tenths of a millibar involved. Thus, a pressure of 987.2 millibars would be sent as "872"; of 1001.5 as "015"; of 1000.0 as "000"; etc.

(*k*) *Temperature.*—This is to be indicated in figures giving its value to the nearest degree Fahrenheit.

(*l*) *Dew point.*—This is to be indicated in figures, giving its value to the nearest degree Fahrenheit. When sent, it follows the temperature and is separated therefrom by an oblique (slant mark).

NOTE.—Temperature below zero Farhenheit is to be indicated by the entry of a minus sign (−) immediately preceding the figures for temperature and/or dew point.

(*m*) *Wind.*—The wind direction, velocity, and character (the latter when appropriate) are to be indicated as follows:

1. The wind *direction* is indicated by arrows, as follows:

↓	North	↑	South
↓↙	North-northeast	↑↗	South-southwest
↙	Northeast	↗	Southwest.
←↙	East-northeast	→↗	West-southwest.
←	East	→	West
←↖	East-southeast	→↘	West-northwest
↖	Southeast	↘	Northwest
↑↖	South-southeast	↓↘	North-northwest

2. The *velocity* is to be indicated by figures representing its value in miles per hour, "calm" being indicated by the letter "C". If estimated, this is to be indicated by the entry of the letter "E" immediately following the figures, without space or oblique.

3. The *character* of the wind is to be indicated, when appropriate, by entry of the following symbols immediately following the velocity, without space or oblique:

−Fresh gusts
+Strong gusts

(*n*) *Altimeter setting.*—This is to be indicated by a group of three figures, the first of which will represent the inch and the last two will represent the number of hundredths of an inch of the pressure setting for sensitive altimeters. When sent, it follows the wind element of the report and is separated therefrom by an oblique (slant mark).

(*o*) *Remarks.*—Remarks are to be entered by use of proper symbols and authorized abbreviations. When sent, remarks are separated from the preceding element by an oblique.

2–118. Grouping of Symbols in Teletype and Radio Transmissions.—Transmission of the reports in symbols by teletype or radio shall be in the order shown below:

(*a*) STATION DESIGNATOR.
(One space.)
(*b*) CLASSIFICATION (1) one letter.
(One space.)
(*c*) TYPE OF REPORT (2).
(One space.)
(*d*) TIME OF REPORT (3).
(One space.)
(*e*) CEILING (4).
(*f*) SKY (5).
(*g*) VISIBILITY (6).
(*h*) WEATHER (7).
(*i*) OBSTRUCTIONS TO VISION (7).
(One space.)

} As one group.

(j) Barometric pressure.—The barometric pressure is to be indicated by a group of three figures, the first two of which represent the tens and units of millibars and the last of which represents the tenths of a millibar involved. Thus, a pressure of 987.2 millibars would be sent as "872"; of 1001.5 as "015"; of 1000.0 as "000"; etc.

(k) Temperature.—This is to be indicated in figures giving its value to the nearest degree Fahrenheit.

(l) Dew point.—This is to be indicated in figures, giving its value to the nearest degree Fahrenheit. When sent, it follows the temperature and is separated therefrom by an oblique (slant mark).

Note.—Temperature below zero Fahrenheit is to be indicated by the entry of a minus sign (-) immediately preceding the figures for temperature and/or dew point.

(m) Wind.—The wind direction, velocity, and character (the latter when appropriate) are to be indicated as follows:

1. The wind direction is indicated by arrows, as follows:

↓	North	↑	South
↓↙	North-northeast	↑↗	South-southwest
↙	Northeast	↗	Southwest
←↙	East-northeast	→↗	West-southwest
←	East	→	West
←↖	East-southeast	→↘	West-northwest
↖	Southeast	↘	Northwest
↑↖	South-southeast	↓↘	North-northwest

2. The velocity is to be indicated by figures representing its value in miles per hour, "calm" being indicated by the letter "C". If estimated, this is to be indicated by the entry of the letter "E" immediately following the figures, without space or oblique.

3. The character of the wind is to be indicated, when appropriate, by entry of the following symbols immediately following the velocity, without space or oblique:

-Fresh gusts
+Strong gusts

4. Wind shifts are to be indicated by entry, immediately following the last element of the wind data of the report, of a direction arrow showing direction of wind prior to shift to 16 points of the compass, followed by the local time, the local time zone, and indication of intensity by entry of minus and plus signs for "light" and "heavy," respectively, and the symbols without the plus or minus sign for "moderate;" e.g., "↖1513E-," "↑0052P+," ↑↗ 1822M."

(n) Altimeter setting.—This is to be indicated by a group of three figures, the first of which will represent the inch and the last two will represent the number of hundredths of an inch of the pressure setting for sensitive altimeters. When sent, it follows the wind element of the report and is separated therefrom by a slant (/).

(o) Remarks.—Remarks will be entered by use of proper symbols and authorized abbreviations. When sent, remarks are separated from the preceding element by a slant (/). If the time of the phenomena reported in remarks differs from the time of the report (e.g., RAFRZ, PIREPS or time of lowest pressure in barogram "V"), a 4-figure time group (omitting day of month) with the appropriate letter designating time zone will be used to show the time that the phenomena were observed.

2-118. GROUPING OF SYMBOLS IN TELETYPE AND RADIO TRANSMISSIONS.—Transmission of the reports in symbols by teletype or radio shall be in the order shown below:

(a) STATION DESIGNATOR.
(One space.)
(b) CLASSIFICATION (1) one letter.
(One space.)
(c) TYPE OF REPORT (2).
(One space.)
(d) TIME OF REPORT (3).
(One space.)
(e) CEILING (4).
(f) SKY (5).
(g) VISIBILITY (6).
(h) WEATHER (7).
(i) OBSTRUCTIONS TO VISION (7).
(One space.)
} As one group.
(j) BAROMETRIC PRESSURE (8), (9).
(k) TEMPERATURE (9).
(l) DEW POINT (9).
(m) WIND AND WINDSHIFTS (10).
(n) ALTIMETER SETTING (8), (10).
(o) REMARKS in symbols and authorized abbreviations.
} As one group.

(1) Sent only by stations at controlled airports within controlled zones.
(2) "Type of report" given only in cases of "special" and "local extra" observations.
(3) "Time of report" given only in cases of "special" or "local extra" observations.
(4) The absence of a value for "ceiling" indicates that it is "unlimited".
(5) The absence of sky condition symbols indicates that the true condition of the sky is not observable owing to the presence of intense types of precipitation or obstructions to vision.
(6) The absence of a value for visibility indicates that this is 10 miles or more.
(7) The absence of an entry for "weather" or "obstructions to vision" indicates that phenomena classified as such are not occurring.
(8) Sent only from stations equipped with mercurial barometers.
(9) Not included in abbreviated special report.
(10) Included in special report only if change in this element requires a special.

2-119. REPORTING MISSING ELEMENTS.—Elements normally sent, but for some reason missing from the teletype or radio transmission, will be indicated by the letter "M" entered in the report in place of the missing data. Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not sent, the temperature will be followed by the wind, etc.

2-118. Grouping of Symbols in Teletype and Radio Transmissions.--Transmission of the reports in symbols by teletype or radio will be in the order shown below:

(a) STATION DESIGNATOR.
► (b) (Cancelled)
(c) TYPE OF REPORT (2).
(d) TIME OF REPORT (3).
(e) CEILING (4).
(f) SKY (5).
(g) VISIBILITY (6)
(h) WEATHER (7)
(i) OBSTRUCTIONS TO VISION (7).
} As one group.
(j) BAROMETRIC PRESSURE (8), (9).
(k) TEMPERATURE (9).
(l) DEW POINT (9).
(m) WIND AND WINDSHIFTS (10).
(n) ALTIMETER SETTING (8), (10).
(o) REMARKS in symbols and authorized contractions.
} As one group.

► (1) (Cancelled)
(2) Type of report given only in cases of special and local extra observations.
(3) Time of report given only in cases of special or local extra observations.
(4) The absence of a value for ceiling indicates that it is unlimited.
► (5) (Cancelled)
► (6) (Cancelled)
(7) The absence of an entry for weather or obstructions to vision indicates that reportable phenomena are not occurring.
(8) Sent only from stations equipped with mercurial barometers.
(9) Not included in abbreviated special report.
► (10) Windshifts and altimeter setting included in special report only if change in these requires a special.

2-119. Reporting Missing Elements.--Elements normally sent, but for some reason missing from the teletype or radio transmission, will be indicated by the letter "M" entered in the report in place of the missing data. Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not sent, the temperature will be followed by the wind, etc.

2-120. Examples.--The following examples indicate the manner in which observations are placed in the symbol form for transmission by teletype. Letters in the left column correspond to those given to the various elements above:

2-118. Grouping of Symbols in Teletype and Radio Transmissions.—Transmission of the reports in symbols by teletype or radio will be in the order shown below:

(a) STATION DESIGNATOR.
(b) (Cancelled).
(c) TYPE OF REPORT (2).
(d) TIME OF REPORT (3).
(e) CEILING (4).
(f) SKY.
(g) VISIBILITY.
(h) WEATHER (7).
(i) OBSTRUCTIONS TO VISION (7).
} As one group.
(j) BAROMETRIC PRESSURE (8), (9).
(k) TEMPERATURE (9).
(l) DEW POINT (9).
(m) WIND AND WINDSHIFTS (10).
(n) ALTIMETER SETTING (8), (10).
(o) REMARKS in symbols and authorized contractions.
} As one group.

▶ (2) Transmit only in special, record-special, and local extra observations.
▶ (3) Transmit unless report is included in a sequence collection.
(4) Omit when unlimited.

(7) Report if present.
(8) Transmit if station is equipped with mercurial barometer.
(9) Omit from abbreviated special reports.
(10) Include if required.

2-119. Reporting Missing Elements.—Indicate omitted data by substituting "M" for each element missing in a report, provided that element would ordinarily be included; e.g., if the temperature is 69, the dew point missing, and the wind west four, the data are transmitted: 69/M→4

Stations that regularly omit certain elements will not substitute "M" for them; e.g., if the dew point is regularly omitted the data in the above example are transmitted: 69→4

2-120. Examples.—The following examples illustrate observations in symbol form for transmission. Letters in the left column correspond with those in paragraph 2-118.

(*j*) BAROMETRIC PRESSURE (8).
(*k*) TEMPERATURE.
(*l*) DEW POINT.
(*m*) WIND and WINDSHIFTS.
(*n*) ALTIMETER SETTING (8).
(*o*) REMARKS in symbols and authorized abbreviations.
} As one group.

(1) Sent only by stations at controlled airports within controlled zones.
(2) "Type of report" given only in cases of "special" and "local extra" observations.
(3) "Time of report" given only in cases of "special" or "local extra" observations.
(4) The absence of a value for "ceiling" indicates that it is "unlimited".
(5) The absence of sky conditions symbols indicates that the true condition of the sky is not observable owing to the presence of intense types of precipitation or obstructions to vision.
(6) The absence of a value for visibility indicates that this is 10 miles or more.
(7) The absence of an entry for "weather" or "obstructions to vision" indicates that phenomena classified as such are not occurring.
(8) Sent only from stations equipped with mercurial barometers.

2–119. Reporting Missing Elements.—Elements normally sent, but for some reason missing from the teletype or radio transmission, will be indicated by the letter "M" entered in the report in place of the missing data. Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not sent, the temperature will be followed by the wind, etc.

2–120. Examples.—The following examples indicate the manner in which observations are placed in the symbol form for transmission by teletype. Letters in the left columns correspond to those given to the various elements above:

Example 1

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(*a*)	CG	Chicago, Ill.	(*j*)	982	998.2 millibars.
(*b*)	X	Closed.	(*k*)	28	28° F.
(*c*)	SPL	Special report.	(*l*)	26	26° F.
(*d*)	1612C	4:12 p. m., C. S. T.	(*m*)	↙20+	Northeast, 20 miles per hour, strong gusts.
(*e*)	E3V	Estimated 300 ft. variable.	(*n*)	945	29.45 inches.
(*f*)	⊕	Overcast.	(*o*)	SNW+ OCNLY	Snow occasionally heavy
(*g*)	1/2V	½ mile, variable.			
(*h*)	S	Moderate snow.			
(*i*)		None, except the snow.			

Written on teletype thus:
CG × SPL 1612C E3V⊕1/2VS 982/28/26↙20+/945/SNW+ OCNLY

Example 2

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(*a*)	CV	Cleveland, Ohio.	(*j*)	991	999.1 millibars.
(*b*)	X	Closed.	(*k*)	75	75° F.
(*c*)	SPL	Special report.	(*l*)	73	73° F.
(*d*)	0020E	12:20 a. m., E. S. T.	(*m*)	→30+↖0015E	West 30 miles per hour, strong gusts, moderate windshift from southeast at 12:15 a. m., E. S. T.
(*e*)	E2	Estimated 200 feet.	(*n*)	950	29.50 inches.
(*f*)	+⊕	Dark overcast.	(*o*)	T MOVG EWD	Thunderstorm moving eastward.
(*g*)	1/2	½ mile.			
(*h*)	T+A+R+	Heavy thunderstorm, heavy hail, heavy rain.			
(*i*)		None, except precipitation.			

Written on teletype thus:
CV × SPL 0020E E2+⊕1/2T+A+R+ 991/75/73→30+↖0015E/950/T MOVG EWD

(j) BAROMETRIC PRESSURE (8).
(k) TEMPERATURE.
(l) DEW POINT.
(m) WIND and WINDSHIFTS.
(n) ALTIMETER SETTING (8).
(o) REMARKS in symbols and authorized abbreviations.
} As one group.

(1) Sent only by stations at controlled airports within controlled zones.
(2) "Type of report" given only in cases of "special" and "local extra" observations.
(3) "Time of report" given only in cases of "special" or "local extra" observations.
(4) The absence of a value for "ceiling" indicates that it is "unlimited".
(5) The absence of sky conditions symbols indicates that the true condition of the sky is not observable owing to the presence of intense types of precipitation or obstructions to vision.
(6) The absence of a value for visibility indicates that this is 10 miles or more.
(7) The absence of an entry for "weather" or "obstructions to vision" indicates that phenomena classified as such are not occurring.
(8) Sent only from stations equipped with mercurial barometers.

2-119. Reporting Missing Elements.—Elements normally sent, but for some reason missing from the teletype or radio transmission, will be indicated by the letter "M" entered in the report in place of the missing data. Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not sent, the temperature will be followed by the wind, etc.

2-120. Examples.—The following examples indicate the manner in which observations are placed in the symbol form for transmission by teletype. Letters in the left columns correspond to those given to the various elements above:

Example 1

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(a)	CG	Chicago, Ill.	(j)	982	998.2 millibars.
(b)	X	Closed.	(k)	28	28° F.
(c)	SPL	Special report.	(l)	26	26° F.
(d)	1612C	4:12 p. m., C. S. T.	(m)	↙20+	Northeast, 20 miles per hour, strong gusts.
(e)	P3V	Precipitation 300 ft. variable	(n)	945	29.45 inches.
(f)	⊕	Overcast.	(o)	SNW+ OCNLY	Snow occasionally heavy
(g)	1/2V	½ mile, variable.			
(h)	S	Moderate snow.			
(i)		None, except the snow.			

Written on teletype thus:
CG × SPL 1612C P3V⊕1/2VS 982/28/26↙20+/945/SNW+ OCNLY

Example 2

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(a)	CV	Cleveland, Ohio.	(j)	991	999.1 millibars.
(b)	X	Closed.	(k)	75	75° F.
(c)	SPL	Special report.	(l)	73	73° F.
(d)	0020E	12:20 a. m., E. S. T.	(m)	→30+↖0015E	West 30 miles per hour, strong gusts, moderate windshift from southeast at 12:15 a. m., E. S. T.
(e)	P2	Precipitation 200 feet.			
(f)	+⊕	Dark overcast.			
(g)	1/2	½ mile.			
(h)	T+A+R+	Heavy thunderstorm, heavy hail, heavy rain.	(n)	950	29.50 inches.
(i)		None, except precipitation.	(o)	T MOVG EWD	Thunderstorm moving eastward.

Written on teletype thus:
CV × SPL 0020E P2+⊕1/2T+A+R+ 991/75/73→30+↖0015E/950/T MOVG EWD

2-120. EXAMPLES.—The following examples indicate the manner in which observations are placed in the symbol form for transmission by teletype. Letters in the left column correspond to those given to the various elements above:

Example 1, Special Observation

Element	Teletype symbol	Translation
(a)--------	CG	Chicago, Illinois
(b)--------	N	Instrument
(c)--------	SPL	Special report
(d)--------	031612C	4:12 p.m., C.S.T.* on the 3d
(e)--------	P3	Precipitation 300 feet
(f)--------	⊕	Overcast
(g)--------	1/2	1/2 mile
(h)--------	S	Moderate snow
(i)--------	———————	None, except the snow
(o)--------	SNW+ OCNLY	Snow occasionally heavy

Written on teletype thus: CG N SPL 031612C P3⊕1/2S/SNW+ OCNLY

Example 2, Special Observation

Element	Teletype symbol	Translation
(a)--------	CV	Cleveland, Ohio
(b)--------	N	Instrument
(c)--------	SPL	Special report
(d)--------	030020E	12:20 a.m., E.S.T.* on the 3d
(e)--------	P2	Precipitation 200 feet
(f)--------	⊕	Overcast
(g)--------	1/4	1/4 mile
(h)--------	T+A+RW+	Heavy thunderstorm, heavy hail, heavy rain showers
(i)--------	———————	None, except precipitation
(m)--------	→30+↖0015E	West 30 miles per hour, strong gusts, moderate wind shift from southeast at 12:15 a.m., E.S.T.*
(n)--------	950	29.50 inches
(o)--------	T OVHD MOVG EWD FQT LTNG CLD TO GND	Thunderstorm overhead, moving eastward; frequent lightning cloud to ground

Written on teletype thus: CV N SPL 030020E P2⊕1/4T+A+RW+ →30+↖0015E/950/T OVHD MOVG EWD FQT LTNG CLD TO GND

* War Time is being used for the duration.

Example 1, Special Observation

Element	Teletype symbol	Translation
(a)-------	CG	Chicago, Illinois
► (b)-------		(Cancelled)
► (c)-------	S3	Third special report of the day
► (d)-------	1612C	4:12 p.m., C.S.T.*
(e)-------	P3	Precipitation ceiling 300 feet
► (f)-------	X	Sky obscured
(g)-------	1/2	1/2 mile visibility
(h)-------	S	Moderate snow
(i)-------		None, except the snow
► (m)-------	C	Calm
(o)-------	SNW OCNLY HVY	Snow occasionally heavy

Written on teletype thus: CG S3 1612C P3X1/2S C/SNW OCNLY HVY

Example 2, Special Observation

Element	Teletype symbol	Translation
(a)-------	CV	Cleveland, Ohio
► (b)-------		(Cancelled)
► (c)-------	S4	Fourth special report of the day
► (d)-------	0020E	12:20 a.m., E.S.T.*
(e)-------	P2	Precipitation ceiling 200 feet
► (f)-------	X	Sky obscured
(g)-------	1/4	1/4 mile visibility
(h)-------	T+RW+A+	Heavy thunderstorm, heavy hail, heavy rain showers
(i)-------		None, except precipitation
(m)-------	→30+↖0015E	West 30 miles per hour, strong gusts, moderate wind shift from southeast at 12:15 a.m., E.S.T.*
(n)-------	950	29.50 inches
(o)-------	T OVHD MOVG EWD FQT LTNG CLD TO GND	Thunderstorm overhead, moving eastward; frequent lightning cloud to ground

Written on teletype thus: CV S4 0020E P2X1/4T+RW+A+ →30+↖0015E/950/T OVHD MOVG EWD FQT LTNG CLD TO GND

*War Time is being used for the duration.

Example 3

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(*a*)	GI	Grand Island, Nebr.	(*g*)	1/8	1/8 mile.
(*b*)	----------	Not a controlled airport.	(*h*)	----------	None to report.
(*c*)	----------	Regular sequence report, no "type of report," required.	(*i*)	GFF	Dense ground fog.
			(*j*)	204	1020.4 millibars.
			(*k*)	59	59° F.
(*d*)	----------	Regular sequence report, no "time of report" required.	(*l*)	59	59° F.
			(*m*)	C	Wind calm.
			(*n*)	014	30.14 inches.
(*e*)	----------	Ceiling unlimited.	(*o*)	----------	None.
(*f*)	○	Clear.			

Written on teletype thus:
GI ○1/8GFF 204/59/59C/014

Example 4

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(*a*)	SL	Salt Lake City, Utah.	(*g*)	0	Visibility zero.
(*b*)	X	Closed.	(*h*)	L+FF	Heavy drizzle, dense fog.
(*c*)	----------	Regular sequence report, no "type of report" required.	(*i*)		
			(*j*)	077	1007.7 millibars.
			(*k*)	40	40° F.
(*d*)	----------	Regular sequence report, no "time of report" required.	(*l*)	40	40° F.
			(*m*)	←4	East, 4 miles per hour.
			(*n*)	976	29.76 inches.
(*e*)	0	Ceiling zero.	(*o*)	----------	None.
(*f*)	----------	Sky not observable, due to "heavy drizzle" and "dense fog."			

Written on teletype thus:
SL X 00L+FF 077/40/40←4/976

NOTE.—As a graphical illustration of symbolized weather reports, see insert, "Explanation of Symbol Weather Reports," at back of this circular.

2–121. Use of Symbols in Circular.—The foregoing symbols will be used hereafter in the circular when considered necessary for the giving of proper illustrations or examples.

B. Method of Telephoning or Telegraphing Reports

2–122. Telegraph.—Airway weather reports will be transmitted by telegraph in accordance with the following rules:

(*a*) All words will be spelled out.

(*b*) The station name and the time of filing in cases of "special" observations, will not be included in the body of the message since these will be indicated in the message as transmitted by the telegraph company.

(*c*) Separate groups of five figures or less may be sent as one word in telegraphed messages. Therefore, figures in groups of five or less shall be used wherever possible in transmitting numerical values of data in the reports. However, the word "minus" must be used preceding the temperature and/or dew-point figures to indicate below-zero values. Fractions can be sent in a figure group by use of a slant mark (oblique); the slant mark is counted as one figure of the group.

(*d*) The word "clouds" will not be sent when giving the "sky" conditions. For example, "broken clouds" would be sent as "broken"; "high broken, lower scattered clouds" as "high broken, lower scattered," etc.

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Example 3

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(a)	GI	Grand Island, Nebr.	(g)	1/8	1/8 mile.
(b)	----------	Not a controlled airport.	(h)	----------	None to report.
(c)	----------	Regular sequence report, no "type of report," required.	(i)	GF⊞	Heavy ground fog.
			(j)	204	1020.4 millibars.
			(k)	59	59° F.
(d)	----------	Regular sequence report, no "time of report" required.	(l)	59	59° F.
			(m)	C	Wind calm.
			(n)	014	30.14 inches.
(e)	----------	Ceiling unlimited.	(o)	----------	None.
(f)	○	Clear.			

Written on teletype thus:
GI ○1/8GF⊞ 204/59/59C/014

Example 4

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(a)	SL	Salt Lake City, Utah.	(g)	0	Visibility zero.
(b)	X	Closed.	(h)	L+F⊞	Heavy drizzle, heavy fog.
(c)	----------	Regular sequence report, no "type of report" required.	(i)		
			(j)	077	1007.7 millibars.
			(k)	40	40° F.
(d)	----------	Regular sequence report, no "time of report" required.	(l)	40	40° F.
			(m)	←4	East, 4 miles per hour.
			(n)	976	29.76 inches.
(e)	0	Ceiling zero.	(o)	----------	None.
(f)	----------	Sky not observable, due to "heavy drizzle" and "heavy fog."			

Written on teletype thus:
SL X 00L+F⊞077/40/40←4/976

NOTE.—As a graphical illustration of symbolized weather reports, see insert, "Explanation of Symbol Weather Reports," at back of this circular.

2–121. Use of Symbols in Circular.—The foregoing symbols will be used hereafter in the circular when considered necessary for the giving of proper illustrations or examples.

B. Method of Telephoning or Telegraphing Reports

2–122. Telegraph.—Airway weather reports will be transmitted by telegraph in accordance with the following rules:

(*a*) All words will be spelled out.

(*b*) The station name and the time of filing in cases of "special" observations, will not be included in the body of the message since these will be indicated in the message as transmitted by the telegraph company.

(*c*) Separate groups of five figures or less may be sent as one word in telegraphed messages. Therefore, figures in groups of five or less shall be used wherever possible in transmitting numerical values of data in the reports. However, the word "minus" must be used preceding the temperature and/or dew-point figures to indicate below-zero values. Fractions can be sent in a figure group by use of a slant mark (oblique); the slant mark is counted as one figure of the group.

(*d*) The word "clouds" will not be sent when giving the "sky" conditions. For example, "broken clouds" would be sent as "broken"; "high broken, lower scattered clouds" as "high broken, lower scattered," etc.

Example 3

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(a)	GI	Grand Island, Nebr.	(g)	1/8	1/8 mile.
(b)	----------	Not a controlled airport.	(h)	----------	None to report.
(c)	----------	Regular sequence report, no "type of report," required.	(i)	GF+	Heavy ground fog.
			(j)	204	1020.4 millibars.
			(k)	59	59° F.
(d)	----------	Regular sequence report, no "time of report" required.	(l)	59	59° F.
			(m)	C	Wind calm.
			(n)	014	30.14 inches.
(e)	----------	Ceiling unlimited.	(o)	----------	None.
(f)	○	Clear.			

Written on teletype thus:
GI ○1/8GF+ 204/59/59C/014

Example 4

Element	Teletype symbol	Translation	Element	Teletype symbol	Translation
(a)	SL	Salt Lake City, Utah.	(g)	0	Visibility zero.
(b)	X	Closed.	(h)	L+F+	Heavy drizzle, heavy fog.
(c)	----------	Regular sequence report, no "type of report" required.	(i)		
			(j)	077	1007.7 millibars.
			(k)	40	40° F.
(d)	----------	Regular sequence report, no "time of report" required.	(l)	40	40° F.
			(m)	←4	East, 4 miles per hour.
			(n)	976	29.76 inches.
(e)	Z0	Indefinite zero.	(o)	----------	None.
(f)	----------	Sky not observable, due to "heavy drizzle" and "heavy fog."			

Written on teletype thus:
SL X Z0OL+F+ 077/40/40←4/976

NOTE.—As a graphical illustration of symbolized weather reports, see insert, "Explanation of Symbol Weather Reports," at back of this circular.

2-121. Use of Symbols in Circular.—The foregoing symbols will be used hereafter in the circular when considered necessary for the giving of proper illustrations or examples.

B. Method of Telephoning or Telegraphing Reports

2-122. Telegraph.—Airway weather reports will be transmitted by telegraph in accordance with the following rules:

(a) All words will be spelled out.

(b) The station name and the time of filing in cases of "special" observations, will not be included in the body of the message since these will be indicated in the message as transmitted by the telegraph company.

(c) Separate groups of five figures or less may be sent as one word in telegraphed messages. Therefore, figures in groups of five or less shall be used wherever possible in transmitting numerical values of data in the reports. However, the word "minus" must be used preceding the temperature and/or dew-point figures to indicate below-zero values. Fractions can be sent in a figure group by use of a slant mark (oblique); the slant mark is counted as one figure of the group.

(d) The word "clouds" will not be sent when giving the "sky" conditions. For example, "broken clouds" would be sent as "broken"; "high broken, lower scattered clouds" as "high broken, lower scattered," etc.

Example 3, Record Observation

Element	Teletype symbol	Translation
(a)-------	GI	Grand Island, Nebr.
(b)-------		(Cancelled)
(c)-------		Regular sequence report, no type of report required.
(d)-------		Regular sequence report, no time of report required.
(e)-------		Ceiling unlimited.
(f)-------	O	Clear.
(g)-------	1/8	1/8 mile.
(h)-------		None to report.
(i)-------	GF+	Heavy ground fog.
(j)-------	204	1020.4 millibars.
(k)-------	59	59° F.
(l)-------	59	59° F.
(m)-------	C	Wind calm.
(n)-------	014	30.14 inches.
(o)-------		None.

Written on teletype thus: GI O1/8GF+ 204/59/59C/014

Example 4, Record Observation

Element	Teletype symbol	Translation
(a)-------	SL	Salt Lake City, Utah.
(b)-------		(Cancelled)
(c)-------		Regular sequence report, no type of report required.
(d)-------		Regular sequence report, no time of report required.
(e)-------	WO	Indefinite zero.
(f)-------	X	Sky obscured.
(g)-------	0	Visibility zero.
(h)-------	L+	Heavy drizzle.
(i)-------	F+	Heavy fog.
(j)-------	077	1007.7 millibars.
(k)-------	40	40° F.
(l)-------	40	40° F.
(m)-------	←4	East, 4 miles per hour.
(n)-------	976	29.76 inches.
(o)-------		None.

Written on teletype thus: SL WOXOL+F+ 077/40/40←4/976

Note.--As a graphical illustration of symbolized weather reports, see insert, "Explanation of Symbol Weather Reports," at back of this circular.

2-121. Use of Symbols in Circular N.--The foregoing symbols will be used in illustrations and examples in this circular.

B. Method of Telephoning or Telegraphing Reports

2-122. Telegraph.--Airway weather reports will be transmitted by telegraph in accordance with the following rules:

(a) All words will be spelled out.

(b) The station name and the time of filing in cases of special observations will not be included in the body of the message since these will be indicated in the message as transmitted by the telegraph company.

(c) Separate groups of five figures or less may be sent as one word in telegraphed messages. Therefore, figures in groups of five or less will be used whenever possible in transmitting numerical values of data in the reports. However, the word "minus" must be used preceding the temperature and dew-point figures to indicate below-zero values. Fractions will be sent in a figure group by use of a slant mark (oblique); the slant mark is counted as one figure of the group.

(d) The word "clouds" will not be included when reporting the sky condition. For example, "broken clouds" would be sent as "broken;" "high broken, lower scattered clouds" as "high broken, lower scattered," etc.

(*e*) Any element ordinarily included in reports from a particular station, but which cannot be determined for use in a particular report because of broken or defective instruments or other causes, will be indicated by the word "missing" being inserted at the proper point in the message.

(*f*) Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not included, the temperature will be followed by the wind, etc.

2–123. Examples of Telegraphed Reports.—For example, the following reports would be telegraphed as indicated:

(*a*) Ceiling estimated 200 feet; sky overcast; visibility ½ mile; heavy thunderstorm; heavy hail; heavy rain; barometric pressure 999.1 millibars; temperature 75°; dew point 73°; wind west, 30 miles per hour, strong gusts; moderate southeast wind shift at 12:15 a. m., E. S. T.; thunderstorm moving east;

Sent as—

"Estimated 200 overcast 1/2 heavy thunderstorm heavy hail heavy rain 9991 7573 west 30 strong gusts moderate southeast wind shift 0015 Eastern Standard thunderstorm moving east."

(*b*) Ceiling unlimited; clear; visibility ⅛ mile; dense ground fog; barometric pressure 1020.4 millibars; temperature 59°; dew point 59°; wind calm;

Sent as—

"Clear 1/8 dense ground fog 10204 5959 calm."

(*c*) Classification, airport closed to operations; ceiling 400 feet, variable; sky overcast, lower scattered clouds at 200 feet; visibility one and a half miles, variable; light freezing rain; light fog; barometric pressure 1002.2 millibars; temperature 31°; dew point 31°; wind east, 12 miles per hour; altimeter setting 29.60;

Sent as—

"Closed 400 variable overcast lower scattered 200 11/2 variable light freezing rain light fog 10022 3131 east 12 2960."

(*d*) Ceiling estimated 5,000 feet; sky overcast, lower broken clouds; visibility 4 miles; light rain; light smoke; barometric pressure 1018.3; temperature 62°; dew point 50°; wind west northwest, 8 miles per hour;

Sent as—

"Estimated 5000 overcast lower broken 4 light rain light smoke 10183 6250 west northwest 8."

2–124. Telephone.—When reports are telephoned to telegraph offices they will be telephoned in exactly the same form as outlined above, so that the body of the telegram will be as prescribed. When, however, they are telephoned direct to some terminal or station for use there, they will be given in the proper order of elements with inclusion of the specific names of elements as may be required for making the report clear to the one receiving it. No specific rules for doing this can be cited here, it only being necessary that the receiver of the report clearly understand it. There should be no difficulty in the two people concerned arranging a proper system for accomplishing this.

Chapter XIV

ABBREVIATIONS FOR USE IN METEOROLOGICAL TRANSMISSIONS BY RADIO AND TELETYPE

2–125. Lists of abbreviations authorized to be used in all transmissions by teletype and/or radio of forecasts, summaries, "remarks," in sequence and special reports, etc., are issued by the Civil Aeronautics Administration. Such lists will be strictly adhered to by all personnel making meteorological transmissions by teletype and/or radio.

(*e*) Any element ordinarily included in reports from a particular station, but which cannot be determined for use in a particular report because of broken or defective instruments or other causes, will be indicated by the word "missing" being inserted at the proper point in the message.

(*f*) Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not included, the temperature will be followed by the wind, etc.

2–123. Examples of Telegraphed Reports.—For example, the following reports would be telegraphed as indicated:

(*a*) Ceiling estimated 200 feet; sky overcast; visibility ½ mile; heavy thunderstorm; heavy hail; heavy rain; barometric pressure 999.1 millibars; temperature 75°; dew point 73°; wind west, 30 miles per hour, strong gusts; moderate southeast wind shift at 12:15 a. m., E. S. T.; thunderstorm moving east;

Sent as—

"Estimated 200 overcast 1/2 heavy thunderstorm heavy hail heavy rain 9991 7573 west 30 strong gusts moderate southeast wind shift 0015 Eastern Standard thunderstorm moving east."

(*b*) Ceiling unlimited; clear; visibility ⅛ mile; heavy ground fog; barometric pressure 1020.4 millibars; temperature 59°; dew point 59°; wind calm;

Sent as—

"Clear 1/8 heavy ground fog 10204 5959 calm."

(*c*) Classification, airport closed to operations; ceiling 400 feet, variable; sky overcast, lower scattered clouds at 200 feet; visibility one and a half miles, variable; light freezing rain; light fog; barometric pressure 1002.2 millibars; temperature 31°; dew point 31°; wind east, 12 miles per hour; altimeter setting 29.60;

Sent as—

"Closed 400 variable overcast lower scattered 200 11/2 variable light freezing rain light fog 10022 3131 east 12 2960."

(*d*) Ceiling estimated 5,000 feet; sky overcast, lower broken clouds; visibility 4 miles; light rain; light smoke; barometric pressure 1018.3; temperature 62°; dew point 50°; wind west northwest, 8 miles per hour;

Sent as—

"Estimated 5000 overcast lower broken 4 light rain light smoke 10183 6250 west northwest 8."

2–124. Telephone.—When reports are telephoned to telegraph offices they will be telephoned in exactly the same form as outlined above, so that the body of the telegram will be as prescribed. When, however, they are telephoned direct to some terminal or station for use there, they will be given in the proper order of elements with inclusion of the specific names of elements as may be required for making the report clear to the one receiving it. No specific rules for doing this can be cited here, it only being necessary that the receiver of the report clearly understand it. There should be no difficulty in the two people concerned arranging a proper system for accomplishing this.

Chapter XIV

ABBREVIATIONS FOR USE IN METEOROLOGICAL TRANSMISSIONS BY RADIO AND TELETYPE

2–125. Lists of abbreviations authorized to be used in all transmissions by teletype and/or radio of forecasts, summaries, "remarks," in sequence and special reports, etc., are issued by the Civil Aeronautics Administration. Such lists will be strictly adhered to by all personnel making meteorological transmissions by teletype and/or radio.

(e) Any element ordinarily included in reports from a particular station, but which cannot be determined for use in a particular report because of broken or defective instruments or other causes, will be indicated by the word "missing" being inserted at the proper point in the message.

(f) Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not included, the temperature will be followed by the wind, etc.

2-123. Examples of Telegraphed Reports. For example, the following reports would be telegraphed as indicated:

(a) Precipitation ceiling 200 feet; sky overcast; visibility 1/2 mile; heavy thunderstorm; heavy hail; heavy rain; barometric pressure 999.1 millibars; temperature 75; dew point 73; wind west, 30 miles per hour, strong gusts; moderate southeast wind shift at 12:15 a.m., E.S.T.; thunderstorm moving east.

Sent as—

Precipitation 200 overcast 1/2 heavy thunderstorm heavy hail heavy rain 9991 7573 west 30 strong gusts moderate southeast wind shift 0015 Eastern Standard thunderstorm moving east.

(b) Ceiling unlimited; clear; visibility 1/8 mile; heavy ground fog; barometric pressure 1020.4 millibars; temperature 69; dew point 69; wind calm.

Sent as —

Clear 1/8 heavy ground fog 10204 6969 calm.

(c) Classification, airport closed to operations; indefinite 400 feet variable; sky overcast, lower scattered clouds at 200 feet; visibility 1 1/2 miles, variable; light freezing rain; light fog; barometric pressure 1002.2 millibars; temperature 31; dew point 31; wind east, 12 miles per hour; altimeter setting 29.60.

Sent as —

Closed indefinite 400 variable overcast lower scattered 200 11/2 variable light freezing rain light fog 10022 3131 east 12 2960.

(d) Ceiling estimated 5,000 feet; sky overcast, lower broken clouds; visibility 4 miles; light rain; light smoke; barometric pressure 1018.3 millibars; temperature 62; dew point 50; wind west northwest, 8 miles per hour; overcast estimated at 9,000 feet.

Sent as —

Estimated 5000 overcast lower broken 4 light rain light smoke 10183 6250 west northwest 8 overcast estimated 9000.

2-124. Telephone. When reports are telephoned to telegraph offices they will be telephoned in exactly the same form as outlined above, so that the body of the telegram will be as prescribed. When, however, they are telephoned direct to some terminal or station for use there, they will be given in the proper order of elements with inclusion of the specific names of elements as may be required for making the report clear to the one receiving it. No specific rules for doing this can be cited here, it only being necessary that the receiver of the report clearly understand it. There should be no difficulty in the two people concerned arranging a proper system for accomplishing this.

CHAPTER XIV

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2-125. Lists of abbreviations authorized to be used in all transmissions by teletype and/or radio of forecasts, summaries, "remarks" in sequence and special reports, etc., are issued by the Civil Aeronautics Administration. Such lists will be strictly adhered to by all personnel making meteorological transmissions by teletype or radio.

(e) Any element ordinarily included in reports from a particular station, but which cannot be determined for use in a particular report because of broken or defective instruments or other causes, will be indicated by the word "missing" being inserted at the proper point in the message.

(f) Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not included, the temperature will be followed by the wind, etc.

2-123. EXAMPLES OF TELEGRAPHED REPORTS. For example, the following reports would be telegraphed as indicated:

(a) Precipitation ceiling 200 feet; sky overcast; visibility 1/2 miles; heavy thunderstorm; heavy hail; heavy rain; barometric pressure 999.1 millibars; temperature 75; dew point 73; wind west, 30 miles per hour, strong gusts; moderate southeast wind shift at 12:15 a.m., E.S.T.*; thunderstorm moving east.

Sent as—

Precipitation 200 overcast 1/2 heavy thunderstorm heavy hail heavy rain 9991 7573 west 30 strong gusts moderate southeast wind shift 0015 Eastern Standard thunderstorm moving east.

(b) Ceiling unlimited; clear; visibility 1/8 mile ; heavy ground fog; barometric pressure 1020.4 millibars; temperature 69; dew point 69; wind calm.

Sent as—

Clear 1/8 heavy ground fog 10204 6969 calm.

(c) Classification, airport below contact flight minimums; indefinite 400 feet; sky overcast, lower scattered clouds at 200 feet; visibility 1 1/2 miles; light freezing rain; light fog; barometric pressure 1002.2 millibars; temperature 31; dew point 31; wind east, 12 miles per hour; altimeter setting 29.60.

Sent as—

Instrument indefinite 400 overcast lower scattered 200 1 1/2 light freezing rain light fog 10022 3131 east 12 2960.

(d) Ceiling estimated 5,000 feet; sky overcast, lower broken clouds; visibility 4 miles; light rain; light smoke; barometric pressure 1018.3 millibars; temperature 62; dew point 50; wind west northwest, 8 miles per hour; overcast estimated at 9,000 feet.

Sent as—

Estimated 5000 overcast lower broken 4 light rain light smoke 10183 6250 west northwest 8 overcast estimated 9000.

2-124. TELEPHONE. When reports are telephoned to telegraph offices they will be telephoned in exactly the same form as outlined above, so that the body of the telegram will be as prescribed. When, however, they are telephoned direct to some terminal or station for use there, they will be given in the proper order of elements with inclusion of the specific names of elements as may be required for making the report clear to the one receiving it. No specific rules for doing this can be cited here, it only being necessary that the receiver of the report clearly understand it. There should be no difficulty in the two people concerned arranging a proper system for accomplishing this.

CHAPTER XIV

ABBREVIATIONS FOR USE IN METEOROLOGICAL TRANSMISSIONS BY RADIO AND TELETYPE

2-125. Lists of abbreviations authorized to be used in all transmissions by teletype and/or radio of forecasts, summaries, "remarks" in sequence and special reports, etc., are issued by the Civil Aeronautics Administration. Such lists will be strictly adhered to by all personnel making meteorological transmissions by teletype or radio.

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*War-time is being used for the duration.

(e) Any element, except sky, ordinarily included in reports from a particular station, but which cannot be determined for use in a particular report because of broken or defective instruments or other causes, will be indicated by the word "missing" being inserted at the proper point in the message. If the sky cannot be observed because of precipitation or obstructions to vision, the word "obscured" will be inserted in the proper place in the message.

(f) Stations regularly not reporting certain elements will omit these, the order of the report being the same. For example, if the dew point is not included, the temperature will be followed by the wind, etc.

2-123. Examples of Telegraphed Reports.--For example, the following reports would be telegraphed as indicated:

(a) Precipitation ceiling 200 feet; sky obscured; visibility 1/2 mile; heavy thunderstorm; heavy rain; heavy hail; barometric pressure 999.1 millibars; temperature 75; dew point 73; wind west, 30 miles per hour, strong gusts; moderate southeast wind shift at 12:15 a.m., E.S.T.*; thunderstorm moving east.

Sent as--

PRECIPITATION 200 OBSCURED 1/2 HEAVY THUNDERSTORM HEAVY RAIN HEAVY HAIL 9991 7573 WEST 30 STRONG GUSTS MODERATE SOUTHEAST WIND SHIFT 0015 EASTERN STANDARD THUNDERSTORM MOVING EAST.

(b) Ceiling unlimited; clear; visibility 1/8 mile; heavy ground fog; barometric pressure 1020.4 millibars; temperature 69; dew point 69; wind calm.

Sent as--

CLEAR 1/8 HEAVY GROUND FOG 10204 6969 CALM.

(c) Indefinite 400 feet; sky overcast, lower scattered clouds at 200 feet; visibility 1 1/2 miles; light freezing rain; light fog; barometric pressure 1002.2 millibars; temperature 31; dew point 31; wind east, 12 miles per hour; altimeter setting 29.60.

Sent as--

INDEFINITE 400 OVERCAST LOWER SCATTERED 200 1 1/2 LIGHT FREEZING RAIN LIGHT FOG 10022 3131 EAST 12 2960.

(d) Ceiling estimated 5,000 feet; sky overcast, lower broken clouds; visibility 4 miles; light rain; light smoke; barometric pressure 1018.3 millibars; temperature 62; dew point 50; wind west northwest, 8 miles per hour; overcast estimated at 9,000 feet.

Sent as--

ESTIMATED 5000 OVERCAST LOWER BROKEN 4 LIGHT RAIN LIGHT SMOKE 10183 6250 WEST NORTHWEST 8 OVERCAST ESTIMATED 9000.

2-124. Telephone.--Reports telephoned to telegraph offices will be in exactly the same form as outlined above, so that the body of the telegram will be as prescribed. When, however, they are telephoned direct to a terminal or station for use there, they will be given in the proper order of elements with inclusion of the specific names of elements as may be required for making the report clear to the one receiving it.

CHAPTER XIV

CONTRACTIONS FOR USE IN METEOROLOGICAL TRANSMISSIONS BY RADIO AND TELETYPE

2-125. Contractions used in forecasts, summaries, "remarks" in airway weather reports, etc., for transmission by teletype or radio will be taken from Federal Airways Manual of Operations III-B-4-1.

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*War-time is being used for the duration.

(*e*) Any element ordinarily included in reports from a particular station, but which cannot be determined for use in a particular report because of broken or defective instruments or other causes, will be indicated by the word "missing" being inserted at the proper point in the message.

(*f*) Stations regularly not reporting certain elements will omit these, the order of the report being kept the same. For example, if the dew point is not included, the temperature will be followed by the wind, etc.

2–123. Examples of Telegraphed Reports.—For example, the following reports would be telegraphed as indicated:

(*a*) Ceiling estimated 200 feet; sky overcast; visibility ½ mile; heavy thunderstorm; heavy hail; heavy rain; barometric pressure 999.1 millibars; temperature 75°; dew point 73°; wind west, 30 miles per hour, strong gusts; moderate southeast wind shift at 12:15 a. m., E. S. T.; thunderstorm moving east;

Sent as—

"Estimated 200 overcast 1/2 heavy thunderstorm heavy hail heavy rain 9991 7573 west 30 strong gusts moderate southeast wind shift 0015 Eastern Standard thunderstorm moving east."

(*b*) Ceiling unlimited; clear; visibility ⅛ mile; dense ground fog; barometric pressure 1020.4 millibars; temperature 59°; dew point 59°; wind calm;

Sent as—

"Clear 1/8 dense ground fog 10204 5959 calm."

(*c*) Classification, airport closed to operations; ceiling 400 feet, variable; sky overcast, lower scattered clouds at 200 feet; visibility one and a half miles, variable; light freezing rain; light fog; barometric pressure 1002.2 millibars; temperature 31°; dew point 31°; wind east, 12 miles per hour; altimeter setting 29.60;

Sent as—

"Closed 400 variable overcast lower scattered 200 11/2 variable light freezing rain light fog 10022 3131 east 12 2960."

(*d*) Ceiling estimated 5,000 feet; sky overcast, lower broken clouds; visibility 4 miles; light rain; light smoke; barometric pressure 1018.3; temperature 62°; dew point 50°; wind west northwest, 8 miles per hour;

Sent as—

"Estimated 5000 overcast lower broken 4 light rain light smoke 10183 6250 west northwest 8."

2–124. Telephone.—When reports are telephoned to telegraph offices they will be telephoned in exactly the same form as outlined above, so that the body of the telegram will be as prescribed. When, however, they are telephoned direct to some terminal or station for use there, they will be given in the proper order of elements with inclusion of the specific names of elements as may be required for making the report clear to the one receiving it. No specific rules for doing this can be cited here, it only being necessary that the receiver of the report clearly understand it. There should be no difficulty in the two people concerned arranging a proper system for accomplishing this.

CHAPTER XIV

ABBREVIATIONS FOR USE IN METEOROLOGICAL TRANSMISSIONS BY RADIO AND TELETYPE

2–125. Lists of abbreviations authorized to be used in all transmissions by teletype and/or radio of forecasts, summaries, "remarks," in sequence and special reports, etc., are issued by the Civil Aeronautics Administration. Such lists will be strictly adhered to by all personnel making meteorological transmissions by teletype and/or radio.

CHAPTER XV

OBSERVING AND REPORTING ELEMENTS OF AIRWAY WEATHER OBSERVATIONS

2–126. Instructions for observing and reporting each element follow in detail.

XV (A)—CLASSIFICATION

2–127. General Limits of Classification.—All airway weather observations, made in accordance with current instructions, at any controlled airport will be classified as follows:

Class C—Contact.—Weather equal to or better than the minima specified for the particular airport for flight in accordance with contact flight rules. (Satisfactory for contact flight.)

Class N—Instrument.—Weather less than the minima specified for the particular airport for contact flight (Class C, above) and down to the minima prescribed for the particular airport for suspension of flight operations. (Requiring observance of instrument flight rules, unless flight in accordance with contact flight rules has been authorized as provided for in CAR 60.440 and 60.441.)

Class X—Closed.—Weather below the minima specified for the particular airport, wherein any landing or take-off other than a flight of public aircraft or scheduled airline aircraft if otherwise authorized, is suspended. (Take-off and landing of nonscheduled civil aircraft suspended, unless authorized as provided for in CAR 60.540.)

2–128. Prescribed Minima and Rules for Classification.—(*a*) The following minima for weather conditions for each of the above classes are prescribed. If these are changed for any particular airport, proper notice will be forwarded to the station concerned:

Class C—Contact.—Within control zones (day or night):

Ceiling—1,000 feet or more.

Visibility—3 miles or more.

Class N—Instrument.—Within control zones (day or night): Below class C minima but not below 500 feet ceiling and/or 1 mile visibility.

Class X—Closed.—Within control zones (day or night): Below 500 feet ceiling and/or 1 mile visibility.

(*b*) If either the ceiling or visibility falls below the minimum for one of the classes described above, the weather report will be given the next lower classification. For example, within control zone, ceiling 600, visibility 4 miles, class N instead of class C.

(*c*) Weather conditions will be classified at the time the observations are made. The letter "C," "N," or "X" denoting such classification will be entered on WB Forms 1130 in the proper column.

(*d*) The symbols, C, N, and X will be used for classifying weather conditions in teletype or radio transmissions, such symbols corresponding to class "C," "N," and "X" of weather conditions, respectively. These symbols will be entered immediately following the station designator, separated therefrom and from following entries by one space, thus—

WA X SPL 1325E 3⊕1/2R–F.....etc.

(*e*) The importance of properly classifying weather conditions cannot be overemphasized. Pilots on the ground or in flight, and air-line companies, will depend upon and be guided by the classification of weather conditions and will make flight plans and dispatch planes accordingly, or may need to change or alter plans already made if the classification in airway weather sequences changes. Airway weather observing personnel must, therefore, become thoroughly familiar with the classifications of weather

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Class C—Contact.—Weather equal to or better than the minima specified for the particular airport for flight in accordance with contact flight rules. (Satisfactory for contact flight.)

Class N—Instrument.—Weather less than the minima specified for the particular airport for contact flight (Class C, above) and down to the minima prescribed for the particular airport for suspension of flight operations. (Requiring observance of instrument flight rules, unless flight in accordance with contact flight rules has been authorized as provided for in CAR 60.440 and 60.441.)

Class X—Closed.—Weather below the minima specified for the particular airport, wherein any landing or take-off other than a flight of public aircraft or scheduled airline aircraft if otherwise authorized, is suspended. (Take-off and landing of nonscheduled civil aircraft suspended, unless authorized as provided for in CAR 60.540.)

2-128. Prescribed Minima and Rules for Classification.—(*a*) The following minima for weather conditions for each of the above classes are prescribed. If these are changed for any particular airport, proper notice will be forwarded to the station concerned:

Class C—Contact.—Within control zones (day or night):

Ceiling—1,000 feet or more.

Visibility—3 miles or more.

Class N—Instrument.—Within control zones (day or night): Below class C minima but not below 500 feet ceiling and/or 1 mile visibility.

Class X—Closed.—Within control zones (day or night): Below 500 feet ceiling and/or 1 mile visibility.

(*b*) If either the ceiling or visibility falls below the minimum for one of the classes described above, the weather report will be given the next lower classification. For example, within control zone, ceiling 600, visibility 4 miles, class N instead of class C.

(*c*) Weather conditions will be classified at the time the observations are made. The letter "C," "N," or "X" denoting such classification will be entered on WB Forms 1130 in the proper column.

(*d*) The symbols, C, N, and X will be used for classifying weather conditions in teletype or radio transmissions, such symbols corresponding to class "C," "N," and "X" of weather conditions, respectively. These symbols will be entered immediately following the station designator, separated therefrom and from following entries by one space, thus—

WA X SPL 1325E Z3⊕1/2R-F_____etc.

(*e*) The importance of properly classifying weather conditions cannot be overemphasized. Pilots on the ground or in flight, and air-line companies, will depend upon and be guided by the classification of weather conditions and will make flight plans and dispatch planes accordingly, or may need to change or alter plans already made if the classification in airway weather sequences changes. Airway weather observing personnel must, therefore, become thoroughly familiar with the classifications of weather

CHAPTER XV

OBSERVING AND REPORTING ELEMENTS OF AIRWAY WEATHER OBSERVATIONS

2-126. Instructions for observing and reporting each element follow in detail.

XV (A) CLASSIFICATION

2-127. General Limits of Classification. All airway weather observations, made in accordance with current instructions, at any controlled airport will be classified as follows:

Class C—Contact.—Weather equal to or better than the minima specified for the particular airport for flight in accordance with contact flight rules. (Satisfactory for contact flight.)

Class N—Instrument.—Weather less than the minima specified for the particular airport for contact flight (Class C, above) and down to the minima prescribed for the particular airport for suspension of flight operations. (Requiring observance of instrument flight rules, unless flight in accordance with contact flight rules has been authorized as provided for in CAR 60.440 and 60.441.)

Class X—Closed.—Weather below the minima specified for the particular airport, wherein any landing or take-off other than a flight of public aircraft or scheduled airline aircraft if otherwise authorized, is suspended. (Take-off and landing of nonscheduled civil aircraft suspended, unless authorized as provided for in CAR 60.540.)

2-128. Prescribed Minima and Rules for Classification.—(*a*) The following minima for weather conditions for each of the above classes are prescribed. If these are changed for any particular airport, proper notice will be forwarded to the station concerned:

Class C—Contact.—Within control zones (day or night):

Ceiling—1,000 feet or more.

Visibility—3 miles or more.

Class N—Instrument.—Within control zones (day or night): Below class C minima but not below 500 feet ceiling and/or 1 mile visibility.

Class X—Closed.—Within control zones (day or night): Below 500 feet ceiling and/or 1 mile visibility.

(*b*) If either the ceiling or visibility falls below the minimum for one of the classes described above, the weather report will be given the next lower classification. For example, within control zone, ceiling 600, visibility 4 miles, class N instead of class C.

(*c*) Weather conditions will be classified at the time the observations are made. The letter "C," "N," or "X" denoting such classification will be entered on WB Forms 1130 in the proper column.

(*d*) The symbols, C, N, and X will be used for classifying weather conditions in teletype or radio transmissions, such symbols corresponding to class "C," "N," and "X" of weather conditions, respectively. These symbols will be entered immediately following the station designator, separated therefrom and from following entries by one space, thus-

WA X SPL 1325E W3⊕1/2R-F etc.

(*e*) The importance of properly classifying weather conditions cannot be overemphasized. Pilots on the ground or in flight, and air-line companies, will depend upon and be guided by the classification of weather conditions and will make flight plans and dispatch planes accordingly, or may need to change or alter plans already made if the classification in airway weather sequences changes. Airway weather observing personnel must, therefore, become thoroughly familiar with the classifications of weather

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

CHAPTER XV

OBSERVING AND REPORTING ELEMENTS OF AIRWAY WEATHER OBSERVATIONS

2-126. Instructions for observing and reporting each element follow in detail.

XV (A) Classification

2-127. CIVIL AIR REGULATIONS REQUIRING CLASSIFICATION.

CAR "60.145 Weather minimums. Weather minimums are ceiling, visibility, and other minimums provided for specified types of flight operation, and below which flight operation is not permitted, unless specifically authorized elsewhere in these regulations or by the Administrator.

"Note: The local United States Weather Bureau reporting station for each control airport will classify existing weather conditions for such airport by one of the following symbols:

Class C—Contact: Weather equal to or better than the minimums specified for the particular airport for flight in accordance with contact flight rules.

Class N—Instrument: Weather less than the minimums specified for the particular airport for flight in accordance with contact rules. Requiring observance of instrument flight rules, unless flight in accordance with contact flight rules has been authorized as provided for in paragraphs 60.440 and 60.441."

CAR "60,44 Weather minimums. The following weather minimums shall govern flight made in accordance with contact flight rules: Provided, however, That an airway traffic control center of the Administrator may for reasons of safety restrict or suspend contact flight operation within the airway traffic control area of such center: Provided, further, That in the interests of safety the Administrator may require higher minimums at any particular control airport, and that such minimums shall govern the control zone in which such control airport lies."

CAR "60.440 Within control zones. Aircraft shall not be flown within a control zone unless the ceiling is at least 1,000 feet and the visibility is at least 3 miles: Provided, however, That a certificated air-traffic control-tower operator on duty in a radio-equipped airport control tower may authorize flight at altitudes of 1,000 feet or less above the ground or water when the visibility is less than 3 miles but not less than 1 mile: And provided further, That such operator may suspend contact flight operation within the control zone when reasons of safety require such actions."

CAR "60.103 Control zone. A control zone is the airspace above that area on the surface of the earth within 3 miles of the center of an airport designated by the Administrator as a control airport, and within one-half mile of a line extending from the center of such airport to the radio range station established for the purpose of directing air traffic to such airport."

CAR "60.21 Control airports. The Administrator, in the interest of safety, and after finding it necessary for the proper control of air traffic may designate as a control airport any airport in the United States."

CHAPTER XV

OBSERVING AND REPORTING ELEMENTS OF AIRWAY WEATHER OBSERVATIONS

2-126. See Part VI for entering airway weather observations on WB Form 1130A.

XV (A)

2-127. Part 60 of the Civil Air Regulations involving weather observations follows:

60.110 Visibility and proximity-to-cloud minimums. Aircraft shall not be flown when visibility is less, or in closer proximity to clouds, than the minimums specified below, unless operated in accordance with instrument flight rules:

(a) Flight at altitudes of more than ~~1,000~~ 700 feet above the surface. 8/1/45

(1) Visibility
(i) inside airport traffic zone - 3 miles*,
(ii) outside airport traffic zone but inside control area - 3 miles or 1 mile with traffic clearance,
(iii) elsewhere - 1 mile;

(2) Proximity to clouds
(i) inside airport traffic zone - 500 feet vertically and 2,000 feet horizontally*,
(ii) elsewhere - 500 feet vertically and 2,000 feet horizontally.

(b) Flight at altitudes of ~~1,000~~ 700 feet or less above the surface. 700 ft.

(1) Visibility
(i) inside an airport traffic zone - 3 miles*,
(ii) elsewhere - 1 mile;

(2) Proximity to clouds
(i) inside airport traffic zone or airport approach zone - 500 feet vertically and 2,000 feet horizontally*,
(ii) elsewhere - clear of clouds.

CHART OF VISIBILITY AND PROXIMITY-TO-CLOUD MINIMUMS

8/1/45

		Inside airport traffic zone	Outside airport traffic zone but inside control area	Elsewhere
Flight at altitudes of more than ~~1,000~~ 700 feet above surface	Visibility	3 miles*	3 miles or 1 mile with traffic clearance	1 mile
	Proximity to clouds	500 feet vertically,* 2,000 feet horizontally*	500 feet vertically, 2,000 feet horizontally	500 feet vertically, 2,000 feet horizontally
Flight at altitudes of ~~1,000~~ 700 feet or less above surface	Visibility	3 miles*	1 mile	1 mile
	Proximity to clouds	500 feet vertically,* 2,000 feet horizontally*	In approach zone 500 feet vertically,* 2,000 feet horizontally* Outside approach zone clear of clouds	Clear of clouds

*If traffic conditions permit, a control tower or control center will issue a traffic clearance when the minimums are less than those specified, but under this provision the flight must remain clear of clouds.

2-128. Prescribed Minimums and Rules for Classification. (a) Stations designated in accordance with CAR 60.21 will classify weather reports as follows:

Class C—Contact.—Within control zones (day or night):

Ceiling—1,000 feet or more. } Except where the Administrator shall require higher minimums in accordance with CAR 60.44
Visibility—3 miles or more. }

Class N—Instrument.—Within control zones (day or night): Below Class C minimums.

(b) If either the ceiling or visibility falls below the minimum for Class C described above, the weather report will be given classification N. For example, within control zone, ceiling 600, visibility 4 miles, Class N instead of Class C.

(c) Weather conditions will be classified at the time the observations are made. The letter "C" or "N", denoting such classification will be entered on WB Form 1130B in the proper column.

(d) The symbols C and N will be used for classifying weather conditions in teletype or radio transmissions, such symbols corresponding to class "C" and "N" of weather conditions. These symbols will be entered immediately following the station designator, separated therefrom and from following entries by one space, thus:

WA N SPL 091315E W301/2R-F

(e) The importance of properly classifying weather conditions cannot be overemphasized. Pilots on the ground or in flight, and air-line companies, will depend upon and be guided by the classification of weather conditions and will make flight plans and dispatch planes accordingly, or may need to change or alter plans already made if the classification in airway weather sequences changes. Airway weather observing personnel must, therefore, become thoroughly familiar with the classifications of weather conditions outlined above and also with weather conditions minima as set for the particular airport station at which they are employed. It is the responsibility of personnel giving out weather reports orally to pilots and others to make certain that the classification of the report or reports is distinctly and clearly given and that there is no misunderstanding on the part of the inquirer which may lead to later confusion or difficulty.

2-129. LIST OF CONTROLLED AIRPORTS. A list of airway weather-reporting stations at controlled airports within controlled zones has already been issued, and as this list may be changed from time to time, stations concerned will be advised accordingly.

2-130. STATIONS WHICH ARE TO CLASSIFY REPORTS. It should be remembered that only airway weather-reporting stations within control zones are required to classify their weather reports, and further, that the inclusion of the symbol C or N automatically indicates that the report is from a controlled airport.

Part 60 of the Civil Air Regulations (continued)

60.9 DEFINITIONS

(c) Airport approach zone. A zone designated by the Administrator to include the airspace above that area on the surface within 10 miles of an airport where adequate radio facilities are provided for instrument approach procedures, unless other dimensions are specified by the Administrator.

(d) Airport traffic zone. A zone designated by the Administrator to include the airspace above that area on the surface of the earth within 3 miles of the center of an airport, unless other dimensions are specified by the Administrator.

(k) Control area. A specified area within which a control center provides for supervision of air traffic.

(l) Control center. A facility operated by the Administrator to provide supervision of air traffic within a specified control area.

(m) Control tower. A facility to provide for the supervision of air traffic directed by personnel holding an air-traffic control-tower operator certificate.

(r) Traffic clearance. An approval of a flight or portion thereof by a control center or control tower with regard only to prevention of collision between known aircraft.

(s) United States means the several States, the District of Columbia, and the several Territories and possessions of the United States, excepting the Philippine Islands, including the territorial waters and the overlying airspace thereof.

(t) Visibility. The official visibility reported by the United States Weather Bureau, when available, for a particular locations; otherwise the average range of vision toward at least one-half the horizon at which conspicuous objects can be readily identified.

CHAPTER XV

OBSERVING AND REPORTING ELEMENTS OF AIRWAY WEATHER OBSERVATIONS

2–126. Instructions for observing and reporting each element follow in detail.

XV (A)—CLASSIFICATION

2–127. General Limits of Classification.—All airway weather observations, made in accordance with current instructions, at any controlled airport will be classified as follows:

Class C—Contact.—Weather equal to or better than the minima specified for the particular airport for flight in accordance with contact flight rules. (Satisfactory for contact flight.)

Class N—Instrument.—Weather less than the minima specified for the particular airport for contact flight (Class C, above) and down to the minima prescribed for the particular airport for suspension of flight operations. (Requiring observance of instrument flight rules, unless flight in accordance with contact flight rules has been authorized as provided for in CAR 60.440 and 60.441.)

Class X—Closed.—Weather below the minima specified for the particular airport, wherein any landing or take-off other than a flight of public aircraft or scheduled airline aircraft if otherwise authorized, is suspended. (Take-off and landing of nonscheduled civil aircraft suspended, unless authorized as provided for in CAR 60.540.)

2–128. Prescribed Minima and Rules for Classification.—(*a*) The following minima for weather conditions for each of the above classes are prescribed. If these are changed for any particular airport, proper notice will be forwarded to the station concerned:

Class C—Contact.—Within control zones (day or night):

Ceiling—1,000 feet or more.

Visibility—3 miles or more.

Class N—Instrument.—Within control zones (day or night): Below class C minima but not below 500 feet ceiling and/or 1 mile visibility.

Class X—Closed.—Within control zones (day or night): Below 500 feet ceiling and/or 1 mile visibility.

(*b*) If either the ceiling or visibility falls below the minimum for one of the classes described above, the weather report will be given the next lower classification. For example, within control zone, ceiling 600, visibility 4 miles, class N instead of class C.

(*c*) Weather conditions will be classified at the time the observations are made. The letter "C," "N," or "X" denoting such classification will be entered on WB Forms 1130 in the proper column.

(*d*) The symbols, C, N, and X will be used for classifying weather conditions in teletype or radio transmissions, such symbols corresponding to class "C," "N," and "X" of weather conditions, respectively. These symbols will be entered immediately following the station designator, separated therefrom and from following entries by one space, thus—

WA X SPL 1325E 3⊕1/2R–F.....etc.

(*e*) The importance of properly classifying weather conditions cannot be overemphasized. Pilots on the ground or in flight, and air-line companies, will depend upon and be guided by the classification of weather conditions and will make flight plans and dispatch planes accordingly, or may need to change or alter plans already made if the classification in airway weather sequences changes. Airway weather observing personnel must, therefore, become thoroughly familiar with the classifications of weather

conditions outlined above and also with weather conditions minima as set for the particular airport station at which they are employed. It is the responsibility of personnel giving out weather reports orally to pilots and others to make certain that the classification of the report or reports is distinctly and clearly given and that there is no misunderstanding on the part of the inquirer which may lead to later confusion or difficulty.

2–129. List of Controlled Airports.—A list of airway weather-reporting stations at controlled airports within controlled zones has already been issued, and, as this list may be changed from time to time, stations concerned will be advised accordingly.

2–130. Stations Which Are To Classify Reports.—It should be remembered that only airway weather-reporting stations within controlled zones are required to classify their weather reports, and, further, that the inclusion of the symbol C, N, or X automatically indicates that the report is from a controlled airport.

XV (B) CEILING

2–131. Concept and Definition of Ceiling.—The fundamental concept of the existence of a ceiling is that during a flight being made in clear air at an altitude of 10,000 feet above a particular station, at any given instant, the pilot would be able, due to the presence of clouds below him, to see less than one-half of the total area of the surface of the earth that would be visible to him from that height if clouds were not present. However, all reported observations must be made from the viewpoint of the observer on the ground and it is necessary that this concept is reversed in the actual practice of taking observations. Therefore, in the meaning of these instructions, THE CEILING IS THE HEIGHT IN FEET OF THE LOWEST LEVEL BELOW TEN THOUSAND FEET ABOVE THE STATION AT WHICH THE TOTAL CLOUDINESS (AS PROJECTED AGAINST THE ENTIRE DOME OF THE SKY) BETWEEN THE SURFACE OF THE EARTH AT THE STATION AND THAT LEVEL (10,000 FEET) COVERS MORE THAN ONE-HALF OF THE ENTIRE AREA OF THE SKY, EXCEPT THAT IN THE PRESENCE OF HEAVY PRECIPITATION, DENSE FOG, OR OTHER CONDITIONS WHICH PREVENT THE OBSERVER FROM SEEING ANY CLOUDINESS THAT MAY BE PRESENT, THE CEILING WILL BE AT ZERO ALTITUDE; THAT IS, AT THE SURFACE. It follows from the above, therefore, that the ceiling to be reported will, in general, coincide with the base of the lowest stratum of clouds below 10,000 feet, the area of which, added to that of any cloudiness that may be present below this stratum, covers an area in excess of five-tenths of the entire dome of the sky.

2–132. Estimation of Ceiling Heights.—If instruments are not available, the height of a ceiling may often be determined with reasonable accuracy by observing the unobscured portions of towers, mountains, or other tall objects, of which the height and the distance from the station is known. A ceiling height determined in such a manner will be reported as "*estimated*" when the object used is *more than 1½ miles* from the station. (See par. 2–134 (*c*) for use of objects within 1½-mile radius of station.) For use in estimating the ceiling in this manner, each station shall prepare and maintain a table of such objects the distances of which are more than 1½ miles from the station. Where ceilings are estimated and the observer is in some doubt as to its height within, say, 100 feet, it is believed advisable to report the lower rather than the higher value, but this should not be carried to the extreme that ceilings are reported consistently at lower altitudes than actually exist.

2–133. Indicating Estimated Ceiling in Reports.—*Except when the ceiling is unlimited, a ceiling-height value will be included in every airway weather report.* If this value is estimated, indication of this will be made in reports transmitted by teletype and radio by use of the symbol "E," and in telegraphed or telephoned reports, by inclusion of the word "estimated" immediately preceding the height given.

2–134. Rules for Observing and Reporting Ceilings.—Rules for observing and reporting the ceiling element follow:

(*a*) *Point of observation.*—The observer must go outside to a point where a view of the entire sky may be had. All ceiling heights will refer to the ground level at the station, and if ceiling measurements are made from the roof of a building the height of the roof above the ground will be added to the value there obtained.

conditions outlined above and also with weather conditions minima as set for the particular airport station at which they are employed. It is the responsibility of personnel giving out weather reports orally to pilots and others to make certain that the classification of the report or reports is distinctly and clearly given and that there is no misunderstanding on the part of the inquirer which may lead to later confusion or difficulty.

2-129. List of Controlled Airports.—A list of airway weather-reporting stations at controlled airports within controlled zones has already been issued, and, as this list may be changed from time to time, stations concerned will be advised accordingly.

2-130. Stations Which Are To Classify Reports.—It should be remembered that only airway weather-reporting stations within controlled zones are required to classify their weather reports, and, further, that the inclusion of the symbol C, N, or X automatically indicates that the report is from a controlled airport.

XV (B) CEILING

2-131. Concept and Definition of Ceiling.—The fundamental concept of the existence of a ceiling is that during a flight being made in clear air at an altitude of 10,000 feet above a particular station, at any given instant, the pilot would be able, due to the presence of clouds below him, to see less than one-half of the total area of the surface of the earth that would be visible to him from that height if clouds were not present. However, all reported observations must be made from the viewpoint of the observer on the ground and it is necessary that this concept is reversed in the actual practice of taking observations. Therefore, in the meaning of these instructions, THE CEILING IS THE HEIGHT IN FEET OF THE LOWEST LEVEL BELOW TEN THOUSAND FEET ABOVE THE STATION AT WHICH THE TOTAL CLOUDINESS (AS PROJECTED AGAINST THE ENTIRE DOME OF THE SKY) BETWEEN THE SURFACE OF THE EARTH AT THE STATION AND THAT LEVEL (10,000 FEET) COVERS MORE THAN ONE-HALF OF THE ENTIRE AREA OF THE SKY, EXCEPT THAT IN THE PRESENCE OF HEAVY PRECIPITATION, HEAVY FOG, OR OTHER CONDITIONS WHICH PREVENT THE OBSERVER FROM SEEING ANY CLOUDINESS THAT MAY BE PRESENT, THE CEILING WILL BE AT ZERO ALTITUDE; THAT IS, AT THE SURFACE. It follows from the above, therefore, that the ceiling to be reported will, in general, coincide with the base of the lowest stratum of clouds below 10,000 feet, the area of which, added to that of any cloudiness that may be present below this stratum, covers an area in excess of five-tenths of the entire dome of the sky.

2-132. Estimation of Ceiling Heights.—If instruments are not available, the height of a ceiling may often be determined with reasonable accuracy by observing the unobscured portions of towers, mountains, or other tall objects, of which the height and the distance from the station is known. A ceiling height determined in such a manner will be reported as "*estimated*" when the object used is *more than 1½ miles* from the station. (See par. 2-134 (*c*) for use of objects within 1½-mile radius of station.) For use in estimating the ceiling in this manner, each station shall prepare and maintain a table of such objects the distances of which are more than 1½ miles from the station. Where ceilings are estimated and the observer is in some doubt as to its height within, say, 100 feet, it is believed advisable to report the lower rather than the higher value, but this should not be carried to the extreme that ceilings are reported consistently at lower altitudes than actually exist.

2-133. Indicating Estimated Ceiling in Reports.—*Except when the ceiling is unlimited, a ceiling-height value will be included in every airway weather report.* If this value is estimated, indication of this will be made in reports transmitted by teletype and radio by use of the symbol "E," and in telegraphed or telephoned reports, by inclusion of the word "estimated" immediately preceding the height given.

2-134. Rules for Observing and Reporting Ceilings.—Rules for observing and reporting the ceiling element follow:

(*a*) *Point of observation.*—The observer must go outside to a point where a view of the entire sky may be had. All ceiling heights will refer to the ground level at the station, and if ceiling measurements are made from the roof of a building the height of the roof above the ground will be added to the value there obtained.

conditions outlined above and also with weather conditions minima as set for the particular airport station at which they are employed. It is the responsibility of personnel giving out weather reports orally to pilots and others to make certain that the classification of the report or reports is distinctly and clearly given and that there is no misunderstanding on the part of the inquirer which may lead to later confusion or difficulty.

2-129. List of Controlled Airports. A list of airway weather-reporting stations at controlled airports within controlled zones has already been issued, and as this list may be changed from time to time, stations concerned will be advised accordingly.

2-130. Stations Which Are To Classify Reports. It should be remembered that only airway weather-reporting stations within controlled zones are required to classify their weather reports, and, further, that the inclusion of the symbol C, N, or X automatically indicates that the report is from a controlled airport.

XV (B) CEILING

2-131. Ceiling. CEILING IS THE HEIGHT ABOVE GROUND OF THE LOWEST CLOUDS REPORTED AS BROKEN OR OVERCAST. *In other words, ceiling is the lowest height above ground at which all clouds at and below that level cover more than 1/2 of the sky.*

(a) *Unlimited Ceiling.* The ceiling will be reported as "unlimited" whenever *(1)* no broken or overcast layer is reported; or *(2)* the base of the lowest reported broken or overcast layer is higher than 9,750 feet above ground. *See paragraph 2-134(d).*

(b) *Zero Ceiling.* The ceiling will be reported as "zero" whenever *(1)* precipitation and/or obstructions to vision prevent observation of the sky and reduce the visibility to less than 1/4 mile; or *(2)* the base of a broken or overcast layer is 50 feet or less above ground. *See paragraph 2-134(g).*

(c) *Estimated Ceiling.* The ceiling height will be preceded by an "E" whenever instrumental measurement of the ceiling height is not practicable.

(d) *Measured Ceiling.* The ceiling height will be preceded by an "M" under the following conditions:

1. Whenever the ceiling projector spot is sharply defined. *If the spot fluctuates between cloud layers, the ceiling should be reported as "Z". An intervening smoke or haze layer will sometimes cause a brightening of the beam some distance below the "ceiling" spot. Such a condition will be noted in remarks as, for example: "K LYR 200", etc. Care should be taken to determine whether this brightening of the beam is caused by smoke or haze, or by a very thin cloud layer.*

2. Whenever the balloon disappears abruptly into the cloud base. *If the balloon disappears slowly from view, or the cloud base is not clearly defined, the ceiling will* *not* *be considered as measured. If the balloon is blown out of sight before reaching the cloud base, a plus sign (+) will be entered (instead of a ceiling classification letter) preceding the figures which represent the last observed height of the balloon. See paragraph 2-117(e).*

3. Whenever the ceiling height can be determined from the known heights of unobscured portions of towers, buildings, etc., within 1 1/2 miles of the station. *See paragraph 2-134(c).*

conditions outlined above and also with weather conditions minima as set for the particular airport station at which they are employed. It is the responsibility of personnel giving out weather reports orally to pilots and others to make certain that the classification of the report or reports is distinctly and clearly given and that there is no misunderstanding on the part of the inquirer which may lead to later confusion or difficulty.

2-129. List of Controlled Airports. A list of airway weather-reporting stations at controlled airports within controlled zones has already been issued, and as this list may be changed from time to time, stations concerned will be advised accordingly.

2-130. Stations Which Are To Classify Reports. It should be remembered that only airway weather-reporting stations within controlled zones are required to classify their weather reports, and, further, that the inclusion of the symbol C, N, or X automatically indicates that the report is from a controlled airport.

XV (B) CEILING

2-131. Ceiling. CEILING IS THE HEIGHT ABOVE GROUND OF THE LOWEST CLOUDS REPORTED AS BROKEN OR OVERCAST. *In other words, ceiling is the lowest height above ground at which all clouds at and below that level cover more than 1/2 of the sky.*

(a) Unlimited Ceiling. The ceiling will be reported as "unlimited" whenever *(1)* no broken or overcast layer is reported; or *(2)* the base of the lowest reported broken or overcast layer is higher than 9,750 feet above ground. *See paragraph 2-134(d).*

(b) Zero Ceiling. The ceiling will be reported as "zero" whenever *(1)* precipitation and/or obstructions to vision prevent observation of the sky and reduce the visibility to less than 1/4 mile; or *(2)* the base of a broken or overcast layer is 50 feet or less above ground. *See paragraph 2-134(g).*

(c) Estimated Ceiling. The ceiling height will be preceded by an "E" whenever instrumental measurement of the ceiling height is not practicable.

(d) Measured Ceiling. The ceiling height will be preceded by an "M" under the following conditions:

1. Whenever the ceiling projector spot is sharply defined. *If the spot fluctuates between cloud layers, the ceiling should be reported as "W". An intervening smoke or haze layer will sometimes cause a brightening of the beam some distance below the "ceiling" spot. Such a condition will be noted in remarks as, for example: "K LYR 200", etc. Care should be taken to determine whether this brightening of the beam is caused by smoke or haze, or by a very thin cloud layer.*

2. Whenever the ceiling height can be determined from the known heights of unobscured portions of towers, buildings, etc., within 1 1/2 miles of the station.

(e) Balloon Ceiling. The ceiling height will be preceded by a "B" whenever the balloon disappears abruptly into the cloud *base. If the balloon disappears slowly from view, or the cloud base is not clearly defined, the ceiling will not be considered as a balloon ceiling. If the balloon is blown out of sight before reaching the cloud base, a plus sign (+) will be entered (instead of a ceiling classification letter) preceding the figures which represent the last observed height of the balloon. See paragraph 2-117(e).*

The subparagraph headings (e), (f), and (g) immediately following on page 28a-R should be changed to (f), (g), and (h).

conditions outlined above and also with weather conditions minima as set for the particular airport station at which they are employed. It is the responsibility of personnel giving out weather reports orally to pilots and others to make certain that the classification of the report or reports is distinctly and clearly given and that there is no misunderstanding on the part of the inquirer which may lead to later confusion or difficulty.

2-129. LIST OF CONTROLLED AIRPORTS. A list of airway weather-reporting stations at controlled airports within controlled zones has already been issued, and as this list may be changed from time to time, stations concerned will be advised accordingly.

2-130. STATIONS WHICH ARE TO CLASSIFY REPORTS. It should be remembered that only airway weather-reporting stations within control zones are required to classify their weather reports, and further, that the inclusion of the symbol C or N automatically indicates that the report is from a controlled airport. Cancelled 3/5/45

XV (B) CEILING

2-131. CEILING. CEILING IS THE HEIGHT ABOVE GROUND OF THE LOWEST CLOUDS REPORTED AS BROKEN OR OVERCAST. In other words, ceiling is the lowest height above ground at which all clouds at and below that level cover more than 1/2 of the sky.

(a) Unlimited Ceiling. The ceiling will be reported as "unlimited" whenever (1) no broken or overcast layer is reported; or (2) the base of the lowest reported broken or overcast layer is higher than 9,750 feet above ground. See paragraph 2-134(d).

(b) Zero Ceiling. The ceiling will be reported as "zero" whenever (1) precipitation and/or obstructions to vision prevent observation of the sky and reduce the visibility to less than 1/4 mile; or (2) the base of a broken or overcast layer is 50 feet or less above ground. See paragraph 2-134(g).

(c) Estimated Ceiling. The ceiling height will be preceded by an "E" whenever instrumental measurement of the ceiling height is not practicable.

(d) Measured Ceiling. The ceiling height will be preceded by an "M" under the following conditions:

1. Whenever the ceiling projector spot is sharply defined. If the spot fluctuates between cloud layers, the ceiling should be reported as "W". An intervening smoke or haze layer will sometimes cause a brightening of the beam some distance below the "ceiling" spot. Such a condition will be noted in remarks as, for example: "K LYR 200", etc. Care should be taken to determine whether this brightening of the beam is caused by smoke or haze, or by a very thin cloud layer.

2. Whenever the ceiling height can be determined from the known heights of unobscured portions of towers, buildings, etc., within 1 1/2 miles of the station.

(e) Balloon Ceiling. The ceiling height will be preceded by a "B" whenever the balloon disappears abruptly into the cloud base. If the balloon disappears slowly from view, or the cloud base is not clearly defined, the ceiling will not be considered as a balloon ceiling. If the balloon is blown out of sight before reaching the cloud base, a plus sign (+) will be entered (instead of a ceiling classification letter) preceding the figures which represent the last observed height of the balloon. See paragraph 2-117(e).

The subparagraph headings (e), (f), and (g) immediately following on page 28a-R should be changed to (f), (g), and (h).

XV (B)--CEILING

2-130. Definition.--Ceiling is the height above ground of the base of the lowest clouds reported as broken or overcast. In other words, ceiling is the minimum height above ground at which all clouds at and below that height cover more than one-half of the sky.

2-131. Unlimited Ceiling.--The ceiling is unlimited:

(a) Whenever the sky is reported as clear or scattered.

(b) Whenever the height of the base of the lowest clouds reported as broken or overcast is more than 9,750 feet above the ground.

2-132. Ceiling Classification.--Except when the ceiling is unlimited, it will be classified according to the means by which it was determined. See par. 2-117.

(a) Measured ceiling.--A ceiling is classified as measured:

1. Whenever obtained by means of a ceiling light or ceilomter, and the projector spot or the ceilometer reaction is sharply defined.

2. Whenever a radiosonde balloon is observed to disappear abruptly into the cloud base and its height at the base is computed.

3. Whenever the ceiling height is determined from the known heights of unobscured portions of tall objects within one and one-half miles of the station.

(b) Estimated ceiling.--A ceiling is classified as estimated:

1. Whenever determined by means of the "Convective-Cloud Base Height Diagram" (WB Form 1113E), under conditions appropriate to and in accordance with instructions for its use.

2. Whenever a ceiling balloon or pilot balloon is observed to enter the base of a broken cloud layer.

3. Whenever a ceiling balloon or pilot balloon enters the side of a cloud or an estimation is based on its ascent through a break between clouds.

4. Whenever the ceiling height is determined from the known heights of unobscured portions of tall objects more than one and one-half miles from the station.

5. Whenever the sky is not obscured and the observer, lacking other guides, determines the ceiling on the basis of experience.

(c) Indefinite ceiling.--A ceiling is classified as indefinite:

1. Whenever a ceiling projector spot on the cloud base is not sharply defined or is fluctuating rapidly; or the ceilometer reaction is not immediate and definite or there are several reactions. In these cases, the lower limit of the spot, fluctuation, or reaction will be used.

2. Whenever the sky is overcast and the balloon disappears slowly into a ragged or irregular cloud base. In this case the height at which obscuration began will be used.

3. Whenever obstructions to vision other than precipitation obscure the cloud base and prevent a determination of its height. In these cases, the ceiling during the daytime is the upper limit of the ceilometer reaction or the height at which the outline of the balloon first becomes indistinct, and at night is the limit of penetration of the projector beam. However, if the horizontal visibility is less than one-fourth mile, the ceiling will be zero.

(d) Balloon ceiling.--A balloon ceiling is one whose height is ascertained by means of a ceiling balloon or pilot balloon which disappears abruptly into the base of an overcast.

(e) Precipitation ceiling.--A precipitation ceiling is an estimate of vertical visibility when precipitation obscures the cloud base and prevents the determination of its height. At night this estimate is based on the limit of penetration of the projector beam. However, if the horizontal visibility is less than one-fourth mile, the ceiling will be zero.

(f) Aircraft ceiling.--An aircraft ceiling is one furnished by a pilot, at a time when a projector measurement is impossible, provided the pilot actually measured the ceiling while in flight over or within one and one-half miles of the boundary of the airport.

2-133. Indicating Ceiling Classification in Reports.--Except when the ceiling is unlimited, a ceiling-height value in all teletype transmissions will be preceded by one of the letters or the symbol described in par. 2-117. In telegraphed or telephoned reports, the word describing the ceiling-height classification will be used instead of the letter.

(e) Indefinite Ceiling. The ceiling height will be preceded by a "Z" under the following conditions:

1. Whenever the projector spot fluctuates rapidly between two or more cloud layers.

2. Whenever the balloon enters the side of a cloud or ascends through a break between clouds and there is insufficient time for another measurement.

3. Whenever the balloon disappears slowly into a ragged or irregular cloud base.

4. Whenever hydrometeors, other than precipitation falling from clouds, prevent estimation or instrumental measurement of the height of the cloud base.

(f) Precipitation Ceiling. The ceiling height will be preceded by a "P" whenever precipitation prevents estimation or instrumental measurement of the height of the actual cloud base. **Precipitation ceiling is defined as the lowest height above ground at which the observer estimates vision of the ground will be obscured by precipitation, and does NOT represent the height of the actual cloud base.** *Accordingly, "P" will never be used preceding figures representing the height of the cloud base. It will be used only when the observer is convinced that vision of the ground is obscured by precipitation at some height below that of the cloud base.*

(g) Ceiling Reported from Aircraft. The ceiling height will be preceded by an "A" whenever the value being reported is one furnished by a pilot, provided the pilot actually measured the ceiling height while in flight over or within 1 1/2 miles of the boundary of the airport. *A pilot's report of ceiling height will be accepted as official* ***unless*** *(1) the ceiling height can be measured by use of a ceiling projector; or (2) the observer is convinced that the value reported by the pilot was not obtained by measurement while in flight over or within 1 1/2 miles of the boundary of the airport, or that the value has been erroneously coded, transmitted, received, or decoded. Whenever a measurement can be made with a ceiling projector, the pilot's report should (regardless of previous measurements) be* ***immediately*** *checked, and in case of a discrepancy the latest projector-measured height used.*

2-132. Estimation of Ceiling Heights. If instruments are not available, the height of a ceiling may often be determined with reasonable accuracy by observing the unobscured portions of towers, mountains, or other tall objects, of which the height and the distance from the station is known. A ceiling height determined in such a manner will be reported as "estimated" when the object used is more than 1 1/2 miles from the station. *See paragraph 2-134(c) for use of objects within 1 1/2-mile radius of station.* For use in estimating the ceiling in this manner, each station shall prepare and maintain a table of such objects the distances of which are more than 1 1/2 miles from the station. Where ceilings are estimated and the observer is in some doubt as to its height within, say, 100 feet, it is believed advisable to report the lower rather than the higher value, but this should not be carried to the extreme that ceilings are reported consistently at lower altitudes than actually exist.

2-133. Indicating Ceiling Classification in Reports. Except when the ceiling is unlimited, a ceiling-height value will be included in every airway weather report. In all teletype transmissions this value will be preceded by one of the letters or symbol described in paragraph 2-131. In telegraphed or telephoned reports the word describing the ceiling-height classification will be used instead of the letter.

2-134. Rules for Observing and Reporting Ceilings.

(a) Point of observation. The observer must go outside to a point where a view of the entire sky may be had. All ceiling heights will refer to the ground level at the station, and if ceiling measurements are made from the roof of a building the height of the roof above the ground will be added to the value there obtained.

(e) Indefinite Ceiling. The ceiling height will be preceded by a "W" under the following conditions:

1. Whenever the projector spot fluctuates rapidly between two or more cloud layers.

2. Whenever the balloon enters the side of a cloud or ascends through a break between clouds and there is insufficient time for another measurement.

3. Whenever the balloon disappears slowly into a ragged or irregular cloud base.

4. Whenever hydrometeors, other than precipitation falling from clouds, prevent estimation or instrumental measurement of the height of the cloud base.

(f) Precipitation Ceiling. The ceiling height will be preceded by a "P" whenever precipitation prevents estimation or instrumental measurement of the height of the actual cloud base. **Precipitation ceiling is defined as the lowest height above ground at which the observer estimates vision of the ground will be obscured by precipitation, and does NOT represent the height of the actual cloud base.** *Accordingly, "P" will never be used preceding figures representing the height of the cloud base. It will be used only when the observer is convinced that vision of the ground is obscured by precipitation at some height below that of the cloud base.*

(g) Ceiling Reported from Aircraft. The ceiling height will be preceded by an "A" whenever the value being reported is one furnished by a pilot, provided the pilot actually measured the ceiling height while in flight over or within 1 1/2 miles of the boundary of the airport. *A pilot's report of ceiling height will be accepted as official unless (1) the ceiling height can be measured by use of a ceiling projector; or (2) the observer is convinced that the value reported by the pilot was not obtained by measurement while in flight over or within 1 1/2 miles of the boundary of the airport, or that the value has been erroneously coded, transmitted, received, or decoded. Whenever a measurement can be made with a ceiling projector, the pilot's report should (regardless of previous measurements) be immediately checked, and in case of a discrepancy the latest projector-measured height used.*

2-132. Estimation of Ceiling Heights. If instruments are not available, the height of a ceiling may often be determined with reasonable accuracy by observing the unobscured portions of towers, mountains, or other tall objects, of which the height and the distance from the station is known. A ceiling height determined in such a manner will be reported as "estimated" when the object used is more than 1 1/2 miles from the station. *See paragraph 2-134(c) for use of objects within 1 1/2-mile radius of station.* For use in estimating the ceiling in this manner, each station shall prepare and maintain a table of such objects the distances of which are more than 1 1/2 miles from the station. Where ceilings are estimated and the observer is in some doubt as to its height within, say, 100 feet, it is believed advisable to report the lower rather than the higher value, but this should not be carried to the extreme that ceilings are reported consistently at lower altitudes than actually exist.

2-133. Indicating Ceiling Classification in Reports. Except when the ceiling is unlimited, a ceiling-height value will be included in every airway weather report. In all teletype transmissions this value will be preceded by one of the letters or symbol described in paragraph 2-131. In telegraphed or telephoned reports the word describing the ceiling-height classification will be used instead of the letter.

2-134. Rules for Observing and Reporting Ceilings.

(a) Point of observation. The observer must go outside to a point where a view of the entire sky may be had. All ceiling heights will refer to the ground level at the station, and if ceiling measurements are made from the roof of a building the height of the roof above the ground will be added to the value there obtained.

2-134. Rules for Observing and Reporting Ceilings.

(a) Point of observation.--The observer must go outside to a point where a view of the entire sky may be had. All ceiling heights will refer to the ground level at the station, and if ceiling measurements are made from the roof of a building, the height of the roof above the ground will be added to the value there obtained.

(*b*) *Use of ceiling-measuring instruments.*—If the station is equipped with ceiling-measuring instruments (ceiling projector and/or ceiling balloons) and a ceiling is adjudged by observation of the sky to be present, the ceiling-measuring instruments *must* be used, if practicable. Ceiling balloons will be used to determine the ceiling height during daylight hours, providing moderate or heavy precipitation is not occurring. The frequency of their use will be governed by the following:

Hourly Reporting Stations.—1. At the discretion of the observer when the ceiling is estimated to be over 2,000 feet, but in no case more frequently than every 2 hours.

2. At 2-hour intervals or more frequently when the ceiling height is between 1,000 and 2,000 feet.

3. At hourly intervals or more frequently, beginning with an observation showing a ceiling of 1,000 feet or less and continuing until an observation shows that the ceiling has risen above 1,000 feet.

4. *Stations taking "local extra" observations.*—At half hour intervals or more frequently, beginning with an observation showing a ceiling of less than 600 feet and continuing until the ceiling rises to 600 feet or more.

Other Than Hourly Reporting Stations.—1. At each observation forwarded (if station is equipped with ceiling balloons) when the ceiling is estimated to be less than 3,000 feet. Should the occasion arise where at certain periods observations are filed at such frequent intervals that time will not permit the use of a ceiling balloon for each observation, the rules for "Hourly reporting stations" above will govern the frequency of use.

If during light precipitation the observer believes the ascensional rate of the balloon to be affected by the precipitation, the ascension of the balloon should be used as a basis for estimating the ceiling height rather than as an accurate measurement.

(*c*) *Use of ceiling-measuring objects.*—The unobscured portions of towers, buildings, or other tall objects (excluding land elevations which are to be used only for *estimating* ceilings) may be used to determine a measured ceiling when such objects are within 1½-mile radius of the station and the object is of such nature that the height of portions can readily be determined. Accordingly, each station shall prepare and maintain a table (separate to the one required under par. 2–132 above) of such objects, within a radius of 1½ miles of the station, suitable for measuring the ceiling. Except under conditions in which the use of ceiling measuring instruments is impracticable, the use of these objects for measuring ceilings will be in addition to and not in place of the ceiling balloons or ceiling light.

(*d*) *Condition under which the ceiling is unlimited.*—The ceiling will be considered "unlimited" and no report made thereof when (1) the sky is clear, (2) there is not cloudiness present covering over five-tenths of the sky below an altitude of 9,751 feet above the station, and (3) any number of tenths of cloud covering at an altitude of 9,751 feet or more above the station are present alone.

(*e*) *Ceiling values to be reported.*—The ceiling height to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet *above the station* will be reported when the total cloudiness below 9,751 feet above the station covers over five-tenths of the sky.

(*f*) *Reporting height of scattered clouds.*—If the "sky" condition is given as "scattered clouds," or if the last part of a combination "sky" condition term is given as "* * * lower scattered clouds," that is, if the term in question represents a layer of clouds covering from one-tenth to five-tenths inclusive of the sky at an altitude of less than 9,751 feet above the station, the height of this stratum shall be indicated to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet above the station, immediately following the term in telegraphed reports and immediately preceding the "scattered clouds" symbol in reports transmitted by teletype. For example, (1) as telegraphed "high broken, lower scattered 1400;" "scattered, lower scattered 2,000;" "scattered clouds 300;" (2) as transmitted by teletype, "⦶/14⦶" "⦶20⦶," "3⦶." It will be noted that this rule does not apply to "high scattered clouds" nor to "scattered clouds" forming the *first part of a combination term.* It is obvious that the height given in these cases almost always will be estimated, but indication of this need not be made.

(*b*) *Use of ceiling-measuring instruments.* If the station is equipped with ceiling-measuring instruments (ceiling projector and/or ceiling balloons) and a ceiling is adjudged by observation of the sky to be present, the ceiling-measuring instruments must be used, if practicable. Ceiling balloons will be used to determine the ceiling height during daylight hours, provided moderate or heavy precipitation is not occurring and the clouds are not broken or scattered. The frequency of their use will be governed by the following:

Hourly Reporting Stations.—1. At the discretion of the observer when the ceiling is estimated to be over 2,000 feet, but in no case more frequently than every 2 hours.

2. At hourly intervals or more frequently when the ceiling height is between 1,000 and 2,000 feet.

3. At hourly intervals or more frequently, beginning with an observation showing a ceiling of 1,000 feet or less and continuing until an observation shows that the ceiling has risen above 1,000 feet.

4. Stations taking "local extra" observations.—At half hour intervals or more frequently, beginning with an observation showing a ceiling of less than 600 feet and continuing until the ceiling rises to 600 feet or more.

Other Than Hourly Reporting Stations.—1. At each observation forwarded (if station is equipped with ceiling balloons) when the ceiling is estimated to be less than 3,000 feet. Should the occasion arise where at certain periods observations are filed at such frequent intervals that time will not permit the use of a ceiling balloon for each observation, the rules for "Hourly reporting stations" above will govern the frequency of use.

(*c*) *Use of ceiling-measuring objects.* The unobscured portions of towers, buildings, or other tall objects (excluding land elevations which are to be used only for *estimating* ceilings) may be used to determine a measured ceiling when such objects are within 1 1/2-mile radius of the station and the object is of such nature that the height of portions can readily be determined. Accordingly, each station shall prepare and maintain a table (separate to the one required under par. 2-132 above) of such objects, within a radius of 1 1/2 miles of the station, suitable for measuring the ceiling.

(*d*) *Temporarily cancelled.*

(*e*) *Ceiling values to be reported.* The ceiling height to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet *above the station* will be reported when the total cloudiness below 9,751 feet above the station covers over five-tenths of the sky.

(*f*) *Reporting height of scattered clouds.*—If the "sky" condition is given as "scattered clouds," or if the last part of a combination "sky" condition term is given as "lower scattered clouds," the height of this stratum shall be indicated to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet above the station, immediately following the term in telegraphed reports and immediately preceding the "scattered clouds" symbol in reports transmitted by teletype. For example, (1) as telegraphed "high broken, lower scattered 1400;" "scattered, lower scattered 2,000;" "scattered clouds 300;" (2) as transmitted by teletype, "⦶/14⦶" "⦶20⦶," "3⦶." It will be noted that this rule does not apply to "high scattered clouds" nor to "scattered clouds" forming the *first part of a combination term.* It is obvious that the height given in these cases almost always will be estimated, but indication of this need not be made.

(b) Use of ceiling-measuring instruments. Wherever available, ceiling-measuring instruments (ceiling projector or ceilometer) will be used if clouds are present unless the observer believes he cannot obtain a cloud height measurement within a reasonable time.

(c) Use of ceiling balloons. Stations equipped with ceiling balloons but not with ceilometers will use the former during daylight hours, provided the clouds are not broken or scattered and moderate or heavy precipitation is not occurring. The frequency of their use will be governed by the following:

Hourly reporting stations. 1. At the discretion of the observer when the ceiling is estimated to be over 2,000 feet, but in no case more frequently than every two hours.

2. At hourly intervals or more frequently beginning with an observation showing a ceiling of 2,000 feet or less and continuing until an observation shows that the ceiling has risen above 2,000 feet.

3. At stations taking local extra observations, at half-hour intervals, or more frequently if necessary to maintain an accurate check on the ceiling, beginning with an observation showing a ceiling of less than 600 feet and continuing until the ceiling rises to 600 feet or more.

Other than hourly reporting stations. 1. At each observation forwarded when the ceiling is estimated to be less than 3,000 feet. Should the occasion arise where at certain periods observations are filed at such frequent intervals that time will not permit the use of a ceiling balloon for each observation, the rules for "hourly reporting stations" above will govern the frequency of use.

(d) Use of ceiling-measuring objects. The unobscured portions of towers, buildings, or other tall objects (excluding land elevations which are to be used only for estimating ceilings) may be used to determine a measured ceiling when such objects are within 1 1/2-mile radius of the station and the object is of such nature that the height of portions can readily be determined. Accordingly, each station shall prepare and maintain a table (separate to the one required under par. 2-132 above) of such objects, within a radius of 1 1/2 miles of the station, suitable for measuring the ceiling.

(e) Ceiling values to be reported. The ceiling height to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet above the station will be reported when the total cloudiness below 9,751 feet above the station covers over five-tenths of the sky.

(f) Reporting height of scattered clouds.—If the "sky" condition is given as "scattered clouds," or if the last part of a combination "sky" condition term is given as "lower scattered clouds," the height of this stratum shall be indicated to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet above the station, immediately following the term in telegraphed reports and immediately preceding the "scattered clouds" symbol in reports transmitted by teletype. For example, (1) as telegraphed "high broken, lower scattered 1400;" "scattered, lower scattered 2,000;" "scattered clouds 300;" (2) as transmitted by teletype, "Φ/14Φ," "Φ20Φ," "3Φ." It will be noted that this rule does not apply to "high scattered clouds" nor to "scattered clouds" forming the first part of a combination term. It is obvious that the height given in these cases almost always will be estimated, but indication of this need not be made.

(*b*) *Use of ceiling-measuring instruments.*—If the station is equipped with ceiling-measuring instruments (ceiling projector and/or ceiling balloons) and a ceiling is adjudged by observation of the sky to be present, the ceiling-measuring instruments *must* be used, if practicable. Ceiling balloons will be used to determine the ceiling height during daylight hours, providing moderate or heavy precipitation is not occurring. The frequency of their use will be governed by the following:

Hourly Reporting Stations.—1. At the discretion of the observer when the ceiling is estimated to be over 2,000 feet, but in no case more frequently than every 2 hours.

2. At 2-hour intervals or more frequently when the ceiling height is between 1,000 and 2,000 feet.

3. At hourly intervals or more frequently, beginning with an observation showing a ceiling of 1,000 feet or less and continuing until an observation shows that the ceiling has risen above 1,000 feet.

4. *Stations taking "local extra" observations.*—At half hour intervals or more frequently, beginning with an observation showing a ceiling of less than 600 feet and continuing until the ceiling rises to 600 feet or more.

Other Than Hourly Reporting Stations.—1. At each observation forwarded (if station is equipped with ceiling balloons) when the ceiling is estimated to be less than 3,000 feet. Should the occasion arise where at certain periods observations are filed at such frequent intervals that time will not permit the use of a ceiling balloon for each observation, the rules for "Hourly reporting stations" above will govern the frequency of use.

If during light precipitation the observer believes the ascensional rate of the balloon to be affected by the precipitation, the ascension of the balloon should be used as a basis for estimating the ceiling height rather than as an accurate measurement.

(*c*) *Use of ceiling-measuring objects.*—The unobscured portions of towers, buildings, or other tall objects (excluding land elevations which are to be used only for *estimating* ceilings) may be used to determine a measured ceiling when such objects are within 1½-mile radius of the station and the object is of such nature that the height of portions can readily be determined. Accordingly, each station shall prepare and maintain a table (separate to the one required under par. 2–132 above) of such objects, within a radius of 1½ miles of the station, suitable for measuring the ceiling. Except under conditions in which the use of ceiling measuring instruments is impracticable, the use of these objects for measuring ceilings will be in addition to and not in place of the ceiling balloons or ceiling light.

(*d*) *Condition under which the ceiling is unlimited.*—The ceiling will be considered "unlimited" and no report made thereof when (1) the sky is clear, (2) there is not cloudiness present covering over five-tenths of the sky below an altitude of 9,751 feet above the station, and (3) any number of tenths of cloud covering at an altitude of 9,751 feet or more above the station are present alone.

(*e*) *Ceiling values to be reported.*—The ceiling height to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet *above the station* will be reported when the total cloudiness below 9,751 feet above the station covers over five-tenths of the sky.

(*f*) *Reporting height of scattered clouds.*—If the "sky" condition is given as "scattered clouds," or if the last part of a combination "sky" condition term is given as "* * * lower scattered clouds," that is, if the term in question represents a layer of clouds covering from one-tenth to five-tenths inclusive of the sky at an altitude of less than 9,751 feet above the station, the height of this stratum shall be indicated to the nearest 100 feet up to 5,000 feet and above that to the nearest 500 feet up to 9,751 feet above the station, immediately following the term in telegraphed reports and immediately preceding the "scattered clouds" symbol in reports transmitted by teletype. For example, (1) as telegraphed "high broken, lower scattered 1400;" "scattered, lower scattered 2,000;" "scattered clouds 300;" (2) as transmitted by teletype, "⦶/14⦶" "⦶20⦶," "3⦶." It will be noted that this rule does not apply to "high scattered clouds" nor to "scattered clouds" forming the *first part of a combination term.* It is obvious that the height given in these cases almost always will be estimated, but indication of this need not be made.

(*g*) *Conditions under which ceiling is reported "zero."*—The ceiling will be reported "zero" when (1) dense fog is present; (2) heavy precipitation, blowing snow, dust or sand; thick smoke or dust, etc., prevent observation of the sky and reduce the visibility to *less* than one-fifth mile; (3) the base of clouds present is 50 feet or less above the station. In the latter case (3) it is possible to have zero ceiling with the visibility one-fifth mile or more, and, since this would be confusing, it will be necessary to explain the condition under "Remarks." For example, "clouds 30 feet above station," etc.

(*h*) *Reporting ceiling when balloon is blown out of sight before reaching clouds.*—When a balloon is used to determine the ceiling height, and is blown out of sight before reaching the clouds, the ceiling will be reported as over the last observed altitude of the balloon. For example, if the balloon was blown out of sight and the last observed altitude was 1,600 feet the ceiling will be reported "over sixteen hundred."

(*i*) *Reporting variable, changeable, or fluctuating ceiling.*—1. When the ceiling is **below 2,000** feet but **not below 1,000** feet and is variable or changeable by not more than **200** feet to either side of the ceiling value to be reported, this will be indicated by the entry of the word "variable" in reports sent by telephone or telegraph and the letter "V" in reports sent by teletype or radio, immediately following the ceiling value. For example, "1,900 variable——" or "19V——" would indicate that the ceiling is 1,900 feet and variable within the range of 1,700 to 2,100 feet inclusive; "1,000 variable——" or "10V——" would indicate that the ceiling is 1,000 feet and variable within the range of 800 to 1,200 feet, inclusive; etc. When the ceiling is variable by more than 200 feet to either side of the ceiling value to be reported, this will be indicated under "Remarks," giving the range of variability. Cloudiness changeable as to amount, unless affecting the ceiling height in accordance with the above, would not requre a "V" for ceiling but should be reported under "Remarks," for example, "⦶V⊕," etc.

2. When the ceiling is **below 1,000 feet** and is variable or changeable by not more than **100** feet to either side of the ceiling value to be reported, this will be indicated by entry of the word "variable" in reports sent by telephone or telegraph and the letter "V" in reports sent by teletype or radio, immediately following the ceiling value. For example, "900 variable——" or "9V——" would indicate that the ceiling is 900 feet and variable within the range of 800 to 1,000 feet, inclusive; "100 variable——" or "1V——" would indicate that the ceiling is 100 feet and variable within the range of zero to 200 feet inclusive; etc. When a ceiling below 1,000 feet is variable by more than 100 feet to either side of the ceiling value, this will be indicated under "Remarks," giving the range of variability. Cloudiness changeable as to amount, unless affecting the ceiling height in accordance with the above, would not require a "V" for ceiling but should be reported under "Remarks."

(*j*) *Caution to be observed in using ceiling light projectors on long base lines.*—Observers using ceiling light projectors installed on base lines of approximately 1,000 feet are cautioned that the spot of light frequently cannot be observed under conditions of low ceilings and poor visibility because of the distance between the observing point and the projector. In such cases, the observers should pace the distance towards the projector to a point where the spot can be observed and make observations of the ceiling computed on the basis of the shorter base line.

XV (C)—SKY

2–135. Purpose and Importance of Reporting Sky Conditions.—The extent to which the sky is covered by clouds and an indication of the stratification of such cloud covering are of interest and importance to a pilot as they determine whether all or part of his course may be flown in full sight of the ground as he stays below all cloud layers, or all or a part of his flight must be above or in cloud layers, or other dense obscuring elements, such as fog, thick blowing snow, dust, etc., with consequent limited or entirely obstructed view of the surface. In the latter event, it is essential that he plan his flight according to reports which will definitely show whether there are breaks in such coverings through which he may ascend to any altitude necessary, may check his course by occasional glimpses of the ground during the flight and descent at his destination. For determining whether it will be necessary to fly between cloud layers,

(g) Conditions under which ceiling is reported "zero".—The ceiling will be reported "zero" when (1) precipitation and/or obstructions to vision prevent observation of the sky condition *and* reduce the visibility *less* than one-fourth mile; (2) the base of clouds present is 50 feet or less above the station. In the latter case (2) it is possible to have zero ceiling with the visibility one-fourth mile or more, and since this would be confusing, it will be necessary to explain the conditions under "Remarks". For example, "clouds 30 feet above station", etc.

(h) Reporting ceiling when balloon is blown out of sight before reaching clouds.—When a balloon is used to determine the ceiling height, and is blown out of sight before reaching the clouds, the ceiling will be reported as over the last observed altitude of the balloon. For example, if the balloon was blown out of sight and the last observed altitude was 1,600 feet the ceiling will be reported "over sixteen hundred."

(i) Reporting variable, changeable or fluctuating ceiling.—1. When the ceiling is below 2,000 feet and is varying or changing rapidly, this will be indicated in reports sent by teletype or radio by entry of the letter "V" immediately following the ceiling value *and* by giving the range of variability in "Remarks". For example, if the prevailing ceiling is 1,400 feet but varying rapidly from say 1,000 to 1,600 feet, "14V" would be given as the ceiling value and a remark included such as "CIG VRBL 10 TO 16", etc. Stations reporting by telephone will indicate a variable ceiling by use of the word "variable" following the ceiling value and by giving the range of variability in "Remarks"; for example, "800 variable----------Ceiling variable 600 to 900" would be appropriate if the prevailing ceiling was 800 feet but varying rapidly from 600 to 900.

2. When the ceiling is 2,000 feet or more and variable, this will be indicated in "Remarks" only, giving the range of variability.

3. Cloudiness changeable as to amount, unless affecting the ceiling height in accordance with the above, will not require a "V" for ceiling but should be reported under "Remarks"; for example, "OVO", "OVO", "OVO", etc.

4. When the ceiling height is changing slowly enough so that time will permit each change to be reported by a special observation, the individual changes will be covered by "Specials" whenever the rules governing special observations given in Chapter V, page 15, require the filing of a "Special".

(j) Caution to be observed in using ceiling light projectors on long base lines.—Observers using ceiling light projectors installed on base lines of approximately 1,000 feet are cautioned that the spot of light frequently cannot be observed under conditions of low ceilings and poor visibility because of the distance between the observing point and the projector. In such cases, the observers should pace the distance towards the projector to a point where the spot can be observed and make observations of the ceiling computed on the basis of the shorter base line.

XV (C)—SKY

2-135. Purpose and Importance of Reporting Sky Conditions.—The extent to which the sky is covered by clouds and an indication of the stratification of such cloud covering are of importance to a pilot as they determine whether all or part of his course may be flown in full sight of the ground, or all or a part of his flight must be above or in cloud layers with consequent limited or entirely obstructed view of the surface. In the latter event, it is essential that he plan his flight according to reports which will definitely show whether there are breaks in such coverings through which he may ascend where necessary, may check his course by occasional glimpses of the ground during the flight and may descend at his destination tion. For determining whether it will be necessary to fly between cloud layers,

it is also essential that the available reports indicate whether or not the visible cloudiness is composed of more than one layer and, if so, whether or not higher layers completely or partly cover openings in the lower layers. It follows, therefore, that the reporting of sky conditions accurately and completely is of great importance and care must be taken by the observer to see that they are so reported. All sky-condition observations are made visually without the use of instruments, although sometimes at night it is advantageous, in order to obtain an accurate conception of the extent and stratification of any cloudiness present, to turn on the ceiling projector and observe the nature of the cloudiness passing through the beam over a period of a few minutes.

2–136. General Types of Sky Conditions.—The principle of sky observations stated in the foregoing paragraph is carried out in airway weather reports by making observations of the sky element in accordance with the following four general types of sky:

Clear.—When there are no clouds present, or less than one-tenth of the sky is covered by clouds.

Scattered.—When from one-tenth to five-tenths, inclusive, of the sky is covered by clouds.

Broken.—When more than five-tenths but not more than nine-tenths of the sky is covered by clouds.

Overcast.—When more than nine-tenths of the sky is covered by clouds.

2–137. Rules for Observing and Reporting Sky Conditions.—Specific instructions for observing and reporting the sky conditions follow:

(*a*) *Point of observation.*—The observations will always be taken at a point from which a view of the entire sky may be had.

(*b*) *Estimating amounts of sky covered by clouds.*—"Scattered," "broken," and "overcast" describe cloudiness and are based on the total visible amount of cloudiness (as projected against the dome of the sky) observed at the time of observation compared with the amount of open sky. In such an instantaneous observation the sum of the tenths of the sky which are covered by clouds, plus those of open sky, if any, is always ten-tenths. The amount, in tenths, of open or covered sky is obtained by estimation and is a matter of experience and good judgment on the part of the observer. If he is able to estimate the tenths, it is readily possible to obtain an accurate value of the amount of cloudiness.

(*c*) *Reporting one layer of clouds.*—If all of the clouds are substantially at one level, *one* term suffices to describe the sky (although this one term may be modified under certain conditions by the addition of the adjective "high" as explained later). The term to be used will be either "scattered clouds," "high scattered clouds," "broken clouds," "high broken clouds," "overcast," or "high overcast." The reporting of stratification is to be avoided when there is only one layer of clouds with a rough or furrowed base; a remark, such as "ceiling ragged" or "ceiling irregular" is to be used in such cases.

(*d*) *Use of modifying term "high."*—The word "high" will be entered preceding the terms whenever the clouds referred to are within the 10,000-foot-ceiling interval, or higher. (The "10,000-foot-ceiling interval" is from 9,751 to 10,000 feet, inclusive, above the station.)

(*e*) *Use of modifying term "lower."*—The word "lower" will be entered immediately preceding the terms whenever the clouds are below the 10,000-foot-ceiling interval and the term which it modifies is the last part of a combination term. For example, it would not be entered if the term were "broken clouds" but would be entered if the "broken clouds" term was preceded by a term such as "high scattered." In other words, the word "lower" is omitted in cases where the cloud term is sent alone or as the first part of a combination term.

(*f*) *Reporting the sky condition when several layers of clouds are present.*—If clouds are observed at different altitudes, one stratum within the 10,000-foot-ceiling interval or higher and others below that altitude, they will be described by a combination of the terms "high" and "lower," as, for example, "high scattered, lower broken clouds." However, if two layers of clouds are each below the 10,000-foot-ceiling interval, then the word "high" will be omitted and the two sky-condition terms will be recorded, as,

for example, "broken, lower broken clouds." In each case the first term will describe the upper layer and the second term the lower layer. This is of great importance and when properly used will permit accurate description of the stratification of the cloudiness. It is often convenient to divide all clouds that may be present into two main groups according to elevation—clouds 9,751 feet or higher above the station being called "high clouds" and those 9,750 or lower being called "low clouds." Since all "high" clouds are grouped into one layer when reporting the sky condition, the word "lower" when used in a combination of sky-condition terms will refer invariably to a layer of "low clouds."

(*g*) *Number of terms to be used in reporting the sky condition.*—Not over two terms will be used in any sky-condition report. Low, scattered clouds which may form a *third* layer should be mentioned under "remarks," giving their approximate altitude. Special attention is called to the fact that this is *not* a repetition of instructions in paragraph 2–134(*f*).

(*h*) *Rules for determining terms to be used when two layers of clouds are present.*—In cases when two layers of clouds are observed the observer will first estimate the number of tenths of the sky covered by the lower clouds, and will record either "clear," "lower scattered clouds," "lower broken clouds," or "overcast," in accordance with the definitions given in paragraph 2–136. If "overcast" is recorded and upper clouds are visible through breaks, this fact will be reported under "remarks" as "upper clouds visible through breaks." If either "lower scattered clouds" or "lower broken clouds" are recorded, then it will next be necessary to record the proper term descriptive of the upper cloud layer, and the observer will proceed as follows:

1. The total tenths of both upper and lower clouds will be estimated, and if at least one-tenth of each layer is visible and the total amount of sky covered by both layers does not exceed five-tenths, the upper layer will be reported as "scattered" and so will the lower one.

(*a*) *Scattered, lower scattered clouds,* or *high scattered, lower scattered clouds.*—When the total cloudiness does not exceed five-tenths of the sky and each layer separately covers one-tenth or more.

2. If the total tenths of upper and lower clouds is over five-tenths and not more than nine-tenths, then only three possible combinations can be used. Examples:

(*a*) *Broken, lower scattered clouds* or *high broken, lower scattered clouds.*—When the lower layer is one-tenth to five-tenths, inclusive, and the total tenths of the sky covered is as given in the first sentence of this subparagraph [2–137(*h*) 2] above.

(*b*) *Scattered, lower broken clouds* or *high scattered, lower broken clouds.*—When the lower layer is over five-tenths but not more than nine-tenths, and it is clearly evident to the observer that the higher layer is actually "scattered," although partially obscured by the lower layer. Such a fine distinction may not always be possible at night.

(*c*) *Broken, lower broken clouds* or *high broken, lower broken clouds.*—When the lower layer is over five-tenths but not more than nine-tenths, and it is clearly evident to the observer that the higher layer is actually "broken," although partially obscured by the lower layer.

3. If the total cloudiness contained in both upper and lower layers is more than nine-tenths, then only two possible combinations can be used. Examples:

(*a*) *Overcast, lower scattered clouds* or *high overcast, lower scattered clouds.*—When the lower layer is one-tenth to five-tenths, inclusive, and the total tenths covered is as given in the first sentence of this subparagraph [2–137(*h*) 3] above.

(*b*) *Overcast, lower broken clouds* or *high overcast, lower broken clouds.*—When the lower layer is over five-tenths but not more than nine-tenths, and the total tenths covered is as given in the first sentence of this subparagraph [2–137 (*h*) 3] above.

(*i*) *Table of sky classifications.*—Table 1 classifies by cloud-layer amounts the combination sky conditions outlined in the foregoing paragraph (h). The values in the horizontal lines marked "U" represent tenths of sky visibly covered by the upper of two cloud layers, and in the lines marked "L" the tenths of sky covered by the lower of two cloud layers. The values in the line marked "B" indicate the amount of blue or open sky visible. If there are three layers, the lower two are combined in such cases into one amount and that considered in this table (as mentioned under (h) above) as the "L" or lower layer. If the "U" layer happens to be a layer above 9,750 feet, the modifier "HIGH" will be the first word of the combination term.

TABLE 1.—*Sky classifications*

(1) SCATTERED; LOWER SCATTERED CLOUDS, or HIGH SCATTERED, LOWER SCATTERED CLOUDS. (Ceiling always UNLIMITED. Altitude of "L" clouds entered on WB Form 1130 as directed in paragraph 2-134 (*f*).

U —	4	3	3	2	2	2	1	1	1	1	Total cloudiness always 5/10 or less.
L —	1	2	1	3	2	1	4	3	2	1	
B —	5	5	6	5	6	7	5	6	7	8	

(2) BROKEN, LOWER SCATTERED CLOUDS, or HIGH BROKEN, LOWER SCATTERED CLOUDS. (Ceiling is at the "U" cloud level. Height of "L" clouds reported as under (1) above.)

U —	8	7	7	6	6	6	5	5	5	4	4	4	4	3	3	3	2	2	1	Total cloudiness is always 6/10, 7/10, 8/10, or 9/10.
L —	1	2	1	3	2	1	4	3	2	1	5	4	3	2	5	4	3	5	4	5	
B —	1	1	2	1	2	3	1	2	3	4	1	2	3	4	2	3	4	3	4	4	

(3) SCATTERED, LOWER BROKEN CLOUDS, or HIGH SCATTERED, LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	3	2	2	1	1	1	Total cloudiness is always 7/10, 8/10, or 9/10. (See note below.)
L —	6	7	6	8	7	6	
B —	1	1	2	1	2	3	

(4) BROKEN, LOWER BROKEN CLOUDS, or HIGH BROKEN LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	3	2	2	1	1	1	Total cloudiness is always 7/10, 8/10, or 9/10.
L —	6	7	6	8	7	6	
B —	1	1	2	1	2	3	

(5) OVERCAST, LOWER SCATTERED CLOUDS, or HIGH OVERCAST, LOWER SCATTERED CLOUDS. (Ceiling is at the "U" cloud level. Height of "L" clouds reported as under (1) above.)

U —	9	8	7	6	5	Total cloudiness always 10/10.
L —	1	2	3	4	5	
B —	0	0	0	0	0	

(6) OVERCAST, LOWER BROKEN CLOUDS, or HIGH OVERCAST, LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	4	3	2	1	Total cloudiness always 10/10.
L —	6	7	8	9	
B —	0	0	0	0	

NOTE.—It should be noted that this grouping of cloud-layer amounts may also be termed BROKEN, LOWER BROKEN CLOUDS or HIGH BROKEN, LOWER BROKEN CLOUDS, and should usually be so termed unless the observer is quite sure that the upper layer of clouds is of very limited extent. A series of frequent observations will often show the extent of the upper cloud layer as the layer of lower broken clouds passes across it.

(*j*) *Use of special modifying terms.*—Any of the foregoing terms may be modified by the insertion of the words "thin" or "dark," where appropriate. It is proper to use the term "thin" in describing the cloudiness whenever the solar or lunar disk or stars are faintly visible through them, and the term "dark" whenever the clouds are of an unusually dark or ugly, threatening appearance. These terms will be inserted following the altitude term, if any, and immediately preceding the cloudiness term proper. For example, "high thin overcast," "high overcast, lower thin broken clouds," "dark overcast," etc. If the clouds are noted to have an unusually rapid motion, or to be in a highly turbulent condition, proper entry of this fact should be made under "Remarks." For example, "clouds moving rapidly," "clouds turbulent," etc.

(*k*) *Omission of sky condition.*—When dense or thick obstructions to vision or heavy precipitation, or combinations of these, are present and reduce the ceiling to zero and/or the visibility to *less* than ⅛ mile, thus making the sky condition unobservable, no term will be employed in the report to represent the sky condition; that is, it will be omitted.

TABLE 1.—*Sky classifications*

(1) SCATTERED; LOWER SCATTERED CLOUDS, or HIGH SCATTERED, LOWER SCATTERED CLOUDS. (Ceiling always UNLIMITED. Altitude of "L" clouds entered on WB Form 1130 as directed in paragraph 2–134 (*f*).

U —	4	3	3	2	2	2	1	1	1	1
L —	1	2	1	3	2	1	4	3	2	1
B —	5	5	6	5	6	7	5	6	7	8

Total cloudiness always 5/10 or less.

(2) BROKEN, LOWER SCATTERED CLOUDS, or HIGH BROKEN, LOWER SCATTERED CLOUDS. (Ceiling is at the "U" cloud level. Height of "L" clouds reported as under (1) above.)

U —	8	7	7	6	6	6	5	5	5	5	4	4	4	4	3	3	3	2	2	1
L —	1	2	1	3	2	1	4	3	2	1	5	4	3	2	5	4	3	5	4	5
B —	1	1	2	1	2	3	1	2	3	4	1	2	3	4	2	3	4	3	4	4

Total cloudiness is always 6/10, 7/10, 8/10, or 9/10.

(3) SCATTERED, LOWER BROKEN CLOUDS, or HIGH SCATTERED, LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	3	2	2	1	1	1
L —	6	7	6	8	7	6
B —	1	1	2	1	2	3

Total cloudiness is always 7/10, 8/10, or 9/10. (See note below.)

(4) BROKEN, LOWER BROKEN CLOUDS, or HIGH BROKEN LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	3	2	2	1	1	1
L —	6	7	6	8	7	6
B —	1	1	2	1	2	3

Total cloudiness is always 7/10, 8/10, or 9/10.

(5) OVERCAST, LOWER SCATTERED CLOUDS, or HIGH OVERCAST, LOWER SCATTERED CLOUDS. (Ceiling is at the "U" cloud level. Height of "L" clouds reported as under (1) above.)

U —	9	8	7	6	5
L —	1	2	3	4	5
B —	0	0	0	0	0

Total cloudiness always 10/10.

(6) OVERCAST, LOWER BROKEN CLOUDS, or HIGH OVERCAST, LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	4	3	2	1
L —	6	7	8	9
B —	0	0	0	0

Total cloudiness always 10/10.

NOTE.—It should be noted that this grouping of cloud-layer amounts may also be termed BROKEN, LOWER BROKEN CLOUDS or HIGH BROKEN, LOWER BROKEN CLOUDS, and should usually be so termed unless the observer is quite sure that the upper layer of clouds is of very limited extent. A series of frequent observations will often show the extent of the upper cloud layer as the layer of lower broken clouds passes across it.

(*j*) *Use of special modifying terms.*—Any of the foregoing terms may be modified by the insertion of the words "thin" or "dark," where appropriate. It is proper to use the term "thin" in describing the cloudiness whenever the solar or lunar disk or stars are faintly visible through them, and the term "dark" whenever the clouds are of an unusually dark or ugly, threatening appearance. These terms will be inserted following the altitude term, if any, and immediately preceding the cloudiness term proper. For example, "high thin overcast," "high overcast, lower thin broken clouds," "dark overcast," etc. If the clouds are noted to have an unusually rapid motion, or to be in a highly turbulent condition, proper entry of this fact should be made under "Remarks." For example, "clouds moving rapidly," "clouds turbulent," etc.

(*k*) ~~*Omission of sky condition.*—When dense or thick obstructions to vision or heavy precipitation, or combinations of these, are present and reduce the ceiling to zero and/or the visibility to *less* than ¼ mile, thus making the sky condition unobservable, no term will be employed in the report to represent the sky condition; that is, it will be omitted.~~ Cancelled 9-1-45.

TABLE 1.—*Sky classifications*

(1) SCATTERED; LOWER SCATTERED CLOUDS, or HIGH SCATTERED, LOWER SCATTERED CLOUDS. (Ceiling always UNLIMITED. Altitude of "L" clouds entered on WB Form 1130 as directed in paragraph 2–134 (*f*).

U —	4	3	3	2	2	2	1	1	1	1	Total cloudiness always 5/10 or less.
L —	1	2	1	3	2	1	4	3	2	1	
B —	5	5	6	5	6	7	5	6	7	8	

(2) BROKEN, LOWER SCATTERED CLOUDS, or HIGH BROKEN, LOWER SCATTERED CLOUDS. (Ceiling is at the "U" cloud level. Height of "L" clouds reported as under (1) above.)

																						Total cloudiness is always 6/10, 7/10, 8/10, or 9/10.
U —	8	7	7	6	6	6	5	5	5	5	4	4	4	4	3	3	3	2	2	1		
L —	1	2	1	3	2	1	4	3	2	1	5	4	3	2	5	4	3	5	4	5		
B —	1	1	2	1	2	3	1	2	3	4	1	2	3	4	2	3	4	3	4	4		

(3) SCATTERED, LOWER BROKEN CLOUDS, or HIGH SCATTERED, LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	3	2	2	1	1	1	Total cloudiness is always 7/10, 8/10, or 9/10. (See note below.)
L —	6	7	6	8	7	6	
B —	1	1	2	1	2	3	

(4) BROKEN, LOWER BROKEN CLOUDS, or HIGH BROKEN LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	3	2	2	1	1	1	Total cloudiness is always 7/10, 8/10, or 9/10.
L —	6	7	6	8	7	6	
B —	1	1	2	1	2	3	

(5) OVERCAST, LOWER SCATTERED CLOUDS, or HIGH OVERCAST, LOWER SCATTERED CLOUDS. (Ceiling is at the "U" cloud level. Height of "L" clouds reported as under (1) above.)

U —	9	8	7	6	5	Total cloudiness always 10/10.
L —	1	2	3	4	5	
B —	0	0	0	0	0	

(6) OVERCAST, LOWER BROKEN CLOUDS, or HIGH OVERCAST, LOWER BROKEN CLOUDS. (Ceiling is at the "L" cloud level.)

U —	4	3	2	1	Total cloudiness always 10/10.
L —	6	7	8	9	
B —	0	0	0	0	

NOTE.—It should be noted that this grouping of cloud-layer amounts may also be termed BROKEN, LOWER BROKEN CLOUDS or HIGH BROKEN, LOWER BROKEN CLOUDS, and should usually be so termed unless the observer is quite sure that the upper layer of clouds is of very limited extent. A series of frequent observations will often show the extent of the upper cloud layer as the layer of lower broken clouds passes across it.

(*j*) *Use of special modifying terms.*—Any of the foregoing terms may be modified by the insertion of the words "thin" or "dark," where appropriate. It is proper to use the term "thin" in describing the cloudiness whenever the solar or lunar disk or stars are faintly visible through them, and the term "dark" whenever the clouds are of an unusually dark or ugly, threatening appearance. These terms will be inserted following the altitude term, if any, and immediately preceding the cloudiness term proper. For example, "high thin overcast," "high overcast, lower thin broken clouds," "dark overcast," etc. If the clouds are noted to have an unusually rapid motion, or to be in a highly turbulent condition, proper entry of this fact should be made under "Remarks." For example, "clouds moving rapidly," "clouds turbulent," etc.

(*k*) *Omission of sky condition.*—When dense or thick obstructions to vision or heavy precipitation, or combinations of these, are present and reduce the ceiling to zero and/or the visibility to *less* than ⅛ mile, thus making the sky condition unobservable, no term will be employed in the report to represent the sky condition; that is, it will be omitted.

XV (D)—VISIBILITY

2–138. Definition of Visibility.—It is quite obvious that it is extremely important to a pilot to know how far he will be able to see during take-off, during the flight, and in landing at his terminal, since upon this, chiefly, will depend his ability to determine landmarks ahead and below, to see obstacles in time to avoid them, etc. To provide this information, the element known as "visibility" is included in airway weather reports. In the meaning of these instructions, the "VISIBILITY" IS THE MEAN GREATEST DISTANCE TOWARD THE HORIZON THAT PROMINENT OBJECTS, SUCH AS MOUNTAINS, BUILDINGS, TOWERS, ETC., CAN BE SEEN AND IDENTIFIED BY THE NORMAL EYE UNAIDED BY SPECIAL OPTICAL DEVICES, SUCH AS BINOCULARS, TELESCOPES, GLARE-ELIMINATING GOGGLES, ETC., AND WHICH DISTANCE MUST PREVAIL OVER A RANGE OF MORE THAN HALF OF THE HORIZON. The above is postulated on the basis that if the eyes of the observer are deficient in any respect this will be corrected by proper eyeglasses.

2–139. Table of Visibility Checking Points.—In accordance with the foregoing, each station will have on public display a table of various prominent objects, observable from the usual observation point, which will be used to determine the visibility values. This table should include objects suitable for determining the visibility at night as well as by day.

(*a*) *Objects for determining visibility at night.*—The most suitable objects for determining visibility at night are moderate lights at known distances, the silhouettes of mountains or hills against the sky, etc. The brilliancy with which stars near the horizon can be observed may also be useful in this connection. The use of airway beacons as visibility checking points is not favored, as these have great penetrating power and often give values in excess of those actually existing. However, the "course light" (red or green) of such beacons, or any unfocussed light, may be used.

(*b*) *Objects for determining visibility during daylight.*—For accurate determinations during daylight hours it is advisable to confine the choice of marks to black, or nearly black, objects against the horizon sky, rejecting light-colored marks and those appearing against terrestrial backgrounds.

2–140. Reporting of Daylight Visibility as Compared with Night Visibility.—The observer should always keep in mind that the absence of daylight does not materially affect the visibility, as such, this being actually a measure of the transparency of the atmosphere. Thus, any considerable daily rise and fall of the values of visibility given for hours of daylight and darkness should be avoided. However, diurnal changes of wind and atmospheric stability may cause some variation in the visibility between hours of daylight and darkness. It is preferable to determine visibility along a line nearly at right angles to the line of sight from the observer toward the sun or bright moon.

2–141. Estimating Visibility From Appearances of Objects at Short Distances.—In making estimates of the visibility in cases where the farthest object is only a comparatively short distance from the observer it will be helpful, in the interest of accurate reports, if the observer notes the sharpness with which the checking points stand out. When objects at some distance stand out sharply with little blurring of color, this indicates fairly well that the air is free of haze and the visibility quite high. On the other hand, if objects are blurred or indistinct and seem to have a gray or purplish hue, this would indicate the presence of haze, or other obstructions, with a consequent reduced visibility. Practice and careful observation will enable the observer to become quite proficient in making such estimates of visibility.

2–142. Instructions for Observing and Reporting Visibility.—Specific Instructions for observing and reporting visibility follow:

(*a*) *Point of observations.*—All observations will be taken from a point where a view of the entire horizon may be had; or, if this is not practicable, the observer will move about in such manner as to obtain a view of the horizon in all directions. This observation point should be on the ground, if at all practicable; otherwise, at the lowest point above the surface at which a satisfactory observation can be made.

XV (D)—VISIBILITY

2–138. Definition of Visibility.—It is quite obvious that it is extremely important to a pilot to know how far he will be able to see during take-off, during the flight, and in landing at his terminal, since upon this, chiefly, will depend his ability to determine landmarks ahead and below, to see obstacles in time to avoid them, etc. To provide this information, the element known as "visibility" is included in airway weather reports. In the meaning of these instructions, the "VISIBILITY" IS THE MEAN GREATEST DISTANCE TOWARD THE HORIZON THAT PROMINENT OBJECTS, SUCH AS MOUNTAINS, BUILDINGS, TOWERS, ETC., CAN BE SEEN AND IDENTIFIED BY THE NORMAL EYE UNAIDED BY SPECIAL OPTICAL DEVICES, SUCH AS BINOCULARS, TELESCOPES, GLARE-ELIMINATING GOGGLES, ETC., AND WHICH DISTANCE MUST PREVAIL OVER A RANGE OF MORE THAN HALF OF THE HORIZON. The above is postulated on the basis that if the eyes of the observer are deficient in any respect this will be corrected by proper eyeglasses.

2–139. Table of Visibility Checking Points.—In accordance with the foregoing, each station will have on public display a table of various prominent objects, observable from the usual observation point, which will be used to determine the visibility values. This table should include objects suitable for determining the visibility at night as well as by day.

(*a*) *Objects for determining visibility at night.*—The most suitable objects for determining visibility at night are moderate lights at known distances, the silhouettes of mountains or hills against the sky, etc. The brilliancy with which stars near the horizon can be observed may also be useful in this connection. The use of airway beacons as visibility checking points is not favored, as these have great penetrating power and often give values in excess of those actually existing. However, the "course light" (red or green) of such beacons, or any unfocussed light, may be used.

(*b*) *Objects for determining visibility during daylight.*—For accurate determinations during daylight hours it is advisable to confine the choice of marks to black, or nearly black, objects against the horizon sky, rejecting light-colored marks and those appearing against terrestrial backgrounds.

2–140. Reporting of Daylight Visibility as Compared with Night Visibility.—The observer should always keep in mind that the absence of daylight does not materially affect the visibility, as such, this being actually a measure of the transparency of the atmosphere. Thus, any considerable daily rise and fall of the values of visibility given for hours of daylight and darkness should be avoided. However, diurnal changes of wind and atmospheric stability may cause some variation in the visibility between hours of daylight and darkness. It is preferable to determine visibility along a line nearly at right angles to the line of sight from the observer toward the sun or bright moon.

2–141. Estimating Visibility From Appearances of Objects at Short Distances.—In making estimates of the visibility in cases where the farthest object is only a comparatively short distance from the observer it will be helpful, in the interest of accurate reports, if the observer notes the sharpness with which the checking points stand out. When objects at some distance stand out sharply with little blurring of color, this indicates fairly well that the air is free of haze and the visibility quite high. On the other hand, if objects are blurred or indistinct and seem to have a gray or purplish hue, this would indicate the presence of haze, or other obstructions, with a consequent reduced visibility. Practice and careful observation will enable the observer to become quite proficient in making such estimates of visibility.

2–142. Instructions for Observing and Reporting Visibility.—Specific Instructions for observing and reporting visibility follow:

(*a*) *Point of observations.*—All observations will be taken from a point where a view of the entire horizon may be had; or, if this is not practicable, the observer will move about in such manner as to obtain a view of the horizon in all directions. This observation point should be on the ground, if at all practicable; otherwise, at the lowest point above the surface at which a satisfactory observation can be made.

XV (D)—VISIBILITY

2-138. Explanation and Definition of Visibility.—It is quite obvious that it is extremely important to a pilot to know how far he will be able to see during take-off, during flight, and in landing at his terminal, since upon this chiefly will depend his ability to determine landmarks ahead and below, to see obstacles in time to avoid them, etc. To provide this information, the element known as "visibility" is included in airway weather reports.

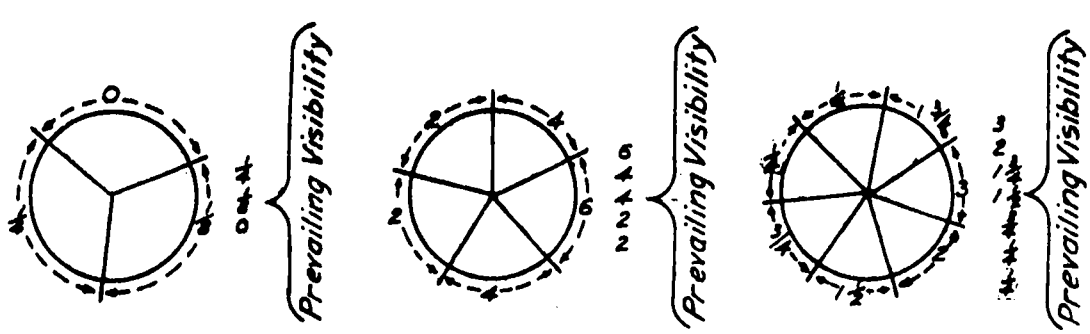
(a) Visibility in a definite direction.—Visibility (visual range) IN A DEFINITE DIRECTION is the MAXIMUM DISTANCE to which prominent suitable objects like trees, houses, etc., located in that direction and viewed against the horizon sky, are visible to an observer of normal eyesight[1] under existing conditions of atmosphere, light, etc. For an object to be regarded as visible, it must be recognized by the observer, who has previous knowledge of its character from having seen it on occasions when the atmosphere was clear.

(b) Prevailing visibility under uniform conditions.—When the visibility is the same in all directions, the prevailing visibility, to be represented by a single value in the body of the report, will obviously be the greatest visual range common to all directions.

(c) Prevailing visibility under non-uniform conditions.—When the visual range is not uniform in all directions a single value to represent the prevailing visibility for the station is also required for the body of the report. Under these circumstances, the prevailing visibility will be the *greatest* value of visual range which satisfies the condition THAT VISUAL RANGES EQUAL TO OR GREATER THAN THAT VALUE EXIST OVER AT LEAST HALF[2] OF THE HORIZON. [See examples in *(e)* and *(f)*]

(d) One procedure for determining prevailing visibility.—One practical procedure for arriving at the required result under non-uniform conditions is the following: Divide the circle of the horizon into a suitable odd number (such as 3, 5, 7, 9, etc.) of equal sectors. The more irregular the visual range around the horizon, the greater the number of sectors required. The sectors should be chosen so that the visual range for each entire sector is quite uniform, and capable of being represented by a single value. Determine the visual range for each sector. Write down or retain in mind the values of the visual ranges for the various sectors. Arrange the data in order of increasing numerical value [see examples in *(e)* following]. Take the value that lies in the middle of the series. This will be the prevailing visibility.

(e) Examples of procedure outlined under (d) above (the visual range for each sector of the horizon in the illustrations is assumed to be uniform and is indicated by the value between arrows):



[1]Binoculars, field glasses, etc., are not to be used in determining visibility. Eyeglasses to bring the observer's vision to normal are permitted. Observers will be tested by field liaison officials to assure that their visual acuity is satisfactory.

[2]Half of the horizon need not necessarily consist of 180 consecutive degrees but may consist of sectors distributed anywhere over the horizon providing they total 180° [see examples in *(e)* and *(f)*].

(*b*) *Visibility values to be reported.*—After viewing the horizon in all directions, if it is decided that the mean visibility is 10 miles or more (the "mean visibility" is the greatest average visibility prevailing over more than half of the horizon), a value will not be entered on retained WB Form 1130, and no value will be included in the report as transmitted. If, however, the prevailing visibility is adjudged to be less than 10 miles, it will be reported to the nearest whole mile and/or fraction of miles, as follows: 0, ⅛, ⅕, ¼, ½, ¾, 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 3, 4, 5, 6, 7, 8, 9, except that if the visibility exceeds 9½ miles, but is less than 10 miles, it will be reported as 9 miles. If the visibility falls half way between two of the above values, the lower will be used.

(*c*) *Reporting greater or less than the average visibility in specified directions.*—If the visibility toward any one-quarter of the horizon is twice or more, or half or less of the average visibility prevailing toward the other quarters, a remark to indicate this will be made, giving the direction from the station, and, if necessary to completely explain the condition, the cause thereof. Also, if the visibility "down wind" is less than the prevailing visibility when the latter is 3 miles or less. a remark to indicate this will always be made.

(*d*) *Reporting estimated visibility.*—If the actual visibility is evidently much greater than the distance of the farthest visible object, and such object is less than 10 miles distant from the observer, an estimate of the value will be made, based on the transparency of the atmosphere between the observer and the object. If, then, the estimated value is 10 miles or more. no value for the visibility will be included in the report; but if less than 10 miles, it will be reported to the nearest whole mile and/or fraction thereof. The letter "E" or the word "estimated" will *not* be used in the transmitted reports to show that the value is estimated.

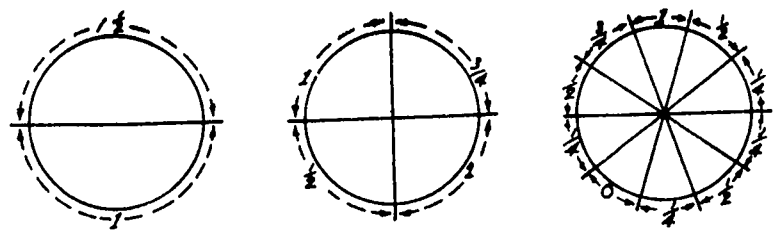
(*e*) *Reporting fluctuating visibility.*—If the visibility is **2** miles or less and is changing or fluctuating rapidly by not more than **1/4** mile to either side of the prevailing visibility at the time of observation, this shall be reported by the word "variable" in telegraphed or telephoned reports and by the letter "V" in reports sent by teletype or radio, immediately following the visibility value. For example, "——2 variable——" or "——2V——" would indicate that the visibility is 2 miles and fluctuating within the range of 1¾ to 2¼ miles, inclusive; "——0 variable——" or "——0V——" would indicate that the visibility is zero and fluctuating within the range of 0 to ¼ mile, inclusive; etc. Rapid fluctuation of visibility will be reported under "Remarks" when the range of fluctuation is greater than ¼ mile to either side of the prevailing visibility and also when a fluctuating visibility is to be reported in connection with a prevailing visibility greater than 2 miles. Reports of fluctuating or variable visibilities in "Remarks" should include the range of variability.

2–143. Importance of Accurate Observations of Visibility.—In view of the importance of accurate information concerning visibility to the safety of flying, it is again impressed upon the observer that his observations of this element should be made with extreme care, particularly when the visibility is 2 miles or less.

XV (E)—WEATHER

2–144. Definition and Importance of "Weather."—In the meaning of these instructions, THE "WEATHER" ELEMENT OF AN AIRWAY OBSERVATION CONSISTS OF THOSE PHENOMENA OCCURRING IN CONNECTION WITH ACTIVE OR IMMINENT PRECIPITATION, OR METEOROLOGICAL DISTURBANCES OF MORE OR LESS LOCALIZED EXTENT AND EFFECT. Therefore, the reporting of this element will include the occurrence of all rain, snow, sleet, hail, freezing rain, etc., and all thunderstorms, squalls, tornadoes, etc., observed at or from a particular station. Reports of the occurrence of the phenomena treated in this section are of importance to the pilot in order that he may be prepared for the lowering of visibility, accumulations of ice, rough air, etc., which may result. Observations of these phenomena are made visually without the aid of instruments, except where wind velocities are involved as a measure of intensity of the phenomenon in question, in which cases an anemometer is sometimes used.

(f) Examples of determining the prevailing visibility by dividing the horizon into an even number of sectors (a uniform visual range for each sector is assumed):



Prevailing Visibility 1½ mi. Prevailing Visibility 1 mi. Prevailing Visibility ½ mi.

2-139. Table of Visibility Checking Points.—In accordance with the foregoing, each station will have on public display a table of various prominent objects, observable from the usual observation point, which will be used to determine the visibility values. This table should include objects suitable for determining the visibility at night as well as by day.

(a) Objects for determining visibility at night.—The most suitable objects for determining visibility at night are moderate lights at known distances, the silhouettes of mountains or hills against the sky, etc. The brilliancy with which stars near the horizon can be observed may also be useful in this connection. The use of airway beacons as visibility checking points is not favored, as these have great penetrating power and often give values in excess of those actually existing. However, the "course light" (red or green) of such beacons, or any unfocused light, may be used.

(b) Objects for determining visibility during daylight.—For accurate determinations during daylight hours it is advisable to confine the choice of marks to black, or nearly black, objects against the horizon sky, rejecting light-colored marks and those appearing against terrestrial backgrounds.

2-140. Reporting of Daylight Visibility as Compared with Night Visibility.—The observer should always keep in mind that the absence of daylight does not materially affect the visibility, as such, this being actually a measure of the transparency of the atmosphere. Thus, any considerable daily rise and fall of the values of visibility given for hours of daylight and darkness should be avoided. However, diurnal changes of wind and atmospheric stability may cause some variation in the visibility between hours of daylight and darkness. It is preferable to determine visibility along a line nearly at right angles to the line of sight from the observer toward the sun or bright moon.

2-141. Estimating Visibility From Appearances of Objects at Short Distances.—In making estimates of the visibility in cases where the farthest object is only a comparatively short distance from the observer it will be helpful, in the interest of accurate reports, if the observer notes the sharpness with which the checking points stand out. When objects at some distance stand out sharply with little blurring of color, this indicates fairly well that the air is free of haze and the visibility quite high. On the other hand, if objects are blurred or indistinct and seem to have a gray or purplish hue, this would indicate the presence of haze, or other obstructions, with a consequent reduced visibility. Practice and careful observation will enable the observer to become quite proficient in making such estimates of visibility.

2-142. Instructions for Observing and Reporting Visibility.—Specific Instructions for observing and reporting visibility follow:

(a) Point of observations.—All observations will be taken from a point where a view of the entire horizon may be had; or, if this is not practicable, the observer will move about in such manner as to obtain a view of the horizon in all directions. This observation point should be on the ground, if at all practicable; otherwise, at the lowest point above the surface at which a satisfactory observation can be made.

(b) Visibility values to be reported.—After viewing the horizon in all directions, if it is decided that the prevailing visibility is 10 miles or more, a value will not be entered on retained WB Form 1130 nor included in the report as transmitted. If, however, the prevailing visibility is adjudged to be less than 10 miles, it will be reported to the nearest whole mile and/or fraction of miles, as follows:

0, 1/8, 1/5, 1/4, 1/2, 3/4, 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 3, 4, 5, 6, 7, 8, 9,

except that if the visibility exceeds 9¼ miles but is less than 10 miles, it will be reported as 9 miles. If the visibility falls half way between two of the above values, the lower will be used.

(c) Reporting greater or less than prevailing visibility in specified directions.—1. If the prevailing visibility is **3 miles or more** and the visibility toward one or two quarters (quadrants) of the horizon is twice or more, or half or less of the prevailing visibility, a remark to indicate this will be made giving the direction(s) from the station, and if necessary to completely explain the conditions, the cause thereof.

2. If the prevailing visibility is **less than 3 miles** and the visibility toward any one-quarter of the horizon is DIFFERENT from this prevailing visibility, a remark giving the visibility in EACH of the four cardinal directions or EACH of the four intermediate directions (NE, SE, SW, NW) will be included in the report. For example, assuming the visibility by quadrants to be 2 miles north, 1½ miles east, 3/4 miles south and 1½ miles west, the prevailing visibility would be 1½ miles and the following remark would be added to the report: "VSBY N2E1½S¾W1½". If the differing visibility can best be indicated in the "visibility by directions" group by use of the four intermediate directions, NE, SE, SW, and NW, these will be used and in such cases the cardinal directions will be omitted; for example, "VSBY NE3SE2½SW2NW2", etc.

(d) Reporting estimated visibility.—If the actual visibility is evidently much greater than the distance of the farthest visible object, and such object is less than 10 miles distant from the observer, an estimate of the value will be made, based on the transparency of the atmosphere between the observer and the object. If, then, the estimated value is 10 miles or more, no value for the visibility will be included in the report; but if less than 10 miles, it will be reported to the nearest whole mile and/or fraction thereof. The letter "E" or the word "estimated" will *not* be used in the transmitted reports to show that the value is estimated.

(e) Reporting fluctuating visibility.—1. If the prevailing visibility is 2 miles or less and is changing or fluctuating *rapidly*, this will be indicated in reports sent by teletype or radio by entry of the letter "V" immediately following the visibility value *and* by giving the range of variability in "Remarks" in each case. For example, if the prevailing visibility is 1½ miles but fluctuating rapidly between 1 and 2 miles, "1½V" would be given in the visibility position of the report and "VSBY VRBL 1 TO 2" would be added as a remark. Stations reporting by telephone or telegraph will indicate a variable visibility by use of the word "variable" following the visibility value *and* by giving the range of variability in "Remarks".

2-142. Instructions for Observing and Reporting Visibility.—Specific Instructions for observing and reporting visibility follow:

(a) Point of observations.—All observations will be taken from a point where a view of the entire horizon may be had; or, if this is not practicable, the observer will move about in such manner as to obtain a view of the horizon in all directions. This observation point should be on the ground, if at all practicable; otherwise, at the lowest point above the surface at which a satisfactory observation can be made.

(b) Visibility values to be reported.—After viewing the horizon in all directions, if it is decided that the prevailing visibility is 10 miles or more, a value will not be entered on retained WB Form 1130 nor included in the report as transmitted. If, however, the prevailing visibility is adjudged to be less than 10 miles, it will be reported to the nearest whole mile and/or fraction of miles, as follows:

0, 1/16, 1/8, 3/16, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 1, 1¼, 1½, 1¾, 2, 2¼, 2½, 3, 4, 5, 6, 7, 8, 9,

except that if the visibility exceeds 9½ miles but is less than 10 miles, it will be reported as 9 miles. If the visibility falls half way between two of the above values, the lower will be used.

(c) Reporting greater or less than prevailing visibility in specified directions.—1. If the prevailing visibility is 3 miles or more and the visibility toward one or two quarters (quadrants) of the horizon is twice or more, or half or less of the prevailing visibility, a remark to indicate this will be made giving the direction(s) from the station, and if necessary to completely explain the conditions, the cause thereof.

2. If the prevailing visibility is less than 3 miles and the visibility toward any one-quarter of the horizon is DIFFERENT from this prevailing visibility, a remark giving the visibility in EACH of the four cardinal directions or EACH of the four intermediate directions (NE, SE, SW, NW) will be included in the report. For example, assuming the visibility by quadrants to be 2 miles north, 1½ miles east, 3/4 miles south and 1½ miles west, the prevailing visibility would be 1½ miles and the following remark would be added to the report: "VSBY N2E1½S¾W1½". If the differing visibility can best be indicated in the "visibility by directions" group by use of the four intermediate directions, NE, SE, SW, and NW, these will be used and in such cases the cardinal directions will be omitted; for example, "VSBY NE3SE2½SW2NW2", etc.

(d) Reporting estimated visibility.—If the actual visibility is evidently much greater than the distance of the farthest visible object, and such object is less than 10 miles distant from the observer, an estimate of the value will be made, based on the transparency of the atmosphere between the observer and the object. If, then, the estimated value is 10 miles or more, no value for the visibility will be included in the report; but if less than 10 miles, it will be reported to the nearest whole mile and/or fraction thereof. The letter "E" or the word "estimated" will *not* be used in the transmitted reports to show that the value is estimated.

(e) Reporting fluctuating visibility.—1. If the prevailing visibility is 2 miles or less and is changing or fluctuating *rapidly*, this will be indicated in reports sent by teletype or radio by entry of the letter "V" immediately following the visibility value *and* by giving the range of variability in "Remarks" in each case. For example, if the prevailing visibility is 1½ miles but fluctuating rapidly between 1 and 2 miles, "1½V" would be given in the visibility position of the report and "VSBY VRBL 1 TO 2" would be added as a remark. Stations reporting by telephone or telegraph will indicate a variable visibility by use of the word "variable" following the visibility value *and* by giving the range of variability in "Remarks".

2-142. INSTRUCTIONS FOR OBSERVING AND REPORTING VISIBILITY.—Specific Instructions for observing and reporting visibility follow:

*(a) Point of observations.—All observations will be taken from a point where a view of the entire horizon may be had; or, if this is not practicable, the observer will move about in such manner as to obtain a view of the horizon in all directions. This observation point should be on the ground, if at all practicable; otherwise, at the lowest point above the surface at which a satisfactory observation can be made.

(b) Visibility values to be reported.—After viewing the horizon in all directions, if it is decided that the prevailing visibility is 10 miles or more, a value will not be entered on retained WB Form 1130 nor included in the report as transmitted. If, however, the prevailing visibility is adjudged to be less than 10 miles, it will be reported to the nearest whole mile and/or fraction of miles, as follows:

0, 1/16, 1/8, 3/16, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/4, 2-1/2, 3, 4, 5, 6, 7, 8, 9, except that if the visibility exceeds 9-1/2 miles but is less than 10 miles, it will be reported as 9 miles. If the visibility falls half way between two of the above values, the lower will be used.

Exception. Alaskan stations will report visibility to the nearest of the following values: 0, 1/16, 1/8, 3/16, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/4, 2 1/2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 20, 25, 30, 35, 40, 45, 50, etc. If the visibility is adjudged to be half-way between two of the above values, the lower will be used.

(c) Reporting greater or less than prevailing visibility in specified directions.—1. If the prevailing visibility is 3 miles or more and the visibility toward one or two quarters (quadrants) of the horizon is twice or more, or half or less of the prevailing visibility, a remark to indicate this will be made giving the direction(s) from the station, and if necessary to completely explain the conditions, the cause thereof.

2. If the prevailing visibility is less than 3 miles and the visibility toward any one-quarter of the horizon is DIFFERENT from this prevailing visibility, a remark giving the visibility in EACH of the four cardinal directions or EACH of the four intermediate directions (NE, SE, SW, NW) will be included in the report. For example, assuming the visibility by quadrants to be 2 miles north, 1 1/2 miles east, 3/4 miles south and 1 1/2 miles west, the prevailing visibility would be 1 1/2 miles and the following remark would be added to the report: "VSBY N2E1 1/2S3/4W1 1/2". If the differing visibility can best be indicated in the "visibility by directions" group by use of the four intermediate directions, NE, SE, SW, and NW, these will be used and in such cases the cardinal directions will be omitted; for example, "VSBY NE3SE2 1/4SW2NW2", etc.

(d) Reporting estimated visibility.—If the actual visibility is evidently much greater than the distance of the farthest visible object, and such object is less than 10 miles distant from the observer, an estimate of the value will be made, based on the transparency of the atmosphere between the observer and the object. If, then, the estimated value is 10 miles or more, no value for the visibility will be included in the report; but if less than 10 miles, it will be reported to the nearest whole mile and/or fraction thereof. The letter "E" or the word "estimated" will not be used in the transmitted reports to show that the value is estimated.

Exception. Reporting estimated visibility in Alaska. If the actual visibility is evidently much greater than the distance to the farthest visible object, and such object is less than 15 miles distant from the observer, an estimate of the value will be made, based on the transparency of the atmosphere between the observer and the object. If, then, the estimated value is greater than 15 miles, it will be reported "fifteen miles plus" (15+); and if 15 miles or less, it will be reported in whole miles. The letter "E" or the word "Estimated" will not be used in the transmitted report to show that the value is estimated. If the farthest visible object

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*The provisions of this paragraph are modified at those stations participating in the Control Tower visibility program.

2-142. Instructions for Reporting Visibility.--All visibility observations will be reported on the basis of a view of the entire horizon.

(a) Visibility values to be reported.--Stations will report prevailing visibility to the nearest of the following values:

Fractional Intervals		One-Mile Intervals
0	1	3 to 15
1/16	1 1/4	
1/8	1 1/2	
3/16	1 3/4	
1/4	2	
5/16	2 1/4	
3/8	2 1/2	Five-Mile Intervals
1/2		
5/8		
3/4		More than 15

If the visibility is halfway between two consecutive values, the lower value will be reported.

(b) Methods of reporting that visibility in specified direction is greater or less than the prevailing visibility.--The above specified visibility values will also be used for determining and reporting conditions of differing visibility as follows:

1. When the prevailing visibility is 3 miles or more, but the visibility in any direction is twice as much or more, or half as much or less, the observer will report this differing visibility and its direction in a remark, including if necessary the cause of the condition.

2. When the prevailing visibility is less than 3 miles and the visibility in any quadrant differs from the prevailing value, the observer will report in a remark the visibility in each of the four quadrants. The four quadrants reported will be N, E, S, W, or NE, SE, SW, NW, whichever system is best suited to the conditions present. The four directions will be reported clockwise, beginning with N or NE as the case may be. The term "QUAD" or "QUADS" will not be necessary.

3. In remarks prepared according to either "1" or "2" above, the introductory term "VSBY" is required, and the figures representing the visibility will follow the direction symbols to which they apply.

(c) Reporting of estimated visibility.--Estimated visibility will be reported whenever the farthest visible object is less than 15 miles distant from the observer and the actual visibility is obviously much greater than the distance to this object. The estimate will be based on the transparency of the atmosphere between the observer and the object, but the letter "E" or the word "Estimated" will not be entered or transmitted in the report. Estimated values of 15 miles or less will be reported in whole miles. Estimated values in excess of 15 miles will be reported as "15+." Estimated visibilities will not be reported when the farthest visible object is more than 15 miles distant. Instead, the distance of this object expressed to the nearest five miles will be given as the visibility, even though the actual visibility is known to be greater than this distance. Under these circumstances the plus sign will not be used.

(d) Methods of reporting fluctuating visibility.--Whenever the visibility is changing slowly enough to permit the reporting of each significant change by a special observation, the rules governing visibility specials will be strictly adhered to. If, however, the prevailing visibility is varying or fluctuating more rapidly than can practicably be reported otherwise, the following procedures will be used:

1. When the prevailing visibility is less than 2 miles, enter a "V" following the visibility value, and give the range of variability in a remark beginning "VSBY VRBL."

2. When the prevailing visibility is 2 miles or more, omit the "V" following the visibility value, but include the "VSBY VRBL" remark giving the range of variability.

2. When the prevailing visibility is more than 2 miles and is fluctuating rapidly, this will be indicated by giving the range of variability in "Remarks" and omitting the "V" following the visibility value.

3. When the visibility is changing slowly enough so that time will permit each change to be reported by a special observation, the individual changes will be covered by "Specials" whenever the rules governing special observations given in Chapter V, Page 15, require the filing of a "Special".

2-143. Importance of Accurate Observations of Visibility.—In view of the importance of accurate information concerning visibility to the safety of flying, it is again impressed upon the observer that his observations of this element should be made with extreme care, particularly when the visibility is 3 miles or less.

XV (E)—WEATHER

2-144. Definition and Importance of "Weather."—In the meaning of these instructions, THE "WEATHER" ELEMENT OF AN AIRWAY OBSERVATION CONSISTS OF THOSE PHENOMENA OCCURRING IN CONNECTION WITH ACTIVE OR IMMINENT PRECIPITATION OR METEOROLOGICAL DISTURBANCES OF MORE OR LESS LOCALIZED EXTENT AND EFFECT. Therefore, the reporting of this element will include the occurrence of all rain, snow, sleet, hail, freezing rain, etc., and all thunderstorms, squalls, tornadoes, etc., observed at or from a particular station. Reports of the occurrence of the phenomena treated in this section are of importance to the pilot in order that he may be prepared for the lowering of visibility, accumulations of ice, rough air, etc., which may result. Observations of these phenomena are made visually without the aid of instruments, except where wind velocities are involved as a measure of intensity of the phenomenon in question, in which cases an anemometer is sometimes used.

is more than 15 miles distant, its distance to the nearest five miles without the plus sign will be given as the visibility, even though it is known that the visibility is greater than this distance.

(e) Reporting fluctuating visibility.—1. If the prevailing visibility is 2 miles or less and is changing or fluctuating rapidly, this will be indicated in reports sent by teletype or radio by entry of the letter "V" immediately following the visibility value and by giving the range of variability in "Remarks" in each case. For example, if the prevailing visibility is 1 1/2 miles but fluctuating rapidly between 1 and 2 miles, "11/2V" would be given in the visibility position of the report and "VSBY VRBL 1 to 2" would be added as a remark. Stations reporting by telephone or telegraph will indicate a variable visibility by use of the word "variable" following the visibility value and by giving the range of variability in "Remarks".

2. When the prevailing visibility is more than 2 miles and is fluctuating rapidly, this will be indicated by giving the range of variability in "Remarks" and omitting the "V" following the visibility value.

3. When the visibility is changing slowly enough so that time will permit each change to be reported by a special observation, the individual changes will be covered by "Specials" whenever the rules governing special observations given in Chapter V, Page 15, require the filing of a "Special".

2-143. IMPORTANCE OF ACCURATE OBSERVATIONS OF VISIBILITY.—In view of the importance of accurate information concerning visibility to the safety of flying, it is again impressed upon the observer that his observations of this element should be made with extreme care, particularly when the visibility is 3 miles or less.

XV (E)—WEATHER

2-144. DEFINITION AND IMPORTANCE OF "WEATHER".—In the meaning of these instructions, THE "WEATHER" ELEMENT OF AN AIRWAY OBSERVATION CONSISTS OF THOSE PHENOMENA OCCURRING IN CONNECTION WITH ACTIVE OR IMMINENT PRECIPITATION OR METEOROLOGICAL DISTURBANCES OF MORE OR LESS LOCALIZED EXTENT AND EFFECT. Therefore, the reporting of this element will include the occurrence of all rain, snow, sleet, hail, freezing rain, etc., and all thunderstorms, squalls, tornadoes, etc., observed at or from a particular station. Reports of the occurrence of the phenomena treated in this section are of importance to the pilot in order that he may be prepared for the lowering of visibility, accumulations of ice, rough air, etc., which may result. Observations of these phenomena are made visually without the aid of instruments, except where wind velocities are involved as a measure of intensity of the phenomenon in question, in which cases an anemometer is used.

2-143. Importance of Accuracy in Visibility Observations.--Observers will keep in mind the importance of accurate visibility information to the safety of flying. Observations must be made and reported with extreme care, particularly when the visibility is 3 miles or less, or near the operating minimums of scheduled aircraft. Even though no aircraft may be operating in an observer's vicinity, a flight plan may be prepared at some distant point on the basis of his reports. In the long run, also, the reliability of forecasts is affected by the reliability of observations.

XV (E)—WEATHER

2-144. Definition and Importance of "Weather."--In the meaning of these instructions, the "weather" element of an airway observation consists of those phenomena occurring in connection with active or imminent precipitation or meteorological disturbances of more or less localized extent and effect. Therefore, the reporting of this element will include the occurrence of all rain, snow, sleet, hail, freezing rain*, etc., and all thunderstorms, squalls, tornadoes, etc., observed at or from a particular station. Reports of the occurrence of the phenomena treated in this section are of importance to the pilot in order that he may be prepared for the lowering of visibility, accumulation of ice, turbulence, and other conditions that may result. Observations of these phenomena are made visually without the aid of instruments, except where wind velocities are involved as a measure of intensity of the phenomenon in question, in which cases an anemometer is used.

*During conditions favorable to freezing rain or freezing drizzle, the observer will remove any accumulation of ice on the ice-accretion indicator or other exposed object at thirty-minute intervals or more frequently. Ice that exists on wires or exposed objects and that may have formed some time prior to the observation should be distinguished, if possible, from the condition of freezing rain or freezing drizzle at the time of the observation.

2–145. Instructions for Observing and Reporting Weather.—The following will govern the observing and reporting of the "weather" element:

(*a*) *Point of observation.*—All observations of this element will be made from a point where a view of the entire sky and horizon can be had. If this is not entirely practicable, the observer is to move until a view of the entire sky and horizon has been obtained.

(*b*) *Position of "weather" data in report.*—When any "weather" phenomena are occurring they will be reported immediately following the visibility, or following the sky conditions if the visibility is not reported due to its being 10 miles or more.

(*c*) *Reports when weather conditions absent.*—When "weather" phenomena, as defined herein, are not occurring, no report will be made of this element. Conversely, the absence of "weather" phenomena is assumed unless they are included in the report.

(*d*) *Rules for reporting tornadoes.*—Tornadoes will be reported invariably as the *first element* under "Weather" whenever observed. They are recognized by their characteristic funnel-shaped cloud and the noise and destruction accompanying them. The direction from the station will be given. No abbreviation will ever be used for the word "tornado" when reporting these, it being written out in full and reported as follows, for example, "Tornado SW," "Tornado NW." (See description of this type of storm under fig. 1.)

(*e*) *Rules for reporting thunderstorms.*—1. Any thunderstorm in progress at time of observation shall be reported as the first element under "Weather," except when a tornado is also observable from or occurring at or near the station, in which case the tornado will be reported before any thunderstorm, as prescribed in paragraph 2–145 (d). A thunderstorm is considered to be "in progress at the time of observation" if thunder is heard or has been heard within 15 minutes preceding the time of that observation.

2. It is necessary that under "Remarks" there shall appear information concerning the thunderstorm which will complete the word-picture already partly drawn by the elements of ceiling, sky, visibility, etc., but such remarks shall be in addition to and not in lieu of the report of "thunderstorm" or "heavy thunderstorm" under "Weather." When "thunderstorm" is reported "Remarks" should contain the following information insofar as practicable:

(*a*) Location of thunderstorm(s) with respect to station, such as "overhead," "distant southwest," etc.

(*b*) Intensity and frequency of lightning as well as whether the lightning is from cloud to ground, cloud to cloud, or within the cloud, for example, "vivid lightning cloud to ground," "occasional lightning in clouds," "frequent intense lightning cloud to ground," etc. If the presence of low clouds prevents observation of lightning then the frequency of thunder should be given, such as "occasional thunder," "frequent thunder," etc.

(*c*) The direction of movement of the thunderstorm. The direction of movement is usually difficult to observe, and more so the nearer the storm. Unless the observer is confident that the direction of movement has been accurately determined this should not be reported. Such remarks as "Thunderstorm in NW apparently approaching and increasing in intensity," are of value and appropriate, provided that the observer has carefully observed the action of the storm.

(*d*) Appearance of clouds such as "dark cloud NW," "clouds turbulent," etc. It is left to the individual judgement and discretion of the observer to make the remarks concerning thunderstorms as brief and concise as practicable but at the same time to include as much as possible of the important information outlined above. For example, a remark such as "Occasional lightning in dark cloud NW approaching station" would indicate the direction of movement, direction from station, the frequency and intensity of lightning, and the appearance of the cloud without making the remarks unduly long.

3. If lightning is observed, but no thunder is heard, this condition does not constitute a "thunderstorm in progress" nor one within the range of the observation station. This condition may be described under "Remarks," but the distinction must be made that a thunderstorm requires that thunder be heard; while a lightning storm, or the mere

2–145. Instructions for Observing and Reporting Weather.—The following will govern the observing and reporting of the "weather" element:

(*a*) *Point of observation.*—All observations of this element will be made from a point where a view of the entire sky and horizon can be had. If this is not entirely practicable, the observer is to move until a view of the entire sky and horizon has been obtained.

(*b*) *Position of "weather" data in report.*—When any "weather" phenomena are occurring they will be reported immediately following the visibility, ~~or following the sky conditions if the visibility is not reported due to its being 10 miles or more.~~ Cancelled 8/1/45

(*c*) *Reports when weather conditions absent.*—When "weather" phenomena, as defined herein, are not occurring, no report will be made of this element. Conversely, the absence of "weather" phenomena is assumed unless they are included in the report.

(*d*) *Rules for reporting tornadoes.*—Tornadoes will be reported invariably as the *first element* under "Weather" whenever observed. They are recognized by their characteristic funnel-shaped cloud and the noise and destruction accompanying them. The direction from the station will be given. No abbreviation will ever be used for the word "tornado" when reporting these, it being written out in full and reported as follows, for example, "Tornado SW," "Tornado NW." (See description of this type of storm under fig. 1.)

(*e*) *Rules for reporting thunderstorms.*—1. Any thunderstorm in progress at time of observation shall be reported as the first element under "Weather," except when a tornado is also observable from or occurring at or near the station, in which case the tornado will be reported before any thunderstorm, as prescribed in paragraph 2–145 (d). A thunderstorm is considered to be "in progress at the time of observation" if thunder is heard or has been heard within 15 minutes preceding the time of that observation.

2. It is necessary that under "Remarks" there shall appear information concerning the thunderstorm which will complete the word-picture already partly drawn by the elements of ceiling, sky, visibility, etc., but such remarks shall be in addition to and not in lieu of the report of "thunderstorm" or "heavy thunderstorm" under "Weather." When "thunderstorm" is reported "Remarks" should contain the following information insofar as practicable:

(*a*) Location of thunderstorm(s) with respect to station, such as "overhead," "distant southwest," etc.

(*b*) Intensity and frequency of lightning as well as whether the lightning is from cloud to ground, cloud to cloud, or within the cloud, for example, "vivid lightning cloud to ground," "occasional lightning in clouds," "frequent intense lightning cloud to ground," etc. If the presence of low clouds prevents observation of lightning then the frequency of thunder should be given, such as "occasional thunder," "frequent thunder," etc.

(*c*) The direction of movement of the thunderstorm. The direction of movement is usually difficult to observe, and more so the nearer the storm. Unless the observer is confident that the direction of movement has been accurately determined this should not be reported. Such remarks as "Thunderstorm in NW apparently approaching and increasing in intensity," are of value and appropriate, provided that the observer has carefully observed the action of the storm.

(*d*) Appearance of clouds such as "dark cloud NW," "clouds turbulent," etc. It is left to the individual judgement and discretion of the observer to make the remarks concerning thunderstorms as brief and concise as practicable but at the same time to include as much as possible of the important information outlined above. For example, a remark such as "Occasional lightning in dark cloud NW approaching station" would indicate the direction of movement, direction from station, the frequency and intensity of lightning, and the appearance of the cloud without making the remarks unduly long.

3. If lightning is observed, but no thunder is heard, this condition does not constitute a "thunderstorm in progress" nor one within the range of the observation station. This condition may be described under "Remarks," but the distinction must be made that a thunderstorm requires that thunder be heard; while a lightning storm, or the mere

observation of lightning, does not occasion remarks other than those concerned with lightning.

4. To obviate the difficulty occasionally involved at times when an observer sees considerable lightning fairly near to his station but cannot hear thunder, the use of appropriate remarks is proper. Here the description of the storm should never be

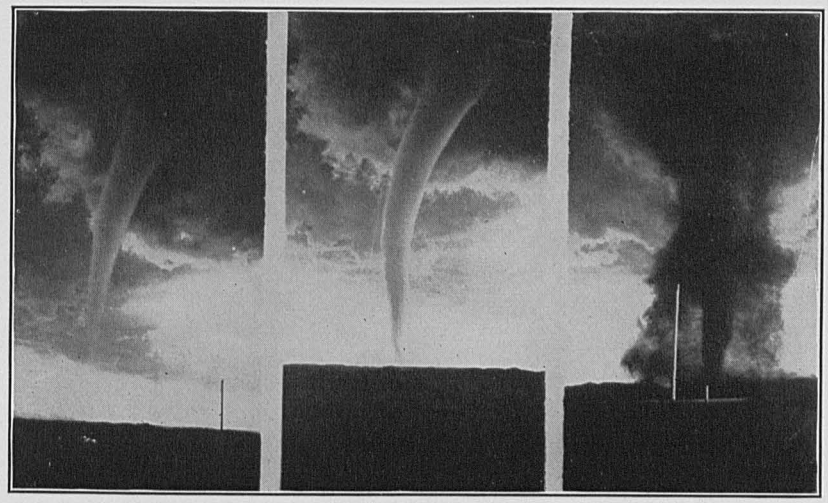

FIGURE 1.—Tornado forming and in progress. (Photographed by Mrs. Roy Homer at Gothenburg, Nebr., autumn, 1930.)

Left: Tornado cone forming. Center: Fully developed cone as it reached the earth. Right: Tornado striking farmhouse, which appears to explode.

given to contain the word "thunder" or "thunderstorm," but such descriptive terms as "dark," "frequent lightning," "thunderheads with lightning," "lightning and rain in west," should be used in remarks, and covers the cases where the observer

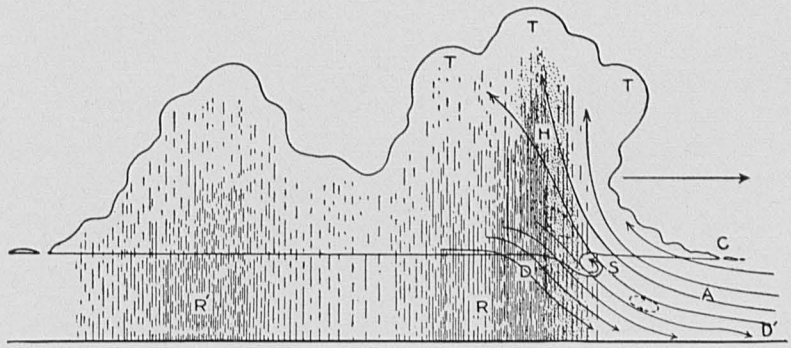

FIGURE 2.—Ideal cross section of a typical thunderstorm. *A*, ascending air; *D*, descending air; *C*, storm collar; *S*, roll scud; *D'*, wind gust; *H*, hail; *T*, thunderheads; *R*, primary rain; *R'*, secondary rain (after Humphreys).

strongly suspects a thunderstorm but has not the required fact of hearing thunder to permit the reporting of a thunderstorm.

5. Thunderstorms should be reported as closely as possible in accordance with the following table:

TABLE 2.—*Thunderstorm intensity equivalents*

Degree of intensity	Specifications for estimating degree of intensity
Thunderstorm	When a thunderstorm is in progress at the station and the intensity of the thunderstorm is less than that given for "heavy" thunderstorm. The following specifications are given as an aid in determining those thunderstorms which will be reported by the term "thunderstorm" or the symbol "T": (1) Occasional or fairly frequent flashes of lightning occur within the cloud, from cloud to cloud, or from cloud to ground; (2) weak to loud peals of thunder occur; (3) rainfall, if any, is light, moderate or possibly heavy; (4) hail, if any, is light or moderate; (5) the wind occurring in connection with the passage of the storm overhead or in close proximity does not reach velocities exceeding 40 m. p. h.; (6) the temperature drop, if any, occurring with the passage of the storm overhead or in the immediate vicinity is not usually as pronounced as in the case of the heavy thunderstorm.
Heavy thunderstorm	(1) When nearly incessant sharp lightning occurs; (2) loud peals of almost continuous thunder occur; (3) heavy rain occurs; (4) hail, if any, is light, moderate, or heavy; (5) the wind occurring in connection with passage of the storm overhead or in close proximity reaches velocities in excess of 40 m. p. h.; (6) a rapid drop in temperature, possibly as much as 20° in 5 minutes, occurs in connection with the storm passing overhead or in the immediate vicinity.

NOTE.—The above is intended merely as a guide and not as an absolute rule for determining thunderstorm intensities. Obviously with so many factors to consider it will depend largely upon the observer as to whether a storm will be reported as "thunderstorm" or "heavy thunderstorm", but he should make every effort to conform as far as possible with the above in making such classifications.

(f) Identifying precipitation and estimating its degree of intensity.—Identify precipitation and estimate its degree of intensity, when occurring, in accordance with the following table:

TABLE 3.—*Precipitation intensity equivalents*

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Rain.—The falling from clouds of drops of water (in the liquid state) in which most drops are larger—or if not larger, then much *sparser*—than the drops in drizzle; that is, diameter of most drops is greater than 1/50 inch (one and a quarter 64ths), they fall in still air faster than 10 feet per second.	Light (R−)	When the rate of fall per hour is from a trace to 0.10 inch (maximum 0.01 inch in 6 minutes).
	Moderate (R)	When the rate of fall per hour is from 0.11 to 0.30 inch (more than 0.01 inch to 0.03 inch in 6 minutes).
	Heavy (R+)	When the rate of fall per hour is over .30 inch (more than 0.03 inch in 6 minutes).
		NOTE.—The observer should practice estimating the degree of intensity of rain, using actual measurements as a check if possible, until he becomes proficient. If no method of actual measurement is available, then the observer shall estimate the intensity from the following criteria:
		Light rain.—Individual drops easily identifiable; no spray, or, at most, very slight spray, observable over pavements, roofs, etc.; puddles form very slowly; appreciable time, possibly over 2 minutes in cases of very light rain, required to wet pavements, roofs, and other dry surfaces; sound on roofs ranges from slow pattering to gentle swishing; trickles to steady small stream from gutters and downspouts.

Table 2.—*Thunderstorm intensity equivalents*

Degree of intensity	Specifications for estimating degree of intensity
Thunderstorm.....	When a thunderstorm is in progress at the station and the intensity of the thunderstorm is less than that given for "heavy" thunderstorm. The following specifications are given as an aid in determining those thunderstorms which will be reported by the term "thunderstorm" or the symbol "T": (1) Occasional or fairly frequent flashes of lightning occur within the cloud, from cloud to cloud, or from cloud to ground; (2) weak to loud peals of thunder occur; (3) rainfall, if any, is light, moderate or possibly heavy; (4) hail, if any, is light or moderate; (5) the wind occurring in connection with the passage of the storm overhead or in close proximity does not reach velocities exceeding 40 m.p.h.; (6) the temperature drop, if any, occuring with the passage of the storm overhead or in the immediate vicinity is not usually as pronounced as in the case of the heavy thunderstorm.
Heavy thunderstorm.....	(1) When nearly incessant sharp lightning occurs; (2) loud peals of almost continuous thunder occur; (3) heavy rain occurs; (4) hail, if any, is light, moderate, or heavy; (5) the wind occuring in connection with passage of the storm overhead or in close proximity reaches velocities in excess of 40 m.p.h.; (6) a rapid drop in temperature, possibly as much as 20° in 5 minutes, occurs in connection with the storm passing overhead or in the immediate vicinity.

NOTE.—The above is intended merely as a guide and not as an absolute rule for determining thunderstorm intensities. Obviously with so many factors to consider it will depend largely upon the observer as to whether a storm will be reported as "thunderstorm" or "heavy thunderstorm," but he should make every effort to conform as far as possible with the above in making such classifications.

(f) Identifying precipitation and estimating its degree of intensity.—Identify precipitation and estimate its degree of intensity, when occuring, in accordance with the following table:

Table 3.—*Precipitation intensity equivalents*

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Rain.—The falling of drops of liquid water in which the drops are generally larger than 1/50 inch in diameter; they fall faster than 10 feet per second in still air. Observers should avoid confusing "light fine rain" with "drizzle." In "light fine rain" the particles may be smaller than 1/50 inch in diameter but are sparse, whereas in "drizzle" they are abundant. Furthermore, "light fine rain" may not greatly reduce visibility. In "drizzle" the numerous small droplets, which although actually falling appear to follow the currents of the air, invariably reduce the visibility to a noticeable extent. When "light fine rain" is falling, R- will be entered in the body of the report and appropriate remarks such as "R- very fine," "pcpn fine," etc., will be included. Further, "light fine rain" generally falls from an advancing high cloud deck, usually alto-stratus, while "drizzle" falls only from low, thick stratus clouds which may even touch the earth.	Light (R—).....	When the rate of fall per hour is from a trace to 0.10 inch (maximum 0.01 inch in 6 minutes).
	Moderate (R).....	When the rate of fall per hour is from 0.11 to 0.30 inch (more than 0.01 inch to 0.03 inch in 6 minutes).
	Heavy (R+).....	When the rate of fall per hour is over .30 inch (more than 0.03 inch in 6 minutes).
		NOTE.—The observer should practice estimating the degree of intensity of rain, using actual measurements as a check if possible, until he becomes proficient. If no method of actual measurement is available, then the observer shall estimate the intensity from the following criteria:
		Light rain.—Individual drops easily identifiable; no spray, or, at most, very slight spray, observable over pavements, roofs, etc.; puddles form very slowly; appreciable time, possibly over 2 minutes in cases of very light rain, required to wet pavements, roofs, and other dry surfaces; sound on roofs ranges from slow pattering to gentle swishing; trickles to steady small stream from gutters and downspouts.

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Rain, etc.—Continued.		*Moderate rain.*—Individual drops not clearly identifiable; spray observable just above pavements, roofs, and other hard surfaces; puddles form fairly rapidly; downspouts on buildings run ⅕ to ½ full; sound on roofs ranges from swishing to gentle roar. *Heavy rain.*—Rain seemingly falling in sheets, individual drops not identifiable; heavy spray to height of several inches observable on roofs, pavements, etc.; downspouts on buildings run ½ to full or overflowing; puddles form rapidly; visibility impaired; sound on roofs resembles roll of drums or distinct roar.
Freezing rain.—The falling from clouds of rain which instantly freezes to objects in the open which it strikes thus generally forming glaze. At the surface, however, the fall may be so rapid that runoff occurs as in the case of rain. This condition should not be confused with sleet (ice pellets).	Light (ZR—)	Same as "light rain."
	Moderate (ZR)	Same as "moderate rain."
	Heavy (ZR+)	Same as "heavy rain." NOTE.—The degree of intensity of any type of rain will invariably be ascribed on a "rate-of-fall" basis, when occurring alone, or in combination with any other form of precipitation or in combination with any obstructions to vision.
Drizzle.—Uniform falling from clouds of minute [diameter less than 1/50 inch (one and one-quarter 64ths)] and very numerous drops, which seem almost to float in the air, and thereby visibly follow even slight motion of the air. Drizzle is *not* associated with cumuloform clouds, and is characteristically accompanied by poor visibility; these criteria should be used in distinguishing it from fine rain. (Designated as "mist" prior to June 1, 1939.)	Light (L—)	When drizzle is occurring *alone*, and objects are distinguishable at 1¼ miles or more.
	Moderate (L)	When drizzle is occurring *alone*, and objects are distinguishable at ⅝ but not at 1¼ miles. Visibility to be reported as ¾ or 1 mile.
	Heavy (L+)	When drizzle is occurring *alone*, and objects are distinguishable at 5/10 mile but not at ⅝ mile. Visibility to be reported as ½ mile. NOTE.—If drizzle is occurring with fog or any other vision-obscuring element, which prevents judging its intensity on the basis of the prevailing visibility, then the degree of intensity of the drizzle will be adjudged by the observer as well as possible on a "rate-of-fall" basis, and the intensity ascribed to the other element will be in accordance with the prevailing visibility. For example, the observer adjudges "light drizzle" to be occurring with fog present and the visibility ¼ mile, report "light drizzle, thick fog;" the observer adjudges "heavy drizzle" to be occurring with smoke present and the visibility ¼ mile, report "heavy drizzle, thick smoke," etc.
Freezing drizzle.—Same as "drizzle," except droplets instantly freeze to objects in the open which they strike, forming glaze.	Light (ZL—)	Same as "light drizzle."
	Moderate (ZL)	Same as "moderate drizzle."
	Heavy (ZL+)	Same as "heavy drizzle."

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Rain, etc.—Continued.		*Moderate rain.*—Individual drops not clearly identifiable; spray observable just above pavements, roofs, and other hard surfaces; puddles form fairly rapidly; downspouts on buildings run ⅓ to ½ full; sound on roofs ranges from swishing to gentle roar. *Heavy rain.*—Rain seemingly falling in sheets, individual drops not identifiable; heavy spray to height of several inches observable on roofs, pavements, etc.; downspouts on buildings run ½ to full or overflowing; puddles form rapidly; visibility impaired; sound on roofs resembles roll of drums or distinct roar.
Freezing rain.—The falling from clouds of rain which instantly freezes to objects in the open which it strikes thus generally forming glaze. At the surface, however, the fall may be so rapid that runoff occurs as in the case of rain. This condition should not be confused with sleet (ice pellets).	Light (ZR−)	Same as "light rain."
	Moderate (ZR)	Same as "moderate rain."
	Heavy (ZR+)	Same as "heavy rain." NOTE.—The degree of intensity of any type of rain will invariably be ascribed on a "rate-of-fall" basis, when occurring alone, or in combination with any other form of precipitation or in combination with any obstructions to vision.
Drizzle.—Uniform falling from clouds of minute [diameter less than 1/50 inch (one and one-quarter 64ths)] and very numerous drops, which seem almost to float in the air, and thereby visibly follow even slight motion of the air. Drizzle is *not* associated with cumuloform clouds, and is characteristically accompanied by poor visibility; these criteria should be used in distinguishing it from fine rain. (Designated as "mist" prior to June 1, 1939.)	Light (L−)	When drizzle is occurring *alone*, and objects are distinguishable at ⅝ mile or more.
	Moderate (L)	When drizzle is occurring *alone*, and objects are distinguishable at 5/16 but not at ⅝ mile.
	Heavy (L+)	When drizzle is occurring *alone*, and objects are not distinguishable at 5/16 mile. NOTE.—If drizzle is occurring with fog or any other vision-obscuring element, which prevents judging its intensity on the basis of the prevailing visibility, then the degree of intensity of the drizzle will be adjudged by the observer as well as possible on a "rate-of-fall" basis, and the intensity ascribed to the other element will be in accordance with the prevailing visibility. For example, the observer adjudges "light drizzle" to be occurring with fog present and the visibility ¼ mile, report "light drizzle, heavy fog;" the observer adjudges "heavy drizzle" to be occurring with smoke present and the visibility ¼ mile, report "heavy drizzle, heavy smoke," etc.
Freezing drizzle.—Same as "drizzle," except droplets instantly freeze to objects in the open which they strike, forming glaze.	Light (ZL−)	Same as "light drizzle."
	Moderate (ZL)	Same as "moderate drizzle."
	Heavy (ZL+)	Same as "heavy drizzle."

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Table 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Rain, etc.—Continued.		*Moderate rain.*—Individual drops not clearly identifiable; spray observable just above pavements, roofs, and other hard surfaces; puddles form fairly rapidly; downspouts on buildings run 1/4 to 1/2 full; sound on roofs ranges from swishing to gentle roar. *Heavy rain.*—Rain seemingly falling in sheets, individual drops not identifiable; heavy spray to height of several inches observable on roofs, pavements, etc.; downspouts on buildings run 1/2 to full or overflowing; puddles form rapidly; visibility impaired; sound on roofs resembles roll of drums or distinct roar.
Freezing rain.—Rain which freezes to exposed, unheated objects just above the ground or roof, such as shrubbery, railings, telephone wires, fences, etc. Although this phenomenon usually occurs at temperatures near 32°, the formation of ice, usually glaze, will be the criterion on which the observer's decision is based, rather than temperature. Occasionally, however, the fall may be so rapid that run-off occurs as in rain. Freezing rain should not be confused with sleet (ice pellets).	Light (ZR—).....	Same as "light rain."
	Moderate (ZR).....	Same as "moderate rain."
	Heavy (ZR+).....	Same as "heavy rain." NOTE.—The degree of intensity of any type of rain will invariably be ascribed on a "rate-of-fall" basis, when occurring alone, or in combination with any other form of precipitation or in combination with any obstructions to vision.
Drizzle.—Uniform falling from clouds of minute [diameter less than 1/50 inch (one and one-quarter 64ths)] and very numerous drops, which seem almost to float in the air, and thereby visibly follow even slight motion of the air. Drizzle is *not* associated with cumuloform clouds, and is charasteristically accompanied by poor visibility; these criteria should be used in distinguishing it from fine rain. (See description of rain above.) (Designated as "mist" prior to June 1, 1939.)	Light (L—).....	When drizzle is occurring *alone*, and objects are distinguishable at 5/8 mile or more.
	Moderate (L).....	When drizzle is occurring *alone*, and objects are distinguishable at 5/16 but not at 5/8 mile.
	Heavy (L+).....	When drizzle is occurring *alone*, and objects are not distinguishable at 5/16 mile. NOTE.—If drizzle is occurring with fog or any other vision-obscuring element, which prevents judging its intensity on the basis of the prevailing visibility, then the degree of intensity of the drizzle will be adjudged by the observer as well as possible on a "rate-of-fall" basis, and the intensity ascribed to the other element will be in accordance with the prevailing visibility. For example, the observer adjudges "light drizzle" to be occurring with fog present and the visibility 1/4 mile, report "light drizzle, heavy fog;" the observer adjudges "heavy drizzle" to be occurring with smoke present and the visibility 1/4 mile, report "heavy drizzle, heavy smoke," etc.
Freezing drizzle.—Drizzle which instantly freezes to exposed, unheated objects just above the ground or roof, such as shrubbery, railings, telephone wires, fences, etc. Although the phenomenon usually occurs at temperatures near 32°, the formation of ice, usually glaze, will be the criterion on which the observer's decision is based, rather than temperature.	Light (ZL—).....	Same as "light drizzle."
	Moderate (ZL).....	Same as "moderate drizzle."
	Heavy (ZL+).....	Same as "heavy drizzle."

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Rain, etc.—Continued.		*Moderate rain.*—Individual drops not clearly identifiable; spray observable just above pavements, roofs, and other hard surfaces; puddles form fairly rapidly; downspouts on buildings run ⅛ to ½ full; sound on roofs ranges from swishing to gentle roar. *Heavy rain.*—Rain seemingly falling in sheets, individual drops not identifiable; heavy spray to height of several inches observable on roofs, pavements, etc.; downspouts on buildings run ½ to full or overflowing; puddles form rapidly; visibility impaired; sound on roofs resembles roll of drums or distinct roar.
Freezing rain.—The falling from clouds of rain which instantly freezes to objects in the open which it strikes thus generally forming glaze. At the surface, however, the fall may be so rapid that runoff occurs as in the case of rain. This condition should not be confused with sleet (ice pellets).	Light (ZR−) Moderate (ZR) Heavy (ZR+)	Same as "light rain." Same as "moderate rain." Same as "heavy rain." NOTE.—The degree of intensity of any type of rain will invariably be ascribed on a "rate-of-fall" basis, when occurring alone, or in combination with any other form of precipitation or in combination with any obstructions to vision.
Drizzle.—Uniform falling from clouds of minute [diameter less than 1/50 inch (one and one-quarter 64ths)] and very numerous drops, which seem almost to float in the air, and thereby visibly follow even slight motion of the air. Drizzle is *not* associated with cumuloform clouds, and is characteristically accompanied by poor visibility; these criteria should be used in distinguishing it from fine rain. (Designated as "mist" prior to June 1, 1939.)	Light (L−) Moderate (L) Heavy (L+)	When drizzle is occurring *alone*, and objects are distinguishable at 1¼ miles or more. When drizzle is occurring *alone*, and objects are distinguishable at ⅝ but not at 1¼ miles. Visibility to be reported as ¾ or 1 mile. When drizzle is occurring *alone*, and objects are distinguishable at 5/16 mile but not at ⅝ mile. Visibility to be reported as ½ mile. NOTE.—If drizzle is occurring with fog or any other vision-obscuring element, which prevents judging its intensity on the basis of the prevailing visibility, then the degree of intensity of the drizzle will be adjudged by the observer as well as possible on a "rate-of-fall" basis, and the intensity ascribed to the other element will be in accordance with the prevailing visibility. For example, the observer adjudges "light drizzle" to be occurring with fog present and the visibility ¼ mile, report "light drizzle, thick fog;" the observer adjudges "heavy drizzle" to be occurring with smoke present and the visibility ¼ mile, report "heavy drizzle, thick smoke," etc.
Freezing drizzle.—Same as "drizzle," except droplets instantly freeze to objects in the open which they strike, forming glaze.	Light (ZL−) Moderate (ZL) Heavy (ZL+)	Same as "light drizzle." Same as "moderate drizzle." Same as "heavy drizzle."

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Snow.—The falling from clouds of white or translucent ice crystals, mainly in branched hexagonal shapes ("stars"), often mixed with simple ice crystals.	Light (S−)	When snow is occurring *alone* and objects are distinguishable at 5/8 mile or more. Visibility to be reported as 3/4 mile or more.
	Moderate (S)	When snow is occurring *alone* and objects are distinguishable at 5/16 mile but not at 5/8 mile. Visibility to be reported at 1/2 mile.
	Heavy (S+)	When snow is occurring *alone* and objects are not distinguishable at 5/16 mile. Visibility to be reported as 1/4, 1/5, 1/8, or *zero* miles. NOTE.—If snow is occurring with fog, smoke, or any other vision-obscuring element which prevents judging its intensity on the basis of the prevailing visibility, then the degree of intensity of the snow will be adjudged by the observer as well as possible on a "rate-of-fall" basis, and the intensity of the other element will be in accordance with the prevailing visibility. In doing this, the rate of fall of "light snow" would consitute little or very slow accumulation on ground, "moderate snow" moderate accumulation, and "heavy snow" rapid accumulation. For example, the observer adjudges "moderate snow" to be occurring with smoke and the visibility 1/4 mile, report "moderate snow, thick smoke," etc.
Sleet (Ice pellets).—The falling from clouds of transparent, globular hard grains of ice, ranging from 1/25 to 5/25 inch in size; they rebound when falling on hard surfaces. Formed by the freezing of rain drops.	Light (E−)	Where a few pellets are falling.
	Moderate (E)	Moderate rate of fall, some accumulation on ground.
	Heavy (E+)	Heavy rate of fall; rapid accumulation on ground.
Hail.—Ice balls or stones, with diameters ranging from 1/5 inch to 2 inches or more, which either fall detached, or fused in irregular lumps. They are either quite transparent or composed of alternating clear and opaque, snow-like layers, the clear layers being at least 1/25 inch thick. Hail occurs almost exclusively in violent or prolonged thunderstorms and never with temperatures below freezing at the ground. Extremely dangerous to aircraft.	Light (A−)	When only few pellets or stones are falling.
	Moderate (A)	Moderate amount of stones falling; some accumulation on ground.
	Heavy (A+)	Great numbers of stones falling; rapid accumulation on ground.
Snow pellets (formerly designated as "graupel").—The falling from clouds of white, opaque, round, or seldom conical, grains of snow-like structure, 1/16 to 1/4 inch in diameter; they are crisp and easily compressible, rebound when falling on hard ground and thereby often burst; occur almost exclusively in showers.	Light (SP−)	Same as "light snow."
	Moderate (SP)	Same as "moderate snow."
	Heavy (SP+)	Same as "heavy snow."

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Snow.—The falling from clouds of white or translucent ice crystals, mainly in branched hexagonal shapes ("stars"), often mixed with simple ice crystals.	Light (S−)	When snow is occurring *alone* and objects are distinguishable at 5/8 mile or more. Visibility to be reported as 3/4 mile or more.
	Moderate (S)	When snow is occurring *alone* and objects are distinguishable at 5/16 mile but not at 5/8 mile. Visibility to be reported at 1/2 mile.
	Heavy (S+)	When snow is occurring *alone* and objects are not distinguishable at 5/16 mile. Visibility to be reported as 1/4, 1/5, 1/8, or *zero* miles. NOTE.—If snow is occurring with fog, smoke, or any other vision-obscuring element which prevents judging its intensity on the basis of the prevailing visibility, then the degree of intensity of the snow will be adjudged by the observer as well as possible on a "rate-of-fall" basis, and the intensity of the other element will be in accordance with the prevailing visibility. In doing this, the rate of fall of "light snow" would consitute little or very slow accumulation on ground, "moderate snow" moderate accumulation, and "heavy snow" rapid accumulation. For example, the observer adjudges "moderate snow" to be occurring with smoke and the visibility 1/4 mile, report "moderate snow, thick smoke," etc.
Sleet (Ice pellets).—The falling from clouds of transparent, globular hard grains of ice, ranging from 1/25 to 5/25 inch in size; they rebound when falling on hard surfaces. Formed by the freezing of rain drops.	Light (E−)	Where a few pellets are falling.
	Moderate (E)	Moderate rate of fall, some accumulation on ground.
	Heavy (E+)	Heavy rate of fall; rapid accumulation on ground.
Hail.—Ice balls or stones, with diameters ranging from 1/8 inch to 2 inches or more, which either fall detached, or fused in irregular lumps. They are either quite transparent or composed of alternating clear and opaque, snow-like layers, the clear layers being at least 1/25 inch thick. Hail occurs almost exclusively in violent or prolonged thunderstorms and never with temperatures below freezing at the ground. Extremely dangerous to aircraft.	Light (A−)	When only few pellets or stones are falling.
	Moderate (A)	Moderate amount of stones falling; some accumulation on ground.
	Heavy (A+)	Great numbers of stones falling; rapid accumulation on ground.
Snow pellets (formerly designated as "graupel").—The falling from clouds of white, opaque, round, or seldom conical, grains of snow-like structure, 1/16 to 1/4 inch in diameter; they are crisp and easily compressible, rebound when falling on hard ground and thereby often burst; occur almost exclusively in showers.	Light (SP−)	Same as "light snow."
	Moderate (SP)	Same as "moderate snow."
	Heavy (SP+)	Same as "heavy snow."

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degree of intensity
Snow.—The falling from clouds of white or translucent ice crystals, mainly in branched hexagonal shapes ("stars"), often mixed with simple ice crystals.	Light (S−)	When snow is occurring *alone* and objects are distinguishable at ⅝ mile or more.
	Moderate (S)	When snow is occurring *alone* and objects are distinguishable at 5/16 mile but not at ⅝ mile.
	Heavy (S+)	When snow is occurring *alone* and objects are not distinguishable at 5/16 mile.
		NOTE.—If snow is occurring with fog, smoke, or any other vision-obscuring element which prevents judging its intensity on the basis of the prevailing visibility, then the degree of intensity of the snow will be adjudged by the observer as well as possible on a "rate-of-fall" basis, and the intensity of the other element will be in accordance with the prevailing visibility. In doing this, the rate of fall of "light snow" would consitute little or very slow accumulation on ground, "moderate snow" moderate accumulation, and "heavy snow" rapid accumulation. For example, the observer adjudges "moderate snow" to be occurring with smoke and the visibility ¼ mile, report "moderate snow, heavy smoke," etc.
Sleet (Ice pellets).—The falling from clouds of transparent, globular hard grains of ice, ranging from 1/25 to 5/25 inch in size; they rebound when falling on hard surfaces. Formed by the freezing of rain drops.	Light (E−)	Where a few pellets are falling.
	Moderate (E)	Moderate rate of fall, some accumulation on ground.
	Heavy (E+)	Heavy rate of fall; rapid accumulation on ground.
Hail.—Ice balls or stones, with diameters ranging from ⅛ inch to 2 inches or more, which either fall detached, or fused in irregular lumps. They are either quite transparent or composed of alternating clear and opaque, snow-like layers, the clear layers being at least 1/25 inch thick. Hail occurs almost exclusively in violent or prolonged thunderstorms and never with temperatures below freezing at the ground. Extremely dangerous to aircraft.	Light (A−)	When only few pellets or stones are falling.
	Moderate (A)	Moderate amount of stones falling; some accumulation on ground.
	Heavy (A+)	Great numbers of stones falling; rapid accumulation on ground.
Snow pellets (formerly designated as "graupel").—The falling from clouds of white, opaque, round, or seldom conical, grains of snow-like structure, 1/16 to ¼ inch in diameter; they are crisp and easily compressible, rebound when falling on hard ground and thereby often burst; occur almost exclusively in showers.	Light (SP−)	Same as "light snow."
	Moderate (SP)	Same as "moderate snow."
	Heavy (SP+)	Same as "heavy snow."

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degrees of intensity
Small hail.—Semitransparent, round or conical grains of frozen water, generally consisting of a grain of soft hail as nucleus, with a very thin ice layer around it, which gives them a glazed appearance; they are not easily compressible or crisp, and even when falling on hard ground, do not generally rebound or burst. They are wet, because they mostly fall at temperatures above freezing.	Light (AP−)	Same as "light hail."
	Moderate (AP)	Same as "moderate hail."
	Heavy (AP+)	Same as "heavy hail."
Showers (rain or snow).—Refer to paragraph (*i*) below for rules regarding showers.	Light ((R or S) W−)	Same as "light rain" or "light snow."
	Moderate ((R or S) W).	Same as "moderate rain" or "moderate snow."
	Heavy ((R or S) W+).	Same as "heavy rain" or "heavy snow."

NOTE.—Letters in parentheses following the "degree-of-intensity" terms, are the teletype symbols for the phenomenon in question.

(*g*) *Times when precipitation is to be reported.*—Precipitation will always be reported when occurring. When this is in connection with a thunderstorm or a tornado it will be reported under "Weather," in addition to (not in place of) that phenomenon, the tornado and/or thunderstorm being placed first. During showery or intermittent precipitation conditions, "snow showers," "intermittent rain," etc., will be reported under "Remarks" when precipitation is not actually occurring at the time of observation; however, these will not be reported under "Remarks" for a period of longer than 15 minutes after the last occurrence of precipitation.

(*h*) *Reporting precipitation when two or more types are occurring together.*—When ~~two or more types of precipitation listed in table 3 above are falling together at the time of observation, all will be reported, the predominating type being placed first and the lesser type(s) following this. In such cases the degree of intensity ascribed to each type occurring in the combination, irrespective of whether or not any of these are defined in terms of visibility when occurring alone, will be determined on a "rate-of-fall" basis as provided for in table 3 above to the best of the observer's ability. For example, if snow and rain are occurring together, the visibility being ½ mile, and the observer adjudges on a "rate-of-fall" basis that the snow is "light" and the rain is heavy, report "heavy rain, light snow."~~ If a mixture has been observed at intervals, but is not occurring at the time of observation, then only the type occurring at the time of observation will be reported under "Weather" and proper remarks will be included concerning the other. For example, "snow occasionally mixed with rain." Cancelled 7-1-45.

(*i*) *Rules for reporting showers.*—Showers are characterized by the suddenness with which the precipitation (rain, snow, snow pellets, etc.) starts or stops and its rapid changes of intensity; but, also, by the aspect of the sky—rapid changes between dark, threatening clouds and clearings of the sky (of short duration, often with an intensely blue sky). Sometimes no definite clearing occurs between the showers, or the precipitation does not even stop entirely between them; the shower character of the precipitation is then revealed by the more or less rapid alternations of lighter and darker clouds. When such conditions occur this shall be indicated by entry of the word or symbol for the type of precipitation, followed by the word, or symbol for "showers." In telegraphed reports the degree of intensity will be given preceding the type of precipitation. For example, "heavy snow showers" (the intensity applies to the precipitation in the showers), while in teletype or radio reports the intensity will be indicated by a minus sign for "light" and a plus sign for "heavy" immediately following the shower symbol, the symbol itself standing for "moderate" precipitation; for example,

TABLE 3.—*Precipitation intensity equivalents*—Continued

Kind of precipitation	Degree-of-intensity term	Specifications for estimating degrees of intensity
Small hail.—Semitransparent, round or conical grains of frozen water, generally consisting of a grain of soft hail as nucleus, with a very thin ice layer around it, which gives them a glazed appearance; they are not easily compressible or crisp, and even when falling on hard ground, do not generally rebound or burst. They are wet, because they mostly fall at temperatures above freezing.	Light (AP−) Moderate (AP) Heavy (AP+)	Same as "light hail." Same as "moderate hail." Same as "heavy hail."
Showers (rain or snow).—Refer to paragraph (*i*) below for rules regarding showers.	Light ((R or S) W−) Moderate ((R or S) W). Heavy ((R or S) W+).	Same as "light rain" or "light snow." Same as "moderate rain" or "moderate snow." Same as "heavy rain" or "heavy snow."

NOTE.—Letters in parentheses following the "degree-of-intensity" terms, are the teletype symbols for the phenomenon in question.

(*g*) *Times when precipitation is to be reported.*—Precipitation will always be reported when occurring. When this is in connection with a thunderstorm or a tornado it will be reported under "Weather," in addition to (not in place of) that phenomenon, the tornado and/or thunderstorm being placed first. During showery or intermittent precipitation conditions, "snow showers," "intermittent rain," etc., will be reported under "Remarks" when precipitation is not actually occurring at the time of observation; however, these will not be reported under "Remarks" for a period of longer than 15 minutes after the last occurrence of precipitation.

(*h*) *Reporting precipitation when two or more types are occurring together.*—When two or more types of precipitation listed in table 3 above are falling together at the time of observation, all will be reported, the predominating type being placed first and the lesser type(s) following this. In such cases the degree of intensity ascribed to each type occurring in the combination, irrespective of whether or not any of these are defined in terms of visibility when occurring alone, will be determined on a "rate-of-fall" basis as provided for in table 3 above to the best of the observer's ability. For example, if snow and rain are occurring together, the visibility being ½ mile, and the observer adjudges on a "rate-of-fall" basis that the snow is "light" and the rain is heavy, report "heavy rain, light snow." If a mixture has been observed at intervals, but is not occurring at the time of observation, then only the type occurring at the time of observation will be reported under "Weather" and proper remarks will be included concerning the other. For example, "snow occasionally mixed with rain."

(*i*) *Rules for reporting showers.*—Showers are characterized by the suddenness with which the precipitation (rain, snow, snow pellets, etc.) starts or stops and its rapid changes of intensity; but, also, by the aspect of the sky—rapid changes between dark, threatening clouds and clearings of the sky (of short duration, often with an intensely blue sky). Sometimes no definite clearing occurs between the showers, or the precipitation does not even stop entirely between them; the shower character of the precipitation is then revealed by the more or less rapid alternations of lighter and darker clouds. When such conditions occur this shall be indicated by entry of the word or symbol for the type of precipitation, followed by the word, or symbol for "showers." In telegraphed reports the degree of intensity will be given preceding the type of precipitation. For example, "heavy snow showers" (the intensity applies to the precipitation in the showers), while in teletype or radio reports the intensity will be indicated by a minus sign for "light" and a plus sign for "heavy" immediately following the shower symbol, the symbol itself standing for "moderate" precipitation; for example,

"RW+" "heavy rain showers." "Sprinkling" of the shower type will be reported as "light rain showers." (A "snow shower" is the same as what is popularly termed a "snow flurry.") See (*g*) above for reporting showers when precipitation is not actually occurring at the time of observation.

(*j*) *Observations of fog with heavy snow.*—Care should be used in determining whether or nor dense fog occurs with heavy snow. It ordinarily does not occur with heavy snow, but the restricted visibility is often mistakenly attributed to it under these conditions. There are times, however, when fog is present with snow; rime then invariably results and is a hazardous flight condition, mostly confined to mountain ridges.

(*k*) *Rules for reporting snow or rain squalls.*—These will be reported under "Weather," following any other "weather" phenomena that may be included in that particular report. As the names imply, these conditions are intermittent, but when occurring they indicate an important state of turbulence near the surface. If it is snowing, sleeting, or raining at the time of observation and squalls have been experienced at the station within the past 15 minutes, the rain or snow will be entered in the report in the prescribed manner, followed by a report of the squalls, e. g., "Fifteen hundred, overcast, five, moderate rain, severe rain squalls." If it is not raining or snowing at the time of observation, but this is occurring intermittently and squalls have occurred at the station within the past 15 minutes, rain or snow squalls will be reported under "Weather" as a current condition. For example, "Fifteen hundred, overcast, five, severe snow squalls, — — —." Entries of squalls under "Weather" in the report proper will be made only when these are occurring at the station itself. Squalls observed to be occurring at some distance from the station, such as over lakes or mountain ridges, or squalls which are observed to be approaching the station but which have not reached there, will be reported only under "Remarks." "Squalls" will be reported in accordance with the degrees of intensity given below, when brief falls of rain or snow, or brief intensifications of occurring rain or snow, accompanied by fresh or strong gusts of wind, are observed. Since squalls are closely akin to thunderstorm conditions, though not necessarily accompanied by thunder and lightning, the reporting of a "thunderstorm" obviates necessity for reporting "squalls" in the same observation.

TABLE 4.—*Squall-intensity equivalents*

Type of squall	Degree of intensity term	Specifications for estimating degree of intensity
Rain squall	Mild (RQ−)	When the gusts *do not exceed* a velocity of 24 miles per hour.
	Moderate (RQ)	When the gusts *do not exceed* a velocity of 39 miles per hour.
	Severe (RQ+)	When the gusts *exceed* a velocity of 39 miles per hour.
Snow squall	Mild (SQ−)	When the gusts *do not exceed* a velocity of 24 miles per hour.
	Moderate (SQ)	When the gusts *do not exceed* a velocity of 39 miles per hour.
	Severe (SQ+)	When the gusts *exceed* a velocity of 39 miles per hour.

(*l*) *Gust velocities to be used as final criterion in estimating degree of intensity of squalls.*—If it should occur that the precipitation occurring with the squall was "light," while the gust velocities would indicate a classification of "severe" for the squall, or any other combination along these lines should occur, then the gust velocities will be used as the criterion for classification of the degree of intensity of the squall. For example, in the case given above, the squall would be classed as "severe."

(*m*) *Reporting two or more types of precipitation in squalls.*—If two or more kinds of precipitation occur together with the squalls, the predominating type will be given for classification of the squall in the body of the report and a proper note made under "Remarks" concerning the other type or types of precipitation; for example, if rain and snow occurred together, with rain predominating, then rain squalls would be reported in the body of the report, and a remark, such as "snow mixed with rain in squalls," would be added to the report.

"RW+" "heavy rain showers." "Sprinkling" is the occasional falling of a few drops of rain. It may be of the "shower" type (falling from cumuliform clouds) or of the "rain" type (falling from stratiform clouds). In either case, "OCNL SPKL" or other appropriate entry in remarks will normally be sufficient, without including "R-" or "RW-" in the body of the report. (A "snow shower" is popularly termed a "snow flurry.") See (*g*) above for reporting showers when precipitation is not actually occurring at the time of observation.

(*j*) *Observations of fog with heavy snow.*—Care should be used in determining whether or not heavy fog occurs with heavy snow. It ordinarily does not occur with heavy snow, but the restricted visibility is often mistakenly attributed to it under these conditions. There are times, however, mostly confined to mountain ridges, when fog is present with snow; rime then invariably results and is a hazardous flight condition.

(*k*) *Rules for reporting snow or rain squalls.*—These will be reported under "Weather." As the names imply, these conditions are intermittent, but when occurring they indicate an important state of turbulence near the surface. If it is snowing, sleeting, or raining at the time of observation and squalls have been experienced at the station within the past 15 minutes, the rain or snow will be entered in the report in the prescribed manner, followed by a report of the squalls, e.g., "Fifteen hundred, overcast, five, moderate rain showers, heavy rain squalls." If it is not raining or snowing at the time of observation, but this is occurring intermittently and squalls have occurred at the station within the past 15 minutes, rain or snow squalls will be reported under "Weather" as a current condition. For example, "Fifteen hundred, overcast, five, heavy snow squalls." Entries of squalls under "Weather" in the report proper will be made only when these are occurring at the station itself. Squalls observed to be occurring at some distance from the station, such as over lakes or mountain ridges, or squalls which are observed to be approaching the station but which have not reached there, will be reported only under "Remarks." "Squalls" will be reported in accordance with the degrees of intensity given below, when brief falls of rain or snow, or brief intensifications of occurring rain or snow, accompanied by fresh or strong gusts of wind, are observed. Since squalls are closely akin to thunderstorm conditions, though not necessarily accompanied by thunder and lightning, the reporting of a "thunderstorm" obviates necessity for reporting "squalls" in the same observation.

TABLE 4.—*Squall-intensity equivalents*

Type of squall	Degree of intensity term	Specifications for estimating degree of intensity
Rain squall.....	Light (RQ-).....	When the gusts *do not exceed* a velocity of 24 miles per hour.
	Moderate (RQ).....	When the gusts *do not exceed* a velocity of 39 miles per hour.
	Heavy (RQ+).....	When the gusts *exceed* a velocity of 39 miles per hour.
Snow squall.....	Light (SQ-).....	When the gusts *do not exceed* a velocity of 24 miles per hour.
	Moderate (SQ).....	When the gusts *do not exceed* a velocity of 39 miles per hour.
	Heavy (SQ+).....	When the gusts *exceed* a velocity of 39 miles per hour.

(*l*) *Gust velocities to be used as final criterion in estimating degree of intensity of squalls.*—If it should occur that the precipitation occurring with the squall was "light," while the gust velocities would indicate a classification of "heavy" for the squall, or any other combination along these lines should occur, then the gust velocities will be used as the criterion for classification of the degree of intensity of the squall.

(*m*) *Reporting two or more types of precipitation in squalls.*—If two or more kinds of precipitation occur together with the squalls, the predominating type will be given for classification of the squall in the body of the report and a proper note made under "Remarks" concerning the other type or types of precipitation; for example, if rain and snow occurred together, with rain predominating, then rain squalls would be reported in the body of the report, and a remark, such as "snow mixed with rain in squalls," would be added to the report.

"RW+" "heavy rain showers." "Sprinkling" is the occasional falling of a few drops of rain. It may be of the "shower" type (falling from cumuliform clouds) or of the "rain" type (falling from stratiform clouds). In either case, "OCNL SPKL" or other appropriate entry in remarks will normally be sufficient, without including "R-" or "RW-" in the body of the report. (A "snow shower" is popularly termed a "snow flurry.") See (*g*) above for reporting showers when precipitation is not actually occurring at the time of observation.

(*j*) *Observations of fog with heavy snow.*—Care should be used in determining whether or not heavy fog occurs with heavy snow. It ordinarily does not occur with heavy snow, but the restricted visibility is often mistakenly attributed to it under these conditions. There are times, however, mostly confined to mountain ridges, when fog is present with snow; rime then invariably results and is a hazardous flight condition.

(*k*) *Rules for reporting snow or rain squalls.*—These will be reported under "Weather." As the names imply, these conditions are intermittent, but when occurring they indicate an important state of turbulence near the surface. If it is snowing, sleeting, or raining at the time of observation and squalls have been experienced at the station within the past 15 minutes, the rain or snow will be entered in the report in the prescribed manner, followed by a report of the squalls, e.g., "Fifteen hundred, overcast, five, moderate rain showers, heavy rain squalls." If it is not raining or snowing at the time of observation, but this is occurring intermittently and squalls have occurred at the station within the past 15 minutes, rain or snow squalls will be reported under "Weather" as a current condition. For example, "Fifteen hundred, overcast, five, heavy snow squalls." Entries of squalls under "Weather" in the report proper will be made only when these are occurring at the station itself. Squalls observed to be occurring at some distance from the station, such as over lakes or mountain ridges, or squalls which are observed to be approaching the station but which have not reached there, will be reported only under "Remarks." "Squalls" will be reported in accordance with the degrees of intensity given below, when brief falls of rain or snow, or brief intensifications of occurring rain or snow, accompanied by fresh or strong gusts of wind, are observed. Since squalls are closely akin to thunderstorm conditions, though not necessarily accompanied by thunder and lightning, the reporting of a "thunderstorm" obviates necessity for reporting "squalls" in the same observation.

TABLE 4.—*Squall-intensity equivalents*

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	Moderate (RQ).....	When the gusts *do not exceed* a velocity of 39 miles per hour.
	Heavy (RQ+).....	When the gusts *exceed* a velocity of 39 miles per hour.
Snow squall.....	Light (SQ-).....	When the gusts *do not exceed* a velocity of 24 miles per hour.
	Moderate (SQ).....	When the gusts *do not exceed* a velocity of 39 miles per hour.
	Heavy (SQ+).....	When the gusts *exceed* a velocity of 39 miles per hour.

(*l*) *Gust velocities to be used as final criterion in estimating degree of intensity of squalls.*—If it should occur that the precipitation occurring with the squall was "light," while the gust velocities would indicate a classification of "heavy" for the squall, or any other combination along these lines should occur, then the gust velocities will be used as the criterion for classification of the degree of intensity of the squall.

(*m*) *Reporting two or more types of precipitation in squalls.*—If two or more kinds of precipitation occur together with the squalls, the predominating type will be given for classification of the squall in the body of the report and a proper note made under "Remarks" concerning the other type or types of precipitation; for example, if rain and snow occurred together, with rain predominating, then rain squalls would be reported in the body of the report, and a remark, such as "snow mixed with rain in squalls," would be added to the report.

(*n*) *Description and rules for reporting wind shifts.*—These are to be reported immediately following the last element of "wind" data whenever the wind has suddenly shifted from a southerly or easterly to a westerly or northerly quadrant, accompanied by gusty winds, rapid dew-point and/or temperature drop, and, in summer, usually lightning and thunder, and possibly hail, intense rain; and in winter, snow squalls at frequent intervals and a rapid lowering or lifting of the ceiling. A westerly or northwesterly wind will continue to blow steadily after it has passed, and the sky will usually clear rapidly and the air feel dryer and cooler, except in a mountainous region. When the wind shifts from an easterly or southerly quadrant to a westerly or northerly quadrant, accompanied by cloudiness or precipitation, it is a strong indication that a wind-shift line has passed the station and the observer should be on the alert for the characteristic changes in other elements of the report in order that the reporting of the wind shift will not be missed. Likewise, if in a mountainous country, cloudiness increases, ceiling lowers, precipitation begins or increases markedly, the dew point—and usually the temperature—drops, and the barometer rises, all within a short period of time, it is a strong indication that a wind-shift line is passing over the station, and the observer should confirm it by noting whether the wind direction changes clockwise, the velocity increases, or whether the direction of low clouds veers. Orographic influences may cause cloudiness, and even dense fog, to continue for several hours after the passage of the wind-shift line. In a flat region dry wind shifts sometimes occur, accompanied by strong winds and blowing dust, which greatly restricts visibility over extensive areas. They thus are a real aviation hazard, not only from the dust but also from the gales attending them. At hourly weather-reporting stations the occurrence of a wind shift will always be the occasion for a special report, while at stations not making special reports the occurrence of a wind shift within the past 6 hours will be reported in the next regular report. In making reports of wind shifts, give the intensity of the shift and the direction the wind was blowing from prior to the shift, followed by the words "wind shift" and the local time on the 24-hour clock, and local time zone; for example, "severe south wind shift fourteen thirty eastern standard." Identify and report wind shifts in the following three degrees:

TABLE 5.—*Wind-shift intensity equivalents*

Kind of wind shift	Specifications for estimating degree of intensity
Mild	(*a*) When precipitation and a lowering of the ceiling occur and the maximum velocity of the wind gusts accompanying the shift does not exceed 24 miles per hour. (*b*) When precipitation and lowering of ceiling do *not* occur and the maximum velocity of the gusts does not exceed 34 miles per hour.
Moderate	(*a*) When precipitation and a lowering of the ceiling occur and the maximum velocity of the wind gust accompanying the shift exceeds 24 miles per hour but does not exceed 39 miles per hour. (*b*) When precipitation and lowering of ceiling do not occur and the maximum velocity of the gusts exceeds 34 miles per hour but does *not* exceed 49 miles per hour.
Severe	(*a*) When precipitation and lowering of the ceiling occur and the maximum velocity of the wind gusts accompanying the shift exceeds 39 miles per hour. (*b*) When precipitation and a lowering of the ceiling do *not* occur and the maximum velocity of the gusts exceeds 49 miles per hour.

NOTE.—There are, of course, other criteria, such as intensity of precipitation, severity of thunderstorms, rapidity with which ceiling and visibility are altered, etc., upon which to base an estimate of the intensity of wind shifts. However, these, in nearly every case, are subordinate to the turbulence and wind occurring in a shift and cannot be used without exception and reservation as absolute factors for determining its intensity.

XV (F) OBSTRUCTIONS TO VISION

2–146. Definition of Obstructions to Vision.—It is commonly known that distant objects are more clearly seen at some times than at others, the degree of this varying quite widely. CONDITIONS CAUSING LIMITATION OF VISION ARE DESIGNATED AS "OBSTRUCTIONS TO VISION," in the meaning of these instructions.

(*n*) *Description and rules for reporting wind shifts.*—These are to be reported immediately following the last element of "wind" data whenever the wind has suddenly shifted from a southerly or easterly to a westerly or northerly quadrant, accompanied by gusty winds, rapid dew-point and/or temperature drop, and, in summer, usually lightning and thunder, and possibly hail, intense rain; and in winter, snow squalls at frequent intervals and a rapid lowering or lifting of the ceiling. A westerly or northwesterly wind will continue to blow steadily after it has passed, and the sky will usually clear rapidly and the air feel dryer and cooler, except in a mountainous region. When the wind shifts from an easterly or southerly quadrant to a westerly or northerly quadrant, accompanied by cloudiness or precipitation, it is a strong indication that a wind-shift line has passed the station and the observer should be on the alert for the characteristic changes in other elements of the report in order that the reporting of the wind shift will not be missed. Likewise, if in a mountainous country, cloudiness increases, ceiling lowers, precipitation begins or increases markedly, the dew point—and usually the temperature—drops, and the barometer rises, all within a short period of time, it is a strong indication that a wind-shift line is passing over the station, and the observer should confirm it by noting whether the wind direction changes clockwise, the velocity increases, or whether the direction of low clouds veers. Orographic influences may cause cloudiness, and even heavy fog, to continue for several hours after the passage of the wind-shift line. In a flat region dry wind shifts sometimes occur, accompanied by strong winds and blowing dust, which greatly restricts visibility over extensive areas. They thus are a real aviation hazard, not only from the dust but also from the gales attending them. At hourly weather-reporting stations the occurrence of a wind shift will always be the occasion for a special report, while at stations not making special reports the occurrence of a wind shift within the past 6 hours will be reported in the next regular report. In making reports of wind shifts, give the intensity of the shift and the direction the wind was blowing from prior to the shift, followed by the words "wind shift" and the local time on the 24-hour clock and local time zone; for example, "heavy south wind shift fourteen thirty eastern standard." Identify and report wind shifts in the following three degrees:

TABLE 5.—*Wind-shift intensity equivalents*

Kind of wind shift	Specifications for estimating degree of intensity
Light	(*a*) When precipitation and a lowering of the ceiling occur and the maximum velocity of the wind gusts accompanying the shift does not exceed 24 miles per hour. (*b*) When precipitation and lowering of ceiling do *not* occur and the maximum velocity of the gusts does not exceed 34 miles per hour.
Moderate	(*a*) When precipitation and a lowering of the ceiling occur and the maximum velocity of the wind gust accompanying the shift exceeds 24 miles per hour but does not exceed 39 miles per hour. (*b*) When precipitation and lowering of ceiling do not occur and the maximum velocity of the gusts exceeds 34 miles per hour but does *not* exceed 49 miles per hour.
Heavy	(*a*) When precipitation and lowering of the ceiling occur and the maximum velocity of the wind gusts accompanying the shift exceeds 39 miles per hour. (*b*) When precipitation and a lowering of the ceiling do *not* occur and the maximum velocity of the gusts exceeds 49 miles per hour.

NOTE.—There are, of course, other criteria, such as intensity of precipitation, severity of thunderstorms, rapidity with which ceiling and visibility are altered, etc., upon which to base an estimate of the intensity of wind shifts. However, these, in nearly every case, are subordinate to the turbulence and wind occurring in a shift and cannot be used without exception and reservation as absolute factors for determining its intensity.

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(*n*) *Description and rules for reporting wind shifts.*—These are to be reported immediately following the last element of "wind" data whenever the wind has suddenly shifted from a southerly or easterly to a westerly or northerly quadrant, accompanied by gusty winds, rapid dew-point and/or temperature drop, and, in summer, usually lightning and thunder, and possibly hail, intense rain; and in winter, snow squalls at frequent intervals and a rapid lowering or lifting of the ceiling. A westerly or northwesterly wind will continue to blow steadily after it has passed, and the sky will usually clear rapidly and the air feel dryer and cooler, except in a mountainous region. When the wind shifts from an easterly or southerly quadrant to a westerly or northerly quadrant, accompanied by cloudiness or precipitation, it is a strong indication that a wind-shift line has passed the station and the observer should be on the alert for the characteristic changes in other elements of the report in order that the reporting of the wind shift will not be missed. Likewise, if in a mountainous country, cloudiness increases, ceiling lowers, precipitation begins or increases markedly, the dew point—and usually the temperature—drops, and the barometer rises, all within a short period of time, it is a strong indication that a wind-shift line is passing over the station, and the observer should confirm it by noting whether the wind direction changes clockwise, the velocity increases, or whether the direction of low clouds veers. Orographic influences may cause cloudiness, and even dense fog, to continue for several hours after the passage of the wind-shift line. In a flat region dry wind shifts sometimes occur, accompanied by strong winds and blowing dust, which greatly restricts visibility over extensive areas. They thus are a real aviation hazard, not only from the dust but also from the gales attending them. At hourly weather-reporting stations the occurrence of a wind shift will always be the occasion for a special report, while at stations not making special reports the occurrence of a wind shift within the past 6 hours will be reported in the next regular report. In making reports of wind shifts, give the intensity of the shift and the direction the wind was blowing from prior to the shift, followed by the words "wind shift" and the local time on the 24-hour clock, and local time zone; for example, "severe south wind shift fourteen thirty eastern standard." Identify and report wind shifts in the following three degrees:

TABLE 5.—*Wind-shift intensity equivalents*

Kind of wind shift	Specifications for estimating degree of intensity
Mild	(*a*) When precipitation and a lowering of the ceiling occur and the maximum velocity of the wind gusts accompanying the shift does not exceed 24 miles per hour. (*b*) When precipitation and lowering of ceiling do *not* occur and the maximum velocity of the gusts does not exceed 34 miles per hour.
Moderate	(*a*) When precipitation and a lowering of the ceiling occur and the maximum velocity of the wind gust accompanying the shift exceeds 24 miles per hour but does not exceed 39 miles per hour. (*b*) When precipitation and lowering of ceiling do not occur and the maximum velocity of the gusts exceeds 34 miles per hour but does *not* exceed 49 miles per hour.
Severe	(*a*) When precipitation and lowering of the ceiling occur and the maximum velocity of the wind gusts accompanying the shift exceeds 39 miles per hour. (*b*) When precipitation and a lowering of the ceiling do *not* occur and the maximum velocity of the gusts exceeds 49 miles per hour.

NOTE.—There are, of course, other criteria, such as intensity of precipitation, severity of thunderstorms, rapidity with which ceiling and visibility are altered, etc., upon which to base an estimate of the intensity of wind shifts. However, these, in nearly every case, are subordinate to the turbulence and wind occurring in a shift and cannot be used without exception and reservation as absolute factors for determining its intensity.

XV (F) —OBSTRUCTIONS TO VISION

2–146. Definition of Obstructions to Vision.—It is commonly known that distant objects are more clearly seen at some times than at others, the degree of this varying quite widely. CONDITIONS CAUSING LIMITATION OF VISION ARE DESIGNATED AS "OBSTRUCTIONS TO VISION," in the meaning of these instructions.

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2–147. Precipitation as an Obstruction to Vision.—From the foregoing it will be seen that, strictly speaking, any form of precipitation is an obstruction to vision. When, therefore, precipitation is reported to be occurring with no other vision-limiting factor being reported it will be assumed by all using the report that the precipitation is the only obstruction to vision present. Strict agreement of any type of obstruction to vision or of any type of precipitation defined in terms of visibility with the visibility reported is required when each is occurring alone.

2–148. Use of Instruments in Observing Obstructions to Vision.—All observations of obstructions to vision are made without the aid of instruments.

2–149. Rules for Observing and Reporting Obstructions to Vision.—Obstructions to vision are to be observed and reported, when appropriate, immediately following "Weather" or following "Visibility" if no "Weather" is reported, in accordance with the following:

(*a*) *Point of observation.*—All observations will be taken at a point on the ground from which a view in all directions may be had. If this is not possible, then the observations should be taken from the lowest elevation possible, and the observer should move about until he has had a clear view in all directions.

(*b*) *Reporting obstructions to vision when prevailing visibility is more than 6 miles.*—If the visibility is more than 6 miles over most of the horizon, no mention should be made under "obstructions to vision" of any obstructions present, except that if the visibility is 6 miles or less in one or more directions and this is one-half or less than the average in all directions, this fact will be reported under "Remarks," e. g., "Fog bank southeast, visibility 2," "Visibility 3 north, smoke," etc.

(*c*) *Reporting obstructions to vision when prevailing visibility is 6 miles or less.*—If the prevailing visibility is 6 miles or less, the cause of the restricted vision must be reported, unless precipitation is the only vision-limiting factor present and has previously been reported under "Weather."

(*d*) *Identifying and reporting types and degrees of intensity of obstructions to vision.*—Identify and report "obstructions to vision" when these are occurring in accordance with the following table. When any of the conditions listed therein are present in such a degree as to reduce the visibility to less than one-fifth mile and preclude direct observation of the sky, the "ceiling" shall be reported as "zero."

TABLE 6.—*Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Dry haze.—Dust or salt particles which are dry and so extremely small that they cannot be felt or discovered individually by the unaided eye; however they diminish the visibility and give a characteristic smoky (hazy and opalescent) appearance to the air. This phenomenon produces a uniform veil over the landscape and subdues its colors. This veil has a bluish tinge when viewed against a dark background such as a mountain, but has a dirty yellow or orange tinge against a bright background, such as the sun, clouds at the horizon, or snow-capped mountain peaks. It is thus distinguished from grayish light fog, the thickness of which it may sometimes attain.	Hazy (H)	When there is an obstruction to vision present which limits the visibility to 6 miles or less and which cannot be identified as any other obstruction to vision, such as, smoke, dust, fog, etc.

2–147. Precipitation as an Obstruction to Vision.—From the foregoing it will be seen that, strictly speaking, any form of precipitation is an obstruction to vision. When, therefore, precipitation is reported to be occurring with no other vision-limiting factor being reported it will be assumed by all using the report that the precipitation is the only obstruction to vision present. Strict agreement of any type of obstruction to vision or of any type of precipitation defined in terms of visibility with the visibility reported is required when each is occurring alone.

2–148. Use of Instruments in Observing Obstructions to Vision.—All observations of obstructions to vision are made without the aid of instruments.

2–149. Rules for Observing and Reporting Obstructions to Vision.—Obstructions to vision are to be observed and reported, when appropriate, immediately following "Weather" or following "Visibility" if no "Weather" is reported, in accordance with the following:

(*a*) *Point of observation.*—All observations will be taken at a point on the ground from which a view in all directions may be had. If this is not possible, then the observations should be taken from the lowest elevation possible, and the observer should move about until he has had a clear view in all directions.

(*b*) *Reporting obstructions to vision when prevailing visibility is more than 6 miles.*—If the visibility is more than 6 miles over most of the horizon, no mention should be made under "obstructions to vision" of any obstructions present, except that if the visibility is 6 miles or less in one or more directions and this is one-half or less than the average in all directions, this fact will be reported under "Remarks," e. g., "Fog bank southeast, visibility 2," "Visibility 3 north, smoke," etc.

(*c*) *Reporting obstructions to vision when prevailing visibility is 6 miles or less.*—If the prevailing visibility is 6 miles or less, the cause of the restricted vision must be reported, unless precipitation is the only vision-limiting factor present and has previously been reported under "Weather."

(*d*) *Identifying and reporting types and degrees of intensity of obstructions to vision.*—Identify and report "obstructions to vision" when these are occurring in accordance with the following table. When any of the conditions listed therein are present in such a degree as to reduce the visibility to less than one-fourth mile and preclude direct observation of the sky, the "ceiling" shall be reported as "zero."

TABLE 6.—*Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Dry haze. Dust or salt particles which are dry and so extremely small that they cannot be felt or discovered individually by the unaided eye; however they diminish the visibility and give a characteristic smoky (hazy and opalescent) appearance to the air. This phenomenon produces a uniform veil over the landscape and subdues its colors. This veil has a bluish tinge when viewed against a dark background such as a mountain, but has a dirty yellow or orange tinge against a bright background, such as the sun, clouds at the horizon, or snow-capped mountain peaks. It is thus distinguished from grayish light fog, the thickness of which it may sometimes attain.	Hazy (H)	When there is an obstruction to vision present which limits the visibility to 6 miles or less and which cannot be identified as any other obstruction to vision, such as, smoke, dust, fog, etc.

2–147. Precipitation as an Obstruction to Vision.—From the foregoing it will be seen that, strictly speaking, any form of precipitation is an obstruction to vision. When, therefore, precipitation is reported to be occurring with no other vision-limiting factor being reported it will be assumed by all using the report that the precipitation is the only obstruction to vision present. Strict agreement of any type of obstruction to vision or of any type of precipitation defined in terms of visibility with the visibility reported is required when each is occurring alone.

2–148. Use of Instruments in Observing Obstructions to Vision.—All observations of obstructions to vision are made without the aid of instruments.

2–149. Rules for Observing and Reporting Obstructions to Vision.—Obstructions to vision are to be observed and reported, when appropriate, immediately following "Weather" or following "Visibility" if no "Weather" is reported, in accordance with the following:

(*a*) *Point of observation.*—All observations will be taken at a point on the ground from which a view in all directions may be had. If this is not possible, then the observations should be taken from the lowest elevation possible, and the observer should move about until he has had a clear view in all directions.

(*b*) *Reporting obstructions to vision when prevailing visibility is more than 6 miles.*—If the visibility is more than 6 miles over most of the horizon, no mention should be made under "obstructions to vision" of any obstructions present, except that if the visibility is 6 miles or less in one or more directions and this is one-half or less than the average in all directions, this fact will be reported under "Remarks," e. g., "Fog bank southeast, visibility 2," "Visibility 3 north, smoke," etc.

(*c*) *Reporting obstructions to vision when prevailing visibility is 6 miles or less.*—If the prevailing visibility is 6 miles or less, the cause of the restricted vision must be reported, unless precipitation is the only vision-limiting factor present and has previously been reported under "Weather."

(*d*) *Identifying and reporting types and degrees of intensity of obstructions to vision.*—Identify and report "obstructions to vision" when these are occurring in accordance with the following table. When any of the conditions listed therein are present in such a degree as to reduce the visibility to less than one-fifth mile and preclude direct observation of the sky, the "ceiling" shall be reported as "zero."

TABLE 6.—*Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Dry haze.—Dust or salt particles which are dry and so extremely small that they cannot be felt or discovered individually by the unaided eye; however they diminish the visibility and give a characteristic smoky (hazy and opalescent) appearance to the air. This phenomenon produces a uniform veil over the landscape and subdues its colors. This veil has a bluish tinge when viewed against a dark background such as a mountain, but has a dirty yellow or orange tinge against a bright background, such as the sun, clouds at the horizon, or snow-capped mountain peaks. It is thus distinguished from grayish light fog, the thickness of which it may sometimes attain.	Hazy (H)	When there is an obstruction to vision present which limits the visibility to 6 miles or less and which cannot be identified as any other obstruction to vision, such as, smoke, dust, fog, etc.

TABLE 6. - *Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Smoke.—The presence of particles of foreign matter in the air resulting from combustion. In light amounts, it may be confused with haze or fog but usually can be easily differentiated from these by its odor. Sun's disk at sunrise and sunset is very red and during daytime has a reddish tinge. Smoke from a distance, such as from forest fires, usually is of light grayish or bluish color and evenly distributed in the upper air. City smoke may be brown, dark gray, or black.	Light (K−)	When smoke is present *alone* and objects are visible at 1¼ miles or more.
	Moderate (K)	When smoke is present *alone*, and objects are visible at ⅝ but not at 1¼ miles. Visibility to be reported as ¾ or 1 mile.
	Thick (K+)	When smoke is present *alone* and objects are not visible at ⅝ mile, visibility to be reported as ½, ¼, ⅕, ⅛, or zero miles.
Dust.—The presence of particles of foreign matter uniformly distributed in the air, but not being picked up from the surface locally, consisting essentially of finely divided earth, such as clay, loam, and humus. It imparts (usually) a tannish or grayish hue to distant objects. The sun's disk is pale and colorless or has perhaps a yellow tinge at all periods of the day. Depositions of dust may be observed on shiny surfaces and when rain or drizzle occur, a muddy residue on car finishes, windows, etc., may be noted.	Light (D−)	When dust is present *alone* and objects are visible at 1¼ miles or more.
	Moderate (D)	When dust is present *alone* and objects are visible at ⅝ but not at 1¼ miles. Visibility to be reported as ¾ or 1 mile.
	Thick (D+)	When dust is present alone and objects are not visible at ⅝ mile. Visibility to be reported as ½, ¼, ⅕, ⅛, or zero miles.
Blowing snow.—When snow is picked up from the surface by the wind and blown about in clouds or sheets. Care must be taken not to record this element as such when the snow is actually falling from a cloud layer. The snow is carried so high that the vertical visibility is reduced considerably.	Light (BS−)	When the condition described is occurring *alone* and objects are visible at ⅝ mile or more. Visibility to be reported as ¾ mile or more.
	Moderate (BS)	When the condition described is occuring *alone* and objects are visible at 5/16 but not at ⅝ mile. Visibility to be reported as ½ mile.
	Thick (BS+)	When the condition described is occurring *alone* and objects are not visible at 5/16 mile. Visibility to be reported as ¼, ⅙, ⅛, or zero miles.
Drifting snow.—Snow raised from the ground and carried by the wind, so that the horizontal visibility becomes reduced although no real precipitation is falling. The snow is drifting so low above the ground that the vertical visibility is not appreciably diminished. (Distinguished from "blowing snow" by the vertical visibility.)	Light drifting snow (GS−).	Same as "light blowing snow."
	Moderate drifting snow (GS).	Same as "moderate blowing snow."
	Thick drifting snow (GS+).	Same as "thick blowing snow."
Blowing dust.—When dust is picked up from the surface by the wind and blown about in clouds or sheets.	Light (BD−)	Same as "light dust."
	Moderate (BD)	Same as "moderate dust."
	Thick (BD+) [1]	Same as "thick dust."
Blowing sand.—When sand is picked up from the surface by the wind and blown about in clouds or sheets.	Light (BN−)	Same as "light dust."
	Moderate (BN)	Same as "moderate dust."
	Thick (BN+) [1]	Same as "thick dust."

[1] "Thick blowing dust," "thick blowing sand" are descriptive terms used, respectively, to indicate "duststorm" and "sandstorm."

TABLE 6.—*Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Smoke.—The presence of particles of foreign matter in the air resulting from combustion. In light amounts, it may be confused with haze or fog but usually can be easily differentiated from these by its odor. Sun's disk at sunrise and sunset is very red and during daytime has a reddish tinge. Smoke from a distance, such as from forest fires, usually is of light grayish or bluish color and evenly distributed in the upper air. City smoke may be brown, dark gray, or black.	Light (K−)	When smoke is present *alone* and objects are visible at ⅝ mile or more.
	Moderate (K)	When smoke is present *alone*, and objects are visible at 5/16 but not at ⅝ mile.
	Heavy (K+)	When smoke is present *alone* and objects are not visible at 5/16 mile.
Dust.—The presence of particles of foreign matter uniformly distributed in the air, but not being picked up from the surface locally, consisting essentially of finely divided earth, such as clay, loam, and humus. It imparts (usually) a tannish or grayish hue to distant objects. The sun's disk is pale and colorless or has perhaps a yellow tinge at all periods of the day. Depositions of dust may be observed on shiny surfaces and when rain or drizzle occur, a muddy residue on car finishes, windows, etc., may be noted.	Light (D−)	When dust is present *alone* and objects are visible at ⅝ mile or more.
	Moderate (D)	When dust is present *alone* and objects are visible at 5/16 but not at ⅝ miles.
	Heavy (D+)	When dust is present alone and objects are not visible at 5/16 mile.
Blowing snow.—When snow is picked up from the surface by the wind and blown about in clouds or sheets. Care must be taken not to record this element as such when the snow is actually falling from a cloud layer. The snow is carried so high that the vertical visibility is reduced considerably.	Light (BS−)	When the condition described is occurring *alone* and objects are visible at ⅝ mile or more.
	Moderate (BS)	When the condition described is occuring *alone* and objects are visible at 5/16 but not at ⅝ mile.
	Heavy (BS+)	When the condition described is occurring *alone* and objects are not visible at 5/16 mile.
Drifting snow.—Snow raised from the ground and carried by the wind, so that the horizontal visibility becomes reduced although no real precipitation is falling. The snow is drifting so low above the ground that the vertical visibility is not appreciably diminished. (Distinguished from "blowing snow" by the vertical visibility.)	Light drifting snow (GS−).	Same as "light blowing snow."
	Moderate drifting snow (GS).	Same as "moderate blowing snow."
	Heavy drifting snow (GS+).	Same as "heavy blowing snow."
Blowing dust.—When dust is picked up from the surface by the wind and blown about in clouds or sheets.	Light (BD−)	Same as "light dust."
	Moderate (BD)	Same as "moderate dust."
	Heavy (BD+) [1]	Same as "heavy dust."
Blowing sand.—When sand is picked up from the surface by the wind and blown about in clouds or sheets.	Light (BN−)	Same as "light dust."
	Moderate (BN)	Same as "moderate dust."
	Heavy (BN+) [1]	Same as "heavy dust."

[1] "Heavy blowing dust," "heavy blowing sand" are descriptive terms used, respectively, to indicate "duststorm" and "sandstorm."

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	Moderate (K)	When smoke is present *alone*, and objects are visible at ⅝ but not at 1¼ miles. Visibility to be reported as ¾ or 1 mile.
	Thick (K+)	When smoke is present *alone* and objects are not visible at ⅝ mile, visibility to be reported as ½, ¼, ⅕, ⅛, or zero miles.
Dust.—The presence of particles of foreign matter uniformly distributed in the air, but not being picked up from the surface locally, consisting essentially of finely divided earth, such as clay, loam, and humus. It imparts (usually) a tannish or grayish hue to distant objects. The sun's disk is pale and colorless or has perhaps a yellow tinge at all periods of the day. Depositions of dust may be observed on shiny surfaces and when rain or drizzle occur, a muddy residue on car finishes, windows, etc., may be noted.	Light (D−)	When dust is present *alone* and objects are visible at 1¼ miles or more.
	Moderate (D)	When dust is present *alone* and objects are visible at ⅝ but not at 1¼ miles. Visibility to be reported as ¾ or 1 mile.
	Thick (D+)	When dust is present alone and objects are not visible at ⅝ mile. Visibility to be reported as ½, ¼, ⅕, ⅛, or zero miles.
Blowing snow.—When snow is picked up from the surface by the wind and blown about in clouds or sheets. Care must be taken not to record this element as such when the snow is actually falling from a cloud layer. The snow is carried so high that the vertical visibility is reduced considerably.	Light (BS−)	When the condition described is occurring *alone* and objects are visible at ⅝ mile or more. Visibility to be reported as ¾ mile or more.
	Moderate (BS)	When the condition described is occuring *alone* and objects are visible at 5/16 but not at ⅝ mile. Visibility to be reported as ½ mile.
	Thick (BS+)	When the condition described is occurring *alone* and objects are not visible at 5/16 mile. Visibility to be reported as ¼, ⅕, ⅛, or zero miles.
Drifting snow.—Snow raised from the ground and carried by the wind, so that the horizontal visibility becomes reduced although no real precipitation is falling. The snow is drifting so low above the ground that the vertical visibility is not appreciably diminished. (Distinguished from "blowing snow" by the vertical visibility.)	Light drifting snow (GS−).	Same as "light blowing snow."
	Moderate drifting snow (GS).	Same as "moderate blowing snow."
	Thick drifting snow (GS+).	Same as "thick blowing snow."
Blowing dust.—When dust is picked up from the surface by the wind and blown about in clouds or sheets.	Light (BD−)	Same as "light dust."
	Moderate (BD)	Same as "moderate dust."
	Thick (BD+) [1]	Same as "thick dust."
Blowing sand.—When sand is picked up from the surface by the wind and blown about in clouds or sheets.	Light (BN−)	Same as "light dust."
	Moderate (BN)	Same as "moderate dust."
	Thick (BN+) [1]	Same as "thick dust."

[1] "Thick blowing dust," "thick blowing sand" are descriptive terms used, respectively, to indicate "duststorm" and "sandstorm."

TABLE 6.—*Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Damp haze.—Small water droplets or very hygroscopic particles suspended in the atmosphere, but the horizontal range of visibility is usually considerably more than 1¼ miles. Similar to a very thin fog, but the droplets or particles are more scattered than in light fog and presumably also smaller. This phenomenon is usually distinguished from dry haze by its grayish color, the "greasy" appearance of clouds seen through it as though viewed through a dirty window pane, and the generally high relative humidity. Commonly observed on seacoasts and in Southern States, most frequently with onshore winds and in the vicinity of tropical disturbances. A common mode of formation is the carrying up to high levels of particles from salt-water spray in windy weather. In contrast, light fog is more commonly observed when there is little movement of the surface air. Since "damp haze" normally develops in oceanic regions, it should only be reported in such regions and in contiguous land areas when the winds have had an opportunity to transport the "damp haze" condition from the scene of its natural development.	Damp haze (F— —)	Same as "dry haze."
Fog.—Water vapor condensed to minute water droplets in the lower part of the atmosphere and interfering with its transparency. It differs from cloud only in its being near or at the surface. It is easily distinguished from haze by its essential wetness.	Light (F—)	When fog is present *alone* and objects are visible at ⅝ mile or more. Visibility to be reported as 3/4, 1, 1 1/4, 1 1/2, etc., miles.
	Moderate (F)	When fog is present *alone* and objects are visible at 5/16 mile but not at ⅝ mile. Visibility to be reported as 1/2 mile.
	Thick (F+)	When fog is present alone and objects are visible at ⅕ mile but not at 5/16 mile. Visibility to be reported as 1/4 or 1/5 mile.
	Dense (FF)	When fog is present *alone* and objects are not visible at ⅕ mile. Visibility to be reported as 1/8 or zero miles.
Ice fog.—The occurrence of fog in the form of ice crystals, or spicules, usually under conditions of clear, windless weather, and low temperature. Occurrence most frequent in the higher latitudes. Sun usually visible but horizontal visibility considerably restricted. Colloquially termed "frost in air," "frozen fog," etc.	Light (IF—)	Same as "light fog."
	Moderate (IF)	Same as "moderate fog."
	Thick (IF+)	Same as "thick fog."
	Dense (IFF)	Same as "dense fog." NOTE.—If "sky" is given with "dense ice fog," it will be understood that the condition is similar to "dense ground fog."

TABLE 6.—*Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Damp haze.—Small water droplets or very hygroscopic particles suspended in the atmosphere, but the horizontal range of visibility is usually considerably more than 1¼ miles. Similar to a very thin fog, but the droplets or particles are more scattered than in light fog and presumably also smaller. This phenomenon is usually distinguished from dry haze by its grayish color, the "greasy" appearance of clouds seen through it as though viewed through a dirty window pane, and the generally high relative humidity. Commonly observed on seacoasts and in Southern States, most frequently with onshore winds and in the vicinity of tropical disturbances. A common mode of formation is the carrying up to high levels of particles from salt-water spray in windy weather. In contrast, light fog is more commonly observed when there is little movement of the surface air. Since "damp haze" normally develops in oceanic regions, it should only be reported in such regions and in contiguous land areas when the winds have had an opportunity to transport the "damp haze" condition from the scene of its natural development.	Damp haze (F— —)	Same as "dry haze."
Fog.—Water vapor condensed to minute water droplets in the lower part of the atmosphere and interfering with its transparency. It differs from cloud only in its being near or at the surface. It is easily distinguished from haze by its essential wetness.	Light (F—)	When fog is present *alone* and objects are visible at ⅝ mile or more.
	Moderate (F)	When fog is present *alone* and objects are visible at 5/16 mile but not at ⅝ mile.
	Heavy (F+)	When fog is present alone and objects are not visible at 5/16 mile.
Ice fog.—The occurrence of fog in the form of ice crystals, or spicules, usually under conditions of clear, windless weather, and low temperature. Occurrence most frequent in the higher latitudes. Sun usually visible but horizontal visibility considerably restricted. Colloquially termed "frost in air," "frozen fog," etc.	Light (IF—) Moderate (IF) Heavy (IF+)	Same as "light fog." Same as "moderate fog." Same as "heavy fog." NOTE.—If "sky" is given with "heavy ice fog," it will be understood that the condition is similar to "heavy ground fog."

TABLE 6.—*Obstructions to vision intensity equivalents*

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Damp haze.—Small water droplets or very hygroscopic particles suspended in the atmosphere, but the horizontal range of visibility is usually considerably more than 1¼ miles. Similar to a very thin fog, but the droplets or particles are more scattered than in light fog and presumably also smaller. This phenomenon is usually distinguished from dry haze by its grayish color, the "greasy" appearance of clouds seen through it as though viewed through a dirty window pane, and the generally high relative humidity. Commonly observed on seacoasts and in Southern States, most frequently with onshore winds and in the vicinity of tropical disturbances. A common mode of formation is the carrying up to high levels of particles from salt-water spray in windy weather. In contrast, light fog is more commonly observed when there is little movement of the surface air. Since "damp haze" normally develops in oceanic regions, it should only be reported in such regions and in contiguous land areas when the winds have had an opportunity to transport the "damp haze" condition from the scene of its natural development.	Damp haze (F——)	Same as "dry haze."
Fog.—Water vapor condensed to minute water droplets in the lower part of the atmosphere and interfering with its transparency. It differs from cloud only in its being near or at the surface. It is easily distinguished from haze by its essential wetness.	Light (F—)	When fog is present *alone* and objects are visible at ⅝ mile or more. Visibility to be reported as 3/4, 1, 1 1/4, 1 1/2, etc., miles.
	Moderate (F)	When fog is present *alone* and objects are visible at 5/16 mile but not at ⅝ mile. Visibility to be reported as 1/2 mile.
	Thick (F+)	When fog is present alone and objects are visible at ⅛ mile but not at 5/16 mile. Visibility to be reported as 1/4 or 1/5 mile.
	Dense (FF)	When fog is present *alone* and objects are not visible at ⅛ mile. Visibility to be reported as 1/8 or zero miles.
Ice fog.—The occurrence of fog in the form of ice crystals, or spicules, usually under conditions of clear, windless weather, and low temperature. Occurrence most frequent in the higher latitudes. Sun usually visible but horizontal visibility considerably restricted. Colloquially termed "frost in air," "frozen fog," etc.	Light (IF—)	Same as "light fog."
	Moderate (IF)	Same as "moderate fog."
	Thick (IF+)	Same as "thick fog."
	Dense (IFF)	Same as "dense fog." NOTE.—If "sky" is given with "dense ice fog," it will be understood that the condition is similar to "dense ground fog."

TABLE 6.—*Obstructions to vision intensity equivalents*—Continued

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Ground fog.—Same as fog, except that it is in the form of a shallow layer, through which the sky, clouds, or heavenly bodies at night, may be observed. When reported, the sky conditions and actual visibility will also be reported. The ceiling will be reported in the same manner as if no fog of any kind were present, and in no case will the ceiling be reported as "zero" in the same observation in which "ground fog" is also reported.	Light (GF−) Moderate (GF) Thick (GF+) Dense (GFF)	Same as "light fog." Same as "moderate fog." Same as "thick fog." Same as "dense fog." NOTE.—"Alone" as used in the above specifications means that no precipitation of any type, or any other type of obstruction to vision is occurring in combination with the condition described.

NOTE.—If haze, smoke, or dust is observed aloft with evidence of less visibility vertically than horizontally, a remark "Thick dust, smoke, or haze aloft, sky condition questionable," should be added to the report.

(*e*) *Method of reporting combinations of obstructions to vision (including precipitation)*.—When combinations of obstructions to vision (including precipitation) occur, the following rules will apply:

1. If two obstructions are present, one being precipitation, both will be reported (the precipitation being entered first), with the intensity ascribed to the precipitation being determined on a "rate-of-fall" basis, irrespective of whether or not its degrees of intensity (see table 3) are defined in terms of visibility. The degree of intensity then ascribed to the obstruction to vision shall correspond to the prevailing visibility. For example, if the observer adjudges on a "rate-of-fall" basis that "light snow" is falling, and fog is occurring, with the visibility being one-fourth mile, then he would report "light snow, thick fog."

2. ~~The same rules as given under "1" above would apply in cases where three types of obstructions were occurring together, two being precipitation. For example, with rain and snow falling together, fog present, and the visibility being one-fifth mile, the observer adjudges on a "rate-of-fall" basis that the rain is "light" and the snow "moderate," he would report "moderate snow, light rain, thick fog."~~ Cancelled 7-1-45.

3. If two or more types of obstructions to vision are positively identified as occurring together, none of them being precipitation, all will be reported, the predominating type being placed first, the lesser type(s) following this, with the degree of intensity ascribed to the predominant type corresponding to the prevailing visibility and that ascribed to the lesser type(s) being judged as well as possible by the observer from actual observation of the condition. If, for example, two types, fog and smoke are occurring together, fog being the predominant type, and there is smoke mixed with the fog, which the observer judges to be "light," the visibility being one-half mile, he would report "moderate fog, light smoke."

2–150. Importance of Proper Reporting of Fog.—The importance of the proper reporting of fog and ground fog can hardly be overemphasized from an airway viewpoint, and all observers are expected to be diligent in the observation of these phenomena.

2–151. Relation of Fog and Dew Point.—For the guidance of those stations equipped to make psychrometric observations, fog rarely, if every, is present in an area where the depression of the dew point exceeds 4°. This is particularly true as regards the formation stage of fog.

TABLE 6.—*Obstructions to vision intensity equivalents*—Continued

Kind of obstruction	Term to be used in reporting	Specifications for estimating degree of intensity
Ground fog.—Same as fog, except that it is in the form of a shallow layer, through which the sky, clouds, or heavenly bodies at night, may be observed. When reported, the sky conditions and actual visibility will also be reported. The ceiling will be reported in the same manner as if no fog of any kind were present, and in no case will the ceiling be reported as "zero" in the same observation in which "ground fog" is also reported.	Light (GF−) Moderate (GF) Heavy (GF+)	Same as "light fog." Same as "moderate fog." Same as "heavy fog." NOTE.—"Alone" as used in the above specifications means that no precipitation of any type, or any other type of obstruction to vision is occurring in combination with the condition described.

NOTE.—If haze, smoke, or dust is observed aloft with evidence of less visibility vertically than horizontally, a remark "Heavy dust, smoke, or haze aloft, sky condition questionable," should be added to the report.

(*e*) *Method of reporting combinations of obstructions to vision (including precipitation)*.—When combinations of obstructions to vision (including precipitation) occur, the following rules will apply:

1. If two obstructions are present, one being precipitation, both will be reported (the precipitation being entered first), with the intensity ascribed to the precipitation being determined on a "rate-of-fall" basis, irrespective of whether or not its degrees of intensity (see table 3) are defined in terms of visibility. The degree of intensity then ascribed to the obstruction to vision shall correspond to the prevailing visibility. For example, if the observer adjudges on a "rate-of-fall" basis that "light snow" is falling, and fog is occurring, with the visibility being one-fourth mile, then he would report "light snow, heavy fog."

2. The same rules as given under "1" above would apply in cases where three types of obstructions were occurring together, two being precipitation. For example, with rain and snow falling together, fog present, and the visibility being one-fourth mile, the observer adjudges on a "rate-of-fall" basis that the rain is "light" and the snow "moderate," he would report "moderate snow, light rain, heavy fog."

3. If two or more types of obstructions to vision are positively identified as occurring together, none of them being precipitation, all will be reported, the predominating type being placed first, the lesser type(s) following this, with the degree of intensity ascribed to the predominant type corresponding to the prevailing visibility and that ascribed to the lesser type(s) being judged as well as possible by the observer from actual observation of the condition. If, for example, two types, fog and smoke are occurring together, fog being the predominant type, and there is smoke mixed with the fog, which the observer judges to be "light," the visibility being one-half mile, he would report "moderate fog, light smoke."

2-150. Importance of Proper Reporting of Fog.—The importance of the proper reporting of fog and ground fog can hardly be overemphasized from an airway viewpoint, and all observers are expected to be diligent in the observation of these phenomena.

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XV (G)—TEMPERATURE

NOTE.—Meteorological sea-level barometric pressure will be entered in reports ahead of temperature. Instructions concerning obtaining and reporting it will be found in paragraphs 2-162 and 2-163.

2-152. Importance and Definition of Temperature.—The temperature of the air is of interest and importance in flying operations from the viewpoint of determining whether icing conditions will exist, determining the mixture ratios for operation of aircraft engines in taking off and landing, being prepared for slow or fast landings according to whether the air immediately over the airport is unusually heated and rarefied or unusually cold and dense, etc. Also, it is extremely important in airway and other forecasting work. Accordingly, it is essential that it be observed and reported properly. For the purpose of these instructions, the TEMPERATURE IS DEFINED AS THE CONDITION OF THE AIR WITH RESPECT TO HEAT, I. E., THE DEGREE OF HEAT EXPRESSED IN FIGURES.

2-153. Method of Measuring Temperature.—Temperature is measured for use in airway weather reports by readings of a standard Weather Bureau Fahrenheit thermometer, exposed in a shelter so located as to protect the thermometer from the direct rays of the sun during the day and radiation at night.

2-154. Instructions for Observing and Reporting Temperature.—The following instructions will govern the observing and reporting of the temperature element:

(*a*) *Method of obtaining temperature from readings of thermometer.*—The thermometer will be read to degrees and *tenths* of a degree, the number of tenths to be determined from eye estimate by the observer. In doing this it is highly important, in the interest of accurate readings, that the eye of the observer be on a line perpendicular to the thermometer at the top of the mercury or alcohol column. If this is not done erroneous readings up to one-half degree or more will result, owing to the foreshortening of the column when seen from any considerable angle. In determining the temperature indicated by the thermometer, the following two rules will apply:

1. *When the temperature is above zero*, estimate the number of tenths, if any, that the mercury or alcohol column stands above the lower degree mark involved (the "lower degree mark" referred to is the one toward the bulb of the thermometer in all cases) and add these to the value of the lower degree mark. For example, if the top of the mercury or alcohol column stands half way between the 75° and 76° marks, the reading would be 75.5°; if it stood three-tenths of the way between 0° and 1°, the reading would be 0.3°, etc.

2. *When the temperature is below zero*, estimate the number of tenths, if any, that the top of the mercury or alcohol column stands above the lower degree mark involved and subtract these from the numerical value of the lower degree mark. For example, if the top of the mercury or alcohol column stands seven-tenths of a degree above the −4° graduation, the reading would be −3.3°; if four-tenths of a degree above the −1° graduation, the reading would be −0.6°, etc.

(*b*) *Methods of applying instrumental corrections to thermometer readings.*—The above rules will apply to the readings of both the wet- and dry-bulb thermometers of a psychrometer at places where this instrument is used for obtaining the current and wet-bulb temperatures. However, a correction for instrumental error must be applied to mercurial or alcohol thermometers under certain conditions, irrespective of whether used as a wet- or dry-bulb thermometer, in order that the readings will indicate the true dry or wet temperature. Correction cards are supplied with each thermometer, and the cards for the thermometers in use should either be kept on the observation desk or duplicates made and posted in the instrument shelter for ready reference. The

XV (G)—TEMPERATURE

NOTE.—Meteorological sea-level barometric pressure will be entered in reports ahead of temperature. Instructions concerning obtaining and reporting it will be found in paragraphs 2-162 and 2-163.

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2-154. Instructions for Observing and Reporting Temperature.—The following instructions will govern the observing and reporting of the temperature element:

(*a*) *Method of obtaining temperature from readings of thermometer.*—The thermometer will be read to degrees and *tenths* of a degree, the number of tenths to be determined from eye estimate by the observer. In doing this it is highly important, in the interest of accurate readings, that the eye of the observer be on a line perpendicular to the thermometer at the top of the mercury or alcohol column. If this is not done erroneous readings up to one-half degree or more will result, owing to the foreshortening of the column when seen from any considerable angle. In determining the temperature indicated by the thermometer, the following two rules will apply:

1. *When the temperature is above zero*, estimate the number of tenths, if any, that the mercury or alcohol column stands above the lower degree mark involved (the "lower degree mark" referred to is the one toward the bulb of the thermometer in all cases) and add these to the value of the lower degree mark. For example, if the top of the mercury or alcohol column stands half way between the 75° and 76° marks, the reading would be 75.5°; if it stood three-tenths of the way between 0° and 1°, the reading would be 0.3°, etc.

2. *When the temperature is below zero*, estimate the number of tenths, if any, that the top of the mercury or alcohol column stands above the lower degree mark involved and subtract these from the numerical value of the lower degree mark. For example, if the top of the mercury or alcohol column stands seven-tenths of a degree above the −4° graduation, the reading would be −3.3°; if four-tenths of a degree above the −1° graduation, the reading would be −0.6°, etc.

(*b*) *Methods of applying instrumental corrections to thermometer readings.*—The above rules will apply to the readings of both the wet- and dry-bulb thermometers of a psychrometer at places where this instrument is used for obtaining the current and wet-bulb temperatures. However, a correction for instrumental error must be applied to mercurial or alcohol thermometers under certain conditions, irrespective of whether used as a wet- or dry-bulb thermometer, in order that the readings will indicate the true dry or wet temperature. Correction cards are supplied with each thermometer, and the cards for the thermometers in use should either be kept on the observation desk or duplicates made and posted in the instrument shelter for ready reference. The

corrections for instrumental error, as contained on the correction card for any particular thermometer, will be applied to its readings under the following conditions:

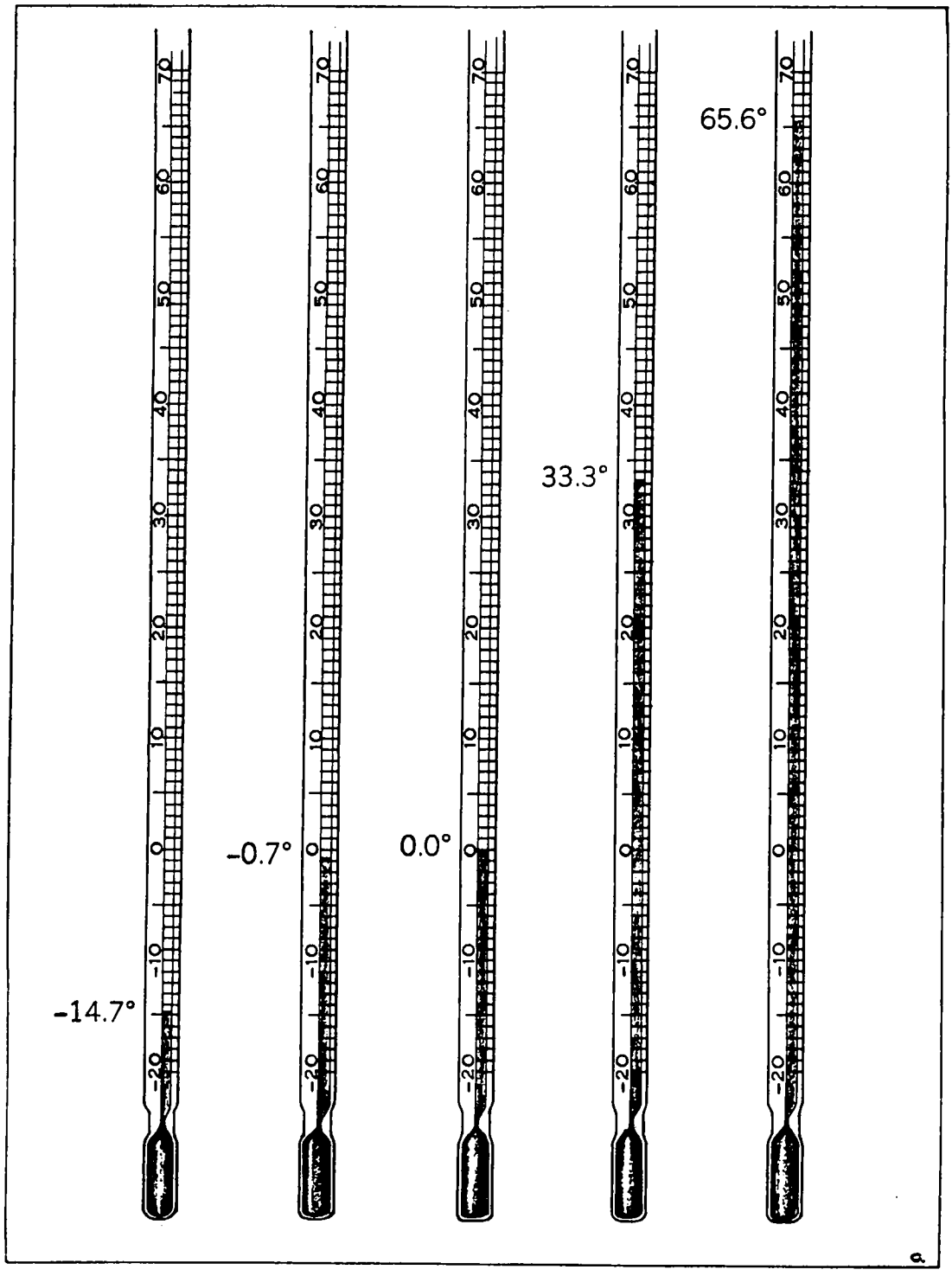

FIGURE 3. Illustrating five different readings of the thermometer.

1. Whenever the temperature indicated by the thermometer is above 42° and the instrumental correction is plus or minus three-tenths (0.3°) of a degree or more in the case of mercurial thermometers, or plus or minus five-tenths (0.5°) of a degree or more in the case of spirit-filled thermometers.

2. Whenever the temperature indicated is 42° or less.

3. Whenever the wet-bulb thermometer has an indicated reading higher than that of a dry-bulb thermometer.

4. The corrections furnished are for each 10° interval and will be applied algebraically to the scale readings of the thermometers before recording the same. For a scale reading between those for which corrections are given an interpolated value of the correction will be used. (This would constitute "single interpolation," an explanation of the processes involved being given in paragraph 2–157 (j).)

For example:

Reading of the thermometer	62.1°
Correction to be applied	−0.5°

Now, the rule for applying corrections algebraically is that whenever the signs of the two values in question—in this case the reading of the thermometer and the instrumental correction for that thermometer—are the *same* they will be added, and when the signs are *different* they will be *subtracted*. Therefore, subtracting 0.5° from 62.1° gives a temperature of 61.6°.

Reading of the thermometer	−8.2°
Correction to be applied	−1.2°

Applying the rule given above that values of like signs are to be added, the temperature would be −8.2° plus −1.2° which equals −9.4°.

5. The corrections on thermometers are given on the cards as low as the comparisons have been made with substandards. If it should happen that a reading for a thermometer is obtained at a point lower than for which any of its corrections are given, then the corrections will be determined by continuing the same ratio of increase or decrease as between the last 30° for which the corrections are given. For example, the correction at 2° is −0.6° and at −28° is −2°. The change of correction between 2° and −28° is, therefore, −1.4°, or approximately 0.047 per degree. For 7° range it is, from the foregoing, about −0.3° ($7 \times 0.047 = 0.329$). Therefore, if the scale reading of the thermometer was −35.0°, which is 7° lower than −28.0°, the correction is −2.3° and the true temperature is −35.0°, plus −2.3°, which equals −37.3°.

(*c*) *Method of entering temperature data on forms and in reports.*—After the reading of the thermometer to tenths of a degree has been determined and the instrumental correction applied, if required, the temperature will be entered on WB Forms 1083, 1001, 1001A, and 1135, when used, in degrees and tenths, and on WB Form 1130 in degrees and tenths in the special columns provided for this, with entry to whole degrees being made in the "temperature and dew point" column in the body of the report. In transmitted reports, temperature shall be entered to the nearest whole degree. For example, in transmitted reports or in the "temperature and dew point" column of WB Form 1130 if the reading were 75.6°, the temperature used would be 76°; if the reading were −2.4°, the temperature used would be −2°, etc. If the reading is exactly half way between two degree marks, it will, of course, not be nearer to one than the other and the following rule will then apply, whether the reading is above zero or below zero: The value of the lower degree mark will be used when this is even and the value of the higher degree mark when it (the lower degree mark) is odd, for example, 76.5° would be reported as 76°; 75.5° would be reported also as 76°; −35.5° would be reported as −36°; −36.5° would be reported also as −36°, etc. "Zero" is considered as an "even" figure.

(*d*) *Indicating below-zero temperatures in reports and on forms.*—When the temperatures are below zero an indication of the negative character of the value will be made by the entry of the minus sign immediately preceding the value on all forms and in transmission by teletype, but the word "minus" should be spelled out in telegrams.

(*e*) *Indicating "zero" temperature in reports and on forms.*—"Zero" temperature will

be reported as the word "zero" in telegrams and the figure naught (0) on all forms and in transmission by teletype (or "0.0" where the temperature is required to be entered in tenths.)

(*f*) *Stations which are to report temperature.*—The temperature will be reported only from those stations equipped with a standard Weather Bureau Fahrenheit thermometer, either as a single instrument or as the dry bulb of a psychrometer.

XV (H)—DEW POINT

2–155. Importance and Definition of Dew Point.—Knowledge of the moisture content of the air is of extreme importance to forecasters, pilots, and others in anticipating the formation of fog, thunderstorms, cloudiness, etc. In airway weather reports such information is contained in an element known as the "dew point." THE DEW POINT IS THAT TEMPERATURE TO WHICH A GIVEN MIXED VOLUME OF AIR AND VAPOR MUST BE REDUCED BEFORE SATURATION OCCURS, RESULTING, AFTER FURTHER REDUCTION OF TEMPERATURE, IN THE CONDENSATION OF SOME OF THE MOISTURE IN THE FORM OF DEW, FOG, FROST, CLOUDS, OR PRECIPITATION.

2–156. Instruments Used in Determining the Dew Point.—The dew point is determined from the readings of ventilated wet- and dry-bulb psychrometers.

2–157. Rules for Observing, Computing, and Reporting Dew Point.—Instructions for reading the wet- and dry-bulb thermometers and computing and reporting the dew point follow:

(*a*) *Stations which shall report dew point.*—The dew point will be reported only from those stations equipped with a Weather Bureau psychrometer of some type.

(*b*) *Cloth on wet bulb required to be clean.*—The cloth or muslin on the wet bulb of such psychrometers will always be kept clean and should be changed at *least once each week.* At some stations it will be necessary to do this more often, particularly at those located where there is considerable dirt and smoke or where the usual water supply is rather heavily charged with mineral matter, such as where surface well water is used. The consequence of using such water on the thermometer bulb is that the muslin has to be changed and the bulb cleaned off. The latter is sometimes difficult to do, and involves risk of breaking the thermometer and is really the principal objection to using impure water. To obviate this latter difficulty, all stations should obtain a small supply of mineral-free water to be kept in a bottle from which the small bottle or container actually used to wet the wet bulb can be replenished occasionally. Distilled water is best, but rain water or melted snow, preferably filtered to remove dust particles, will do just as well. A catch of water during a fairly heavy fall of rain or snow should give enough water to last almost a year.

(*c*) *Use of psychrometer when temperature is above freezing.*—When the temperature is above the freezing point (32° F.) the cloth around the wet bulb will ordinarily be moistened *just prior* to the taking of a reading. However, when *temperatures are extraordinarily high and the relative humidity is quite low the cloth on the wet bulb should be thoroughly wetted, resulting in the formation of a drop of water on the cloth-covered bulb that should be allowed to remain for several minutes before whirling.* This is necessary in order that the temperature of the wet bulb may be reduced considerably before whirling or rapid rotation of the shelter fan is begun, and will insure a true reading which, of course, would not be possible if the cloth were dried out before the necessary whirling was completed.

(*d*) *Use of psychrometer when temperature is at or below freezing.*—When the current temperature *is at or below the freezing point* (32° F.) the cloth will be moistened from *10 to 15 minutes* prior to the taking of a reading, the greater interval being used when temperatures are near the freezing point. This is necessary in order that the latent heat released when water freezes may be dissipated and the wet-bulb temperature brought down to or below the current temperature prior to the whirling of the psychrometer. If this is not done the observer will find that a considerable period of time will be consumed in obtaining a depression, which may result in late or missed observations. During periods when the temperature is below freezing it will be found that

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be reported as the word "zero" in telegrams and the figure naught (0) on all forms and in transmission by teletype (or "0.0" where the temperature is required to be entered in tenths.)

(*f*) *Stations which are to report temperature.*—The temperature will be reported only from those stations equipped with a standard Weather Bureau Fahrenheit thermometer, either as a single instrument or as the dry bulb of a psychrometer.

(*g*) *Setting maximum and minimum thermometers.*—Set the maximum and minimum thermometers after obtaining the temperatures for the six-hourly and midnight observations.

XV (H)—DEW POINT

2–155. Importance and Definition of Dew Point. Knowledge of the moisture content of the air is of extreme importance to forecasters, pilots, and others in anticipating the formation of fog, thunderstorms, cloudiness, etc. In airway weather reports such information is contained in an element known as the "dew point." THE DEW POINT IS THAT TEMPERATURE TO WHICH A GIVEN MIXED VOLUME OF AIR AND VAPOR MUST BE REDUCED BEFORE SATURATION OCCURS, RESULTING, AFTER FURTHER REDUCTION OF TEMPERATURE, IN THE CONDENSATION OF SOME OF THE MOISTURE IN THE FORM OF DEW, FOG, FROST, CLOUDS, OR PRECIPITATION.

2–156. Instruments Used in Determining the Dew Point.—The dew point is determined from the readings of ventilated wet- and dry-bulb psychrometers.

2–157. Rules for Observing, Computing, and Reporting Dew Point.—Instructions for reading the wet- and dry-bulb thermometers and computing and reporting the dew point follow:

(*a*) *Stations which shall report dew point.* The dew point will be reported only from those stations equipped with a Weather Bureau psychrometer of some type.

(*b*) *Cloth on wet bulb required to be clean.*—The cloth or muslin on the wet bulb of such psychrometers will always be kept clean and should be changed at *least once each week.* At some stations it will be necessary to do this more often, particularly at those located where there is considerable dirt and smoke or where the usual water supply is rather heavily charged with mineral matter, such as where surface well water is used. The consequence of using such water on the thermometer bulb is that the muslin has to be changed and the bulb cleaned off. The latter is sometimes difficult to do, and involves risk of breaking the thermometer and is really the principal objection to using impure water. To obviate this latter difficulty, all stations should obtain a small supply of mineral-free water to be kept in a bottle from which the small bottle or container actually used to wet the wet bulb can be replenished occasionally. Distilled water is best, but rain water or melted snow, preferably filtered to remove dust particles, will do just as well. A catch of water during a fairly heavy fall of rain or snow should give enough water to last almost a year.

(*c*) *Use of psychrometer when temperature is above freezing.*—When the temperature is above the freezing point (32° F.) the cloth around the wet bulb will ordinarily be moistened *just prior* to the taking of a reading. However, when *temperatures are extraordinarily high and the relative humidity is quite low the cloth on the wet bulb should be thoroughly wetted, resulting in the formation of a drop of water on the cloth-covered bulb that should be allowed to remain for several minutes before whirling.* This is necessary in order that the temperature of the wet bulb may be reduced considerably before whirling or rapid rotation of the shelter fan is begun, and will insure a true reading which, of course, would not be possible if the cloth were dried out before the necessary whirling was completed.

(*d*) *Use of psychrometer when temperature is at or below freezing.*—When the current temperature *is at or below the freezing point* (32° F.) the cloth will be moistened from *10 to 15 minutes* prior to the taking of a reading, the greater interval being used when temperatures are near the freezing point. This is necessary in order that the latent heat released when water freezes may be dissipated and the wet-bulb temperature brought down to or below the current temperature prior to the whirling of the psychrometer. If this is not done the observer will find that a considerable period of time will be consumed in obtaining a depression, which may result in late or missed observations. During periods when the temperature is below freezing it will be found that

ice will accumulate on the bulb of the wet-bulb thermometer, which condition should be avoided. The cup of water used to wet the wet bulb should be kept in the office room between observations so that the water will be lukewarm. The wet bulb should be thoroughly soaked in this each time it is to be wetted until all the ice on the wet bulb has been melted. If this is done it will be found that a thin and thoroughly cooled ice coating will have formed before the reading must be taken. This procedure is mandatory at intermediate airway stations. Also, during periods when the temperature is below freezing, but particularly when it is near or below zero, it will be found that the depressions obtained are quite small and that the difference in values of the dew point are quite large for small differences in the depressions of the wet-bulb temperatures. It will, therefore, be necessary that the readings be made with extreme care at such time, the psychrometer being carefully whirled or the shelter fan rotated, until it is certain that the lowest reading has been obtained. Care must be used at all times when taking an observation that the observer's breath does not enter the shelter, and that proper instrumental corrections are applied to readings of both thermometers.

(*e*) *Dew point temperature when no depression of the wet bulb can be obtained.*—During a dense, thick, or moderate fog it will often be found that, after proper instrumental corrections have been applied to the readings, no depression of the wet-bulb thermometer results. In such cases the temperature of the dew point is the same as the current temperature and will be reported as the same.

(*f*) *Lowest possible readings of wet- and dry-bulb thermometers required.*—The psychrometer will be whirled, or the shelfter fan rotated, until successive readings of both thermometers indicate that the readings have reached their lowest points.

(*g*) *Rules for reading thermometer and obtaining depression of the wet bulb.*—The thermometers will then be read to tenths of a degree and proper instrumental corrections applied to the readings, as directed in the chapter on "temperature," after which the depression of the wet-bulb thermometer will be obtained as follows:

1. *When both wet- and dry-bulb temperatures are above zero,* subtract the wet-bulb temperature from the dry-bulb temperature.

2. *When the dry-bulb temperature is at or above zero and wet-bulb temperature is at or below zero,* add the dry-bulb temperature to the wet-bulb temperature without regard to sign. For example, if the dry bulb reads 1.2° and the wet bulb reads −0.7°, add 1.2° to 0.7°, which gives the depression 1.9°. If either temperature is exactly zero the depression will be the value of the reading of the other thermometer without regard to sign; for example, if the dry bulb reads 0.0° and the wet bulb −1.2°, obviously 0.0° added to 1.2° gives 1.2°.

3. *When both wet- and dry-bulb temperatures are below zero,* subtract the dry-bulb temperature from the wet-bulb temperature, disregarding the minus signs, e. g., if the dry bulbs reads −3.4° and the wet bulb reads −4.7°, then the depression would be 4.7 minus 3.4°, or 1.3°.

(*h*) *Obtaining the dew point from the psychrometric tables.*—After the wet-bulb depression is obtained the proper column marked "Depression of the wet-bulb thermometer" will be found along the top of the psychrometric tables. The dry-bulb temperature will be found in the column headed "Air temperature," at the left of the tables. The figure given in the tables at the intersection of the two lines of figures therein thus indicated will be the dew point to be reported, provided that the depression of the wet-bulb and the air temperature used correspond with a value given at the top and at the left of the tables, respectively. However, in the majority of cases, the values for the dry-bulb reading and the depression of the wet bulb, obtained when the wet- and dry-bulb thermometers are read to tenths of a degree, will *lie between* values given at the left and top of the tables, respectively, requiring interpolation to secure the correct result.

(*i*) *Interpolating between values given in psychrometric tables.*—"Interpolation" is the process of obtaining values that lie between the values given in the tables and falls into two classes, namely, double and single. If the observer is familiar with the process of double interpolation it should be used by him when required by the circumstances surrounding the determination of the dew point. If the observer is not familiar with

ice will accumulate on the bulb of the wet-bulb thermometer, which condition should be avoided. The cup of water used to wet the wet bulb should be kept in the office room between observations so that the water will be lukewarm. The wet bulb should be thoroughly soaked in this each time it is to be wetted until all the ice on the wet bulb has been melted. If this is done it will be found that a thin and thoroughly cooled ice coating will have formed before the reading must be taken. This procedure is mandatory at intermediate airway stations. Also, during periods when the temperature is below freezing, but particularly when it is near or below zero, it will be found that the depressions obtained are quite small and that the difference in values of the dew point are quite large for small differences in the depressions of the wet-bulb temperatures. It will, therefore, be necessary that the readings be made with extreme care at such time, the psychrometer being carefully whirled or the shelter fan rotated, until it is certain that the lowest reading has been obtained. Care must be used at all times when taking an observation that the observer's breath does not enter the shelter, and that proper instrumental corrections are applied to readings of both thermometers.

(*e*) *Dew point temperature when no depression of the wet bulb can be obtained.*—During a heavy or moderate fog it will often be found that, after proper instrumental corrections have been applied to the readings, no depression of the wet-bulb thermometer results. In such cases the temperature of the dew point is the same as the current temperature and will be reported as the same.

(*f*) *Lowest possible readings of wet- and dry-bulb thermometers required.*—The psychrometer will be whirled, or the shelfter fan rotated, until successive readings of both thermometers indicate that the readings have reached their lowest points.

(*g*) *Rules for reading thermometer and obtaining depression of the wet bulb.*—The thermometers will then be read to tenths of a degree and proper instrumental corrections applied to the readings, as directed in the chapter on "temperature," after which the depression of the wet-bulb thermometer will be obtained as follows:

1. *When both wet- and dry-bulb temperatures are above zero,* subtract the wet-bulb temperature from the dry-bulb temperature.

2. *When the dry-bulb temperature is at or above zero and wet-bulb temperature is at or below zero,* add the dry-bulb temperature to the wet-bulb temperature without regard to sign. For example, if the dry bulb reads 1.2° and the wet bulb reads −0.7°, add 1.2° to 0.7°, which gives the depression 1.9°. If either temperature is exactly zero the depression will be the value of the reading of the other thermometer without regard to sign; for example, if the dry bulb reads 0.0° and the wet bulb −1.2°, obviously 0.0° added to 1.2° gives 1.2°.

3. *When both wet- and dry-bulb temperatures are below zero,* subtract the dry-bulb temperature from the wet-bulb temperature, disregarding the minus signs, e. g., if the dry bulbs reads −3.4° and the wet bulb reads −4.7°, then the depression would be 4.7 minus 3.4°, or 1.3°.

(*h*) *Obtaining the dew point from the psychrometric tables.*—After the wet-bulb depression is obtained the proper column marked "Depression of the wet-bulb thermometer" will be found along the top of the psychrometric tables. The dry-bulb temperature will be found in the column headed "Air temperature," at the left of the tables. The figure given in the tables at the intersection of the two lines of figures therein thus indicated will be the dew point to be reported, provided that the depression of the wet-bulb and the air temperature used correspond with a value given at the top and at the left of the tables, respectively. However, in the majority of cases, the values for the dry-bulb reading and the depression of the wet bulb, obtained when the wet- and dry-bulb thermometers are read to tenths of a degree, will *lie between* values given at the left and top of the tables, respectively, requiring interpolation to secure the correct result.

(*i*) *Interpolating between values given in psychrometric tables.*—"Interpolation" is the process of obtaining values that lie between the values given in the tables and falls into two classes, namely, double and single. If the observer is familiar with the process of double interpolation it should be used by him when required by the circumstances surrounding the determination of the dew point. If the observer is not familiar with

this process, which merely involves interpolating between two values previously obtained by "single" interpolation he will be given thorough instruction upon the next visit of a Weather Bureau inspector, but, in the meantime, it will be necessary for him to adhere to the following rule:

Rule.—An examination of the dew-point tables will show that diagonal lines exist therein, inclining downward and to the right, along which the tabulated values of the dew point are constant, or change very little. As a result of this circumstance, when the observed values of the air temperature and the depression of the wet-bulb thermometer fall between the values of these, as given at the left and top of the tables, the observer will obtain a result by going to the next lower numerical values of temperature and depression given at the left and top of the tables, respectively, and, using the horizontal and vertical lines of figures indicated by these, find the corresponding dew point, as explained in paragraph 2–157 (*h*). For example, let us assume that the following values are involved:

Air temperature	45.8°
Depression of the wet bulb	2.7°

Air temperature (degrees)	Depression of wet-bulb thermometer (degrees)			
	2.0	2.5	3.0	3.5
44	40	38	37	36
45	41	40	38	37
46	42	41	40	38

Now, by dropping the fractions in the temperature and depression values given so as to obtain the "next lower" values of those given at the left and top of the table, we have the values of 45° for temperature and 2.5° for depression. Consulting the table for the value at the intersection of the two lines of figures thus indicated, we find the figure 40, which would be the value of the required dew point. Actual double interpolation would give a value of 40.32°, which would, in accordance with previous instructions herein, be included in the report as 40°.

(*j*) *Obtaining dew-point values by use of single interpolations.*—If one of the values obtained, that is, the air temperature or the depression of the wet-bulb thermometer, corresponds to a respective value given at the left or top of the tables, but the other falls between the values given there, then *single interpolation* is involved. In this type of interpolation it is necessary to apply the proportional fraction involved in the direction in which it lies. Specifically, this means that the difference in value between any two figures in the body of the table, taken either horizontally or vertically, as required, will be multiplied by the value of the proportional fraction, and this result will be added to or subtracted from the figure, as may be proper.

Examples:

1. Temperature 44.0°
   Depression of wet bulb 2.3°
   (See table given in paragraph 2–157 (*i*).)

The figure 44 is found in the "Air temperature" column at the left of the tables and the line of figures thus indicated is followed to the right until the vertical column for depressions of the wet bulb for 2.0° is reached. The figure given there is 40. Since the depression 2.3° lies between 2.0° and 2.5°, the line of 44° is followed one more column to the right and this contains values of dew point for depressions of 2.5°. The figure given there is 38. The difference between 40 and 38 is 2, while the depression 2.3° represents three-fifths or 0.6 of the difference between 2.0° and 2.5°. Multiplying 2 by three-fifths or 0.6 gives 1.2. Subtracting this from 40—as this is the direction

in which the proportional fraction lies—gives 38.8°, which is the actual dew point to tenths of a degree and which would be included in the report as 39°.

2. Temperature	44.8°
Depression of the wet bulb	2.5°
(See table given in paragraph 2-157 (i).)	

The figure 44 is found in the "Air temperature" column at the left of the tables, and the line thus indicated is followed to the right until the column for depression of 2.5 is reached. The figure there is 38. Dropping down one line in the same depression column—this will be the line for temperature 45°—44.8°, lying between 44° and 45°—the figure 40 is found. The difference between 40 and 38 is 2, while 44.8 represents 0.8 of the difference between 44 and 45. Multiplying 2 by 0.8 gives 1.6. *Adding* this to 38—as this is the direction in which the proportional fraction lies—gives 39.6, which is the actual dew point to tenths of a degree and which would be included in the report as 40°.

NOTES.—The procedure of dropping the tenths of the dry-bulb temperature described in paragraph 2-157 (i) is intended for use only in determining the dew point and will *not* be used in reporting the temperature element of the airway observation. The nearest whole degree, Fahrenheit, as directed in chapter XV (G), will be used for that purpose.

The figures quoted in the foregoing examples were taken from tables of dew points for a pressure of 30 inches and may not correspond to those for pressures lower than this, but the principle outlined remains unchanged, of course, when using tables for any other pressure.

2-158. Practice in Obtaining Dew Points From Tables.—In studying the examples given in paragraph 2-157 the observer should have a table of dew points at hand for reference and study, as the actual working of the methods explained therein can not be understood merely by a cursory reading of the text of the instructions. Several other examples should be worked by the observer until he is sure that the process is completely understood.

2-159. Reading Thermometers Accurately to Tenths Required.—The observer will read both wet- and dry-bulb thermometers to tenths of a degree, accurately and without bias, in the matter of whether or not these come out in values corresponding to those given at the left and top of the tables, which methods might thus eliminate the necessity for interpolation.

XV (I)—WIND

(Direction, velocity, character)

2-160. Importance and Definition of Wind.—Data concerning the direction, velocity, and character of air, moving horizontally, is of importance to the pilot in determining take-off and landing procedure, and as an indication of wind that he may encounter aloft; and to the forecaster in preparing airway and other forecasts. Therefore, it is necessary that a report of the wind element be included in every airway observation. For purposes of identification in these instructions, WIND IS THE HORIZONTAL, OR NEARLY HORIZONTAL, NATURAL MOVEMENT OF AIR, that is, AIR NATURALLY IN HORIZONTAL MOTION WITH ANY DEGREE OF VELOCITY. Vertical movements of air are not considered as wind but as "air currents."

2-161. Rules for Observing and Reporting Wind.—The following instructions will govern the observing and reporting of the wind element:

(*a*) *Definition of "direction of wind."*—The *direction* of the wind is that direction *from which* it is moving; that is, if the wind is coming from the northwest its direction would be reported as "northwest."

(*b*) *Method to be used in reporting "direction of wind."*—The direction of the wind will be reported to 16 points of the compass, as follows:

North.	South.
North-northeast.	South-southwest.
Northeast.	Southwest.
East-northeast.	West-southwest.
East.	West.
East-southeast.	West-northwest.
Southeast.	Northwest.
South-southeast.	North-northwest.

(*c*) *Estimating the "direction of wind" when the station is not equipped with wind instruments.*—When the station is not equipped with wind-indicating equipment, the direction may be determined by observing the drift of smoke, or the direction in which twigs, leaves, etc., are swaying; or, if the station is located at an airport, the direction can be obtained from the wind cone or tee.

(*d*) *Determining the wind direction from wind-direction indicators.*—Stations equipped with 4-point and 8-point wind-direction indicators can easily obtain the intermediate directions by observation of the indicator during the taking of the reading. The 8-point wind-direction indicator, however, provides greater refinement in determining direction than does the 4-point wind-direction indicator. Examples in the use of the two types of wind indicators are given below:

4-POINT WIND INDICATORS

Description	*Direction to be recorded*
North lamp burns steadily or North lamp burns steadily with occasional flashes sometimes on west and sometimes on east lamp	North.
North lamp burns steadily with occasional flashes on west lamp	North northwest.
Both north and west lamps burn steadily or Both north and west lamps burn with sometimes north and sometimes west lamps flashing off	Northwest.

8-POINT WIND INDICATORS

North lamp burns steadily or North lamp burns steadily with occasional flashes on either the northwest or the northeast lamp or North lamp burns steadily with occasional flashes sometimes on northwest and sometimes on northeast lamp	North.
North and northwest lamps burn steadily or North lamp burns steadily but with northwest lamp burning also more than half of the time or Northwest lamp burns steadily with north lamp burning also more than half of the time	North northwest.

(*e*) *Method of determining wind velocity with instruments.*—The *velocity* of the wind will be reported in miles per hour as obtained from a reading of Weather Bureau wind-indicating instruments, or by estimation. The wind-indicators, electrically connected with the exposed wind instruments, commonly furnished to airway and airport stations, give one buzz a minute for each mile of wind blowing, it only being necessary to count the buzzes for 1 minute to obtain the indicated velocity in miles per hour. The indicated velocity must be corrected to obtain the true velocity in accordance with table 7. Buzzes will *always* be counted over periods of 1 minute, as doing this over shorter periods is certain to result in inaccurate wind-velocity values in practically all cases.

TABLE 7.—*Corrections for indicated wind velocities*

VELOCITIES INDICATED

By 3-cup anemometer, m. p. h.	By 4-cup anemometer, m. p. h.	By 4-cup anemometer with beaded cups, m. p. h.	By small airway anemometer, m. p. h.	Corrections in whole miles per hour
0 to 16 [1]	0 to 8	0 to 5	0 to 35	+1
17 to 26	9 to 12	6 to 13	35 to 57	0
27 to 35	13 to 16	14 to 20	(Corrections under higher velocities not determined; use zero.)	−1
36 to 44	17 to 20	21 to 27		−2
45 to 52	21 to 24	28 to 34		−3
53 to 61	25 to 28	35 to 41		−4
62 to 70	29 to 32	42 to 48		−5
71 to 79	33 to 36	49 to 55		−6
80 to 87	37 to 39	56 to 62		−7
88 to 96	40 to 43	63 to 69		−8
97 to 105	44 to 47	70 to 75		−9
106 to 114	48 to 51	76 to 82		−10
115 to 122	52 to 54	83 to 89		−11
123 to 132	55 to 58	90 to 96		−12
133 to 139	59 to 62	97 to 103		−13
140 to 149	63 to 65	104 to 110		−14
150 to 157	66 to 69	111 to 117		−15
158 to 166	70 to 73	118 to 124		−16
167 to 174	74 to 77	125 to 131		−17
175 to 184	78 to 80	132 to 138		−18
185 to 192	81 to 84	139 to 145		−19
193 to 200	85 to 88	146 to 152		−20
	89 to 91	153 to 158		−21
	92 to 95	159 to 165		−22
	96 to 99	166 to 171		−23
	100 to 103	172 to 178		−24
	104 to 106	179 to 185		−25
	107 to 110	186 to 192		−26
	111 to 114	193 to 200		−27
	115 to 117			−28
	118 to 121			−29
	122 to 125			−30
	126 to 128			−31
	129 to 132			−32
	133 to 136			−33
	137 to 140			−34
	141 to 143			−35

[1] Inconsequential variation from the rule for disposal of decimals disregarded at 2 and 4 m. p. h. Reprint from Instructions No. 1, 1935.

NOTE.—Corrections to be applied to wind velocities determined by anemometers. Correction to be added when the sign is plus and subtracted when the sign is minus.

(*f*) *Method of estimating wind velocity.*—If no wind-velocity-indicating equipment is available, the velocity may be estimated by application of the values given in the following table (usually known as the "Beaufort scale" of wind velocities):

TABLE 8.—*Wind velocity equivalents*

Descriptive word [1]	Velocity (miles per hour)	Specifications for estimating velocities
Calm	Less than 1	Smoke rises vertically.
	1 to 3	Direction of wind shown by smoke drift but not by wind vanes.
Light	4 to 7	Wind felt on face; leaves rustle; ordinary vane moved by wind.
Gentle	8 to 12	Leaves and small twigs in constant motion, wind extends light flag.
Moderate	13 to 18	Raises dust and loose paper; small branches are moved.
Fresh	19 to 24	Small trees in leaf begin sway; crested wavelets form on inland waters.
	25 to 31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
Strong	32 to 38	Whole trees in motion; inconvenience felt in walking against the wind.
	39 to 46	Breaks twigs off trees; generally impedes progress.
Gale	47 to 54	Slight structural damage occurs (chimney pots and slate removed).
	55 to 63	Trees uprooted; considerable structural damage occurs.
Whole gale	64 to 75	Rarely experienced; accompanied by wide-spread damage.
Hurricane	Above 75.	

[1] Except "calm," these terms not to be used in reports of velocity.

(*g*) *Determining and reporting zero wind velocities (calms).*—If the cups of the anemometer are not moving, or if smoke rises vertically, the velocity will be zero and the wind will be reported as "calm."

(*h*) *Method of indicating estimated velocities in reports and on WB Form 1130.*—If necessary to estimate the wind velocity as outlined, this will be indicated by the entry of the word "estimated," immediately following the velocity in reports made by telephone or telegraph and by entry of the letter "E" after the velocity in teletype and radio reports. Such entries would also be made on WB Form 1130.

(*i*) *Method of indicating character of wind in reports and on WB Form 1130.*—The *character* of the wind will be indicated immediately following the velocity, when appropriate, in reports and on WB Form 1130 by use of the following terms:

1. *Fresh gusts*, when sudden, intermittent increases in velocity of 10 miles or more per hour reach 19 to 24 miles per hour.

2. *Strong gusts*, when sudden, intermittent increases in velocity of 10 miles or more per hour reach 25 miles or more per hour.

(*j*) *Determining degree of gustiness.*—It should be kept in mind when reporting gusts that the velocity of the wind at the peak of the gusts determines whether the gustiness will be reported as "fresh" or "strong." Further, gusts should never be reported, no matter what the velocity, unless the peak velocity is 10 miles per hour, or more, greater than the velocity between gusts. For example, if the velocity is 19 to 24 miles per hour at the *peak* of gusts, the gustiness will be "fresh," and if the velocity is 25 miles per hour or more at the *peak* of gusts, the gustiness will be "strong." The velocity will be reported in each case as that recorded at the observation, the type of gustiness will be determined by the velocity at the peak of gusts. Unless the station is equipped with the pressure type of wind-velocity indicator it will be necessary for the observer to employ a great deal of care in estimating the degree of gustiness. However, constant practice and diligence will make it possible for the observer to give an accurate report of gustiness as obtained from the buzzer type of indicator.

290297° -41——5

XV (J)— METEOROLOGICAL BAROMETRIC PRESSURE

2–162. Importance and Definition of Barometric Pressure.—Accurate data concerning the barometric pressure is of high importance to the forecaster in the preparation of his weather maps and forecasts. Therefore, it can not be too strongly impressed upon the observer concerning the need for care in the observing and reporting of this element. THE BAROMETRIC PRESSURE AT A GIVEN LEVEL IS THE FORCE WHICH THE VERTICAL COLUMN OF AIR ABOVE THAT LEVEL EXERTS ON A UNIT AREA AT THE LEVEL BY REASON OF THE WEIGHT OF THE AIR IN THE VERTICAL COLUMN. For example, suppose the area of the inside of a barometer tube to be just 1 square inch, then a 30-inch barometric column will contain just 30 cubic inches of mercury. Now, 1 cubic inch of mercury weighs 0.4906 pound, which, multiplied by 30, gives the ordinary sea-level pressure of the air to be 14.718 pounds per square inch. This quantity is frequently used by engineers, and is called a pressure of one "atmosphere." In the main, it is nothing more than the weight of an air column having a sectional area of 1 square inch and extending vertically to the upper limits of the atmosphere. For meteorological purposes the force exerted by this weight is to be expressed in terms of "millibars," a millibar being a measure of force exerted over a specified unit area.

2–163. General Rules for Reporting Barometric Pressure.—The following general rules will cover the reporting of the barometric pressure:

(*a*) *Stations required to report barometric pressure.*—The barometric pressure will be reported only from stations which are equipped with mercurial barometers.

(*b*) *Procedure to be employed in obtaining station and sea-level pressures.*– Special instructions, such as reading a mercurial barometer, reductions of the pressure to sea level, or standard atmosphere, proper care of barometers, etc., will be given in individual cases by a properly trained Weather Bureau official. The following instructions are designed to cover the procedure to be employed in regard to the obtainment of (I) "station pressure," (II) "sea-level" (reduced) pressure.

(I) STATION PRESSURES.

1. *Station has a mercurial barometer and either an aneroid or barograph.*—(*a*) Mercurial barometer readings are to be made every 6 hours at the 1:30 and 7:30 a. m. and p. m., E. S. T., map observations, or at the 1:30 and 7:30 a. m. and p. m., E. S. T., teletype or radio sequence observations.

(*b*) Each time the mercurial barometer is read, the aneroid barometer or the barograph, should be read and the correction to be applied to the latter reading to make it agree with the "station pressure" as based on the mercurial barometer readings should be determined. This correction should be posted conspicuously, near the aneroid or barograph for instant use. Caution should be exercised to insure that the currently applicable correction is the one which is posted and not an older, inapplicable one.

(*c*) At the times indicated above, "station pressures" will be based on the mercurial barometer readings. At other times "station pressures" should be based on the aneroid or barograph readings.

(*d*) "Station pressures," whether based on mercurial, aneroid, or barograph readings, will be recorded on WB Form 1130 in the column provided thereon for these data. This will serve as the original permanent record of the data on these forms.

(*e*) If both an aneroid and an open-scale, 4-day barograph are available, the barograph should be used in obtaining "station pressure"; if both an aneroid and a 7-day barograph are available, the aneroid will be used.

(II) REDUCTION OF STATION PRESSURE TO SEA-LEVEL PRESSURE

The following instructions are provided for reducing station pressures to sea-level pressures:

1. Stations at elevations of 50 feet or less above mean sea level will apply an assigned constant correction to the station pressure to obtain sea-level pressure. These stations will not use sea-level reduction tables.

2. Stations more than 50 feet above mean sea level will reduce station pressure to sea-level pressure by using tables specially computed for each station. As an illustration of these tables, a portion of the sea-level reduction table for Weather Bureau Airport Station, Rock Springs, Wyoming, (station elevation 6745 feet, mean sea level) is reproduced below.

Mean temperature:	STATION PRESSURE (inches)								
°F	23.70	23.80	23.90	24.00	24.10	24.20	24.30	24.40	24.50
30	30.49	30.62	30.75	30.88	31.00	31.13	31.26	31.39	31.52
56	30.23	30.36	30.49	30.61	30.74	30.87	30.99	31.12	31.25
58	30.22	30.34	30.47	30.60	30.72	30.85	30.98	31.11	31.23
60	30.20	30.33	30.45	30.58	30.71	30.83	30.96	31.09	31.22
62	30.19	30.31	30.44	30.57	30.69	30.82	30.95	31.07	31.20
64	30.17	30.30	30.43	30.55	30.68	30.81	30.93	31.06	31.18
66	30.16	30.28	30.41	30.54	30.66	30.79	30.92	31.04	31.17
68	30.14	30.27	30.40	30.52	30.65	30.78	30.90	31.03	31.15
70	30.13	30.26	30.38	30.51	30.63	30.76	30.89	31.01	31.14
72	30.12	30.24	30.37	30.49	30.62	30.75	30.87	31.00	31.12

The table lists station pressures to tenths of an inch across the top, and twelve-hour mean temperatures at two-degree intervals down the side. Tabular values represent the sea-level pressures, to hundredths of an inch, corresponding to each station pressure and mean temperature. The table is used, however, with twelve-hour mean temperatures to degrees and tenths (°F) and station pressures to hundredths of an inch. Interpolation is usually necessary to determine the sea-level pressure corresponding to untabulated, intermediate values. General instructions for interpolating sea-level pressure are given under "3" and "4" below.

(a) The twelve-hour mean temperature is obtained by adding the current temperature to the temperature twelve hours previous and dividing by two.

Example:

	°F
Current temperature	64.8
Temperature 12 hours ago	52.6
Sum	117.4
12-hour mean temperature (1/2 sum)	58.7

If only one observation is taken daily, the temperature twelve hours previous will be obtained from the thermogram to the nearest whole degree and used as above to compute the twelve-hour mean temperature.

(b) The station pressure is required to the nearest hundredth of an inch. The third decimal place of station pressures that have been read to thousandths will be disposed of according to the Weather Bureau rule for the disposition of decimals (par. 2-809).

3. Sea-level pressure interpolations for temperature are performed vertically in the table.

(a) Interpolation for temperature is not required if the difference between two sea-level pressures corresponding to two successive temperatures in the table is only 0.01 inch. Instead, the listed temperature nearer to the twelve-hour mean temperature is used. If the twelve-hour mean temperature happens to be exactly on an odd whole degree, half way between two listed temperatures, the numerically lower listed temperature will be used.

(b) If the difference between two sea-level pressures corresponding to two successive temperatures in the table is greater than 0.01 inch, interpolation for temperature is necessary. For example, assume a station pressure of 23.70 inches and a twelve-hour mean temperature of 58.7°. A difference of 0.02 inch exists in the 23.70 column between 30.20 and 30.22, the sea-level pressures corresponding to 58° and 60°, respectively. By interpolation, the sea-level pressure in the 23.70 column corresponding to 58.7° is 30.213, or, after the third decimal place is dropped, 30.21 inches.

4. Interpolations for station pressure are performed horizontally in the table and will usually be necessary as the station pressure will often be somewhere between the values given at the top of the table columns.

(a) If interpolation for temperature is unnecessary, the desired sea-level pressure is found at once by entering the table at the proper temperature and performing a single horizontal interpolation to determine the sea-level pressure corresponding to the given station pressure. For example, if the Rock Springs table is entered at 60° temperature with a station pressure of 23.74 inches, the sea-level pressure 30.20 will be found in the 23.70 column, and 30.33 in the 23.80 column. Since 23.74 station pressure is four-tenths of the way from 23.70 to 23.80, the corresponding sea-level pressure is four-tenths of the way from 30.20 to 30.33. The difference between 30.20 and 30.33 is 0.13 inch, and four-tenths of 0.13 is 0.052 inch (0.13 x 0.4 = 0.052). Adding 0.052 to 30.20 and disposing of the third decimal place produce 30.25 inches, the required sea-level pressure. When the third decimal figure is 0.005, the hundredths digit of the final sea-level pressure will always be an even number, under the Weather Bureau rule for disposition of decimals.

(b) When interpolations for both temperature and station pressure are involved, the procedure is merely some combination of the foregoing interpolation instructions. If the station pressure (horizontal) interpolations are performed first, they will produce two sea-level pressures between which a single vertical interpolation for temperature will give the final sea-level pressure in inches. If the temperature (vertical) interpolations are performed first, they will likewise provide two sea-level pressures between which a single horizontal interpolation for station pressure will give the final sea-level pressure in inches. It must be noted, however, that if the second method is used, interpolation for temperature must be performed in each column, even though the pressure difference in one column may be only 0.01 inch, or else a discrepancy would sometimes occur between the two methods. Whichever method of double interpolation is used, no decimal places may be dropped until the final sea-level pressure is obtained.

5. Sea-level pressures are most frequently recorded and transmitted in millibars rather than in inches. Sea-level pressures obtained as above in inches are readily converted to millibars by means of conversion tables.

Cancel "1" through "4" on page 59.

(II) SEA-LEVEL (REDUCED) PRESSURES

1. Sea-level (reduced) pressures, whenever required for a report, should be determined from the reduction tables on the basis of the current "station pressure" and the temperature argument equal to "one-half (current temperature+12-hour preceding temperature)." These are outdoor shelter temperatures. It is not permissible to apply a given, fixed reduction factor, i. e., an amount which must be added to the "station pressure" to obtain the sea-level pressure, for more than 1 hour unless the "station pressures" and the actual temperature arguments for the successive times when referred to the reduction table happen to give the same value.

2. Sea-level pressures should be recorded on WB Form 1130 in the spaces allotted therefor.

3. Unless special instructions are given to the contrary, the temperature argument used in the reduction of barometric pressure to sea level should be obtained as illustrated in the following example:

	°F.	
Current temperature	64. 8	Use as the temperature argument in reducing the pressure to sea level, the temperature value in the sea-level reduction table nearest to the mean temperature. (The mean temperature in this case is 58.7° F.)
Temperature 12 hours previous	52. 6	
Sum	117. 4	
Mean=Sum÷2	58. 7	

4. When the thermograph readings (corrected) are used for either the current or 12-hour preceding temperature, they shall be taken to the nearest whole degree.

5. *Values to be reported.*—When reported, the sea-level pressure will be indicated in millibars and tenths of millibars.

6. *Use of aneroid barometer in obtaining barometric pressure.*—The following method should be used for obtaining the pressure by means of an aneroid barometer; bearing in mind that aneroid barometers are not to be used for original determinations of pressure, except at stations where readings of a mercurial barometer are made at least every 6 hours.

(*a*) The barometer should be on a level with the eyes of the observer, and where it will not be subject to extremes of heat and cold or rapid changes in temperature, and especially where it is not likely to be jarred or disturbed.

(*b*) Before making a reading, tap the face of the barometer very gently with the finger, or eraser end of a pencil; this will take the needle to its true settling point. A correction will be applied to this reading, when necessary, as described under "d" below.

(*c*) These instruments are usually graduated to every two-hundredth of an inch, and reading of them to hundredths is, therefore, easy. Care, however, should be taken not to confuse the tenths divisions with those for hundredths. Figure 4 is a reproduction of a portion of the dial of a common type of aneroid barometer, to which has been affixed a series of imaginary positions of the needle, marked "a," "b," "c," etc. The following are the correct readings corresponding to these positions:

a 28.75 inches (973.6 millibars).
b 29.06 inches (984.1 millibars).
c 29.20 inches (988.8 millibars).
d 29.56 inches (1001.0 millibars).
e 30.00 inches (1015.9 millibars).
f 30.10 inches (1019.3 millibars).

(*d*) *Applying corrections to readings of aneroid barometers.*—The aneroid is at times subject to a slow change or "creeping." In such cases the matter will be reported to the supervising Weather Bureau official for the airway. *Under no circumstances will the observer attempt to adjust the instrument.* Upon receipt of advice that the aneroid is reading inaccurately, as compared with station pressure readings of the mercurial barometer located at the station, the supervising Weather Bureau official will issue instructions concerning a correction to be applied to the instrumental readings. The correction will be changed from time to time by the supervising Weather Bureau station as circumstances warrant. The observer will make certain that the correction is applied to all readings before using them for any purpose, including reductions to sea level.

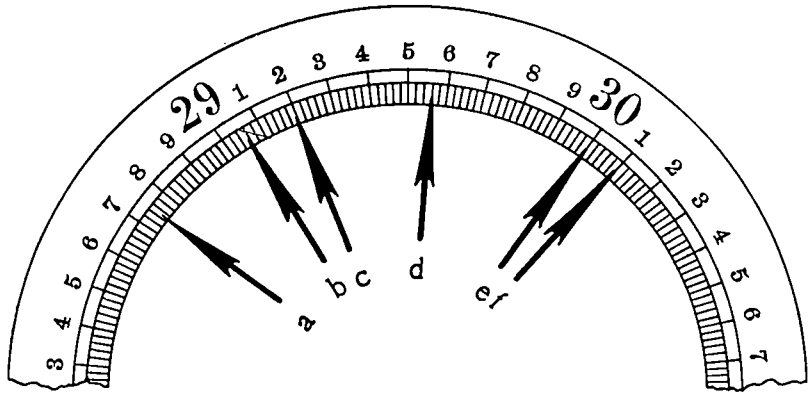

FIGURE 4.—Illustrating six different readings of the aneroid barometer.

XV (K)—ALTIMETER SETTINGS

2-164. General Rules for Determining and Reporting Altimeter Settings.—This is essentially a value for the current standard atmosphere sea level pressure, and will be determined in accordance with instructions in part V of this section.

XV (L)—REMARKS

2-165. Scope and Purpose.—It is intended that the "Remarks" contain all pertinent weather information which cannot properly be given in the reporting of specific elements of the report. As such, they have a very broad use, and the observer will take full advantage of this to the end that a complete and accurate picture is presented of all conditions obtaining at the time the observation is taken, or immediately prior thereto, and for which no special report could be filed showing the change.

2-166. Position and Methods of Entry of Remarks in Reports.—The remarks will constitute the last part of the observation proper, and will be entered by use of symbols, figures, and English abbreviations representing the remark or remarks to be included in the report.

2-167. Any Remarks Having a Bearing on Weather Conditions to be Included in Reports.—Under no circumstances will a remark be omitted to save the trouble of including it, or because it is not specifically mentioned herein. If it has a bearing on the weather conditions at the time, it will be included in all cases. If no symbol and figure group can be assigned for a remark to cover a particular condition which may arise, then the remark shall be written out in English, using authorized abbreviations and figures. Transmissions of such remarks on teletype circuits will not be monitored with respect to the actual phenomenon reported, or the manner in which it is reported, except that proper abbreviations must be used and procedure observed.

2-168. Remarks Concerning the Various Elements.—Examples of standard remarks and the proper methods of composing these for entry in the reports are contained in part IV of this section.

2-169. Extreme Importance of Proper Remarks.—It is again desired to impress upon the observer that any conditions of importance not covered fully in the body of the report are to be reported under "Remarks," and that diligence and care must be exercised to see that such remarks are made. The importance of remarks in amplifying the reports is so great that the necessity for the conscientious reporting of these cannot be overemphasized.

CHAPTER XVI

CONDITIONS UNDER WHICH PILOTS' OBSERVATIONS MAY BE ACCEPTED AS OFFICIAL AIRWAY WEATHER REPORTS

2–170. Necessity and Purpose and Rules Governing Use of Pilots' Reports.—Cases have arisen where observations of ceilings and other elements made by the Weather Bureau personnel at a particular point have been at variance with the opinions of pilots and transport operators at the same point concerning the values of these same elements. In order that there will be no confusion with regard to the proper procedure in such cases, the following instructions will be adhered to:

(*a*) *Conditions under which Weather Bureau reports will govern.*—The Weather Bureau reports of ceilings and other elements shall govern in all cases where official observations are taken at the point in question by personnel holding a "Certificate of Authority to Take Airway Weather Observations," or regular Weather Bureau personnel, and when the values used in such reports have been obtained by approved methods of measurement. Approved methods of measurement of ceiling include values obtained by use of ceiling projectors, ceiling balloons, pilot balloons, or observation of the unobscured portions of towers, buildings, etc. (excluding land elevations), located within a radius of 1½ miles of the station and the height of which are definitely known.

(*b*) *Conditions under which transport or commercial pilots' reports accepted for official use.*—Transport or commercial pilots' reports of ceiling values may be accepted as official and used in airway reports under the following conditions:

1. When such reports are made while in flight over any point at which there is no official airway weather-reporting station within a radius of 1½ miles.
2. When such reports are made from the ground at a landing point at which there is no official airway weather-reporting station.
3. When such reports are made at a point where there is an official airway weather-reporting station and the personnel have not been able to obtain a direct measurement by approved methods and the pilot has obtained his value within a radius of 1½ miles of the station through direct observation while *taking off* from or *landing* at the field in question, provided that the official weather observer has no reason to question the accuracy of the report.

(*c*) *Adding of pilots' reports to regular reports.*—Reports of the type outlined in "b (1) and (2)" above may be added as remarks to the regular report, using symbols and abbreviations "PIREPS 6⊕3 MUSCATINE," "PIREPS 8⊕◐2 SE STN," etc., while reports of the type outlined under "b (3)" above should be used as the official ceiling value—without the word "estimated"—in the body of the report.

(*d*) *Reports by other than authorized Weather Bureau observers where an official weather-reporting station is located.*—Estimates or measurements of ceiling made by ground personnel of any transport or aviation company, or of the airport personnel, or of pilots on the ground at any point where there is an official weather-reporting station within a radius of 1½ miles, cannot be accepted as official and included in any airway weather report unless verified or accepted by the official observer on duty.

(*e*) *Clearance of pilots' reports through the Weather Bureau.*—All reports made by pilots must be cleared through the Weather Bureau before being placed in official use.

(*f*) *Basis of pilots' reports of ceiling values.*—Pilots' reports of ceiling values made from the ground must be in terms of feet above the surface at the point at which the observation is taken, and in this case only the proper figures will be entered. Pilots' reports of ceiling made while in flight must be in feet above sea level. Such values which will be reported under "Remarks" must carry the abbreviation "MSL" to indicate the reference plane is mean sea level. Care must be exercised by the official ob-

Chapter XVI

PILOTS' REPORTS

2-170. Rules Governing Use of Pilots' Reports by Ground Stations.—Cases have arisen where observations of ceilings and other elements made by the Weather Bureau personnel at a particular point have been at variance with the opinions of pilots and transport operators at the same point concerning the values of these same elements. In order that there will be no confusion with regard to the proper procedure in such cases, the following instructions will be adhered to:

(a) Conditions under which Weather Bureau reports will govern.—The Weather Bureau reports of ceilings and other elements shall govern in all cases where official observations are taken at the point in question by personnel holding a "Certificate of Authority to Take Airway Weather Observations," or regular Weather Bureau personnel, and when the values used in such reports have been obtained by approved methods of measurement. Approved methods of measurement of ceiling include values obtained by use of ceiling projectors, ceiling balloons, pilot balloons, or observation of the unobscured portions of towers, buildings, etc. (excluding land elevations), located within a radius of 1½ miles of the station and the height of which are definitely known.

(b) Conditions under which pilots' reports of ceiling values may be accepted for official use.—Pilots' reports of ceiling values may be accepted as official and used in airway reports under the following conditions:

1. When such reports are made while in flight over any point at which there is no official airway weather-reporting station within a radius of 1½ miles.

2. When such reports are made from the ground at a landing point at which there is no official airway weather-reporting station.

3. When such reports are made at a point where there is an official airway weather reporting station and the personnel have not been able to obtain a direct measurement by approved methods and the pilot has obtained his value within a radius of 1½ miles of the station through direct observation while in flight, provided that the official weather observer has no reason to question the accuracy of the report.

(c) Entry of pilots' reports of ceiling values in regular reports.—Reports of the type outlined in *(b)*1 and *(b)*2 above may be added as remarks to the regular report, using symbols and abbreviations, while reports of the type outlined under *(b)*3 above should be used as the official ceiling value—*without* the word "estimated"—in the body of the report. In case *(b)*3 the remark "PIREPS CIG" will be carried.

(d) Reports by other than official weather observers where an official weather-reporting station is located.—Estimates or measurements of ceiling made by ground personnel of any transport or aviation company, or of the airport personnel, or of pilots on the ground at any point where there is an official weather-reporting station within a radius of 1½ miles, cannot be accepted as official and included in any airway weather report unless verified or accepted by the official observer on duty.

(e) Basis of pilots' reports of ceiling- and cloud-height values.—Pilot's reports of ceiling- and cloud-height values made from the ground must be in terms of feet ABOVE THE SURFACE at the point at which the observation is taken, and in this case only the proper figures will be entered. Pilots' reports of ceiling and

Chapter XVI

PILOTS' REPORTS

2-170. Rules Governing Use of Pilots' Reports by Ground Stations. Cases have arisen where observations of ceilings and other elements made by the Weather Bureau personnel at a particular point have been at variance with the opinions of pilots and transport operators at the same point concerning the values of these same elements. In order that there will be no confusion with regard to the proper procedure in such cases, the following instructions will be adhered to:

(a) Conditions under which Weather Bureau reports will govern. The Weather Bureau reports shall govern in all cases where official observations are taken by personnel holding a "Certificate of Authority to Take Airway Weather Observations," or regular Weather Bureau personnel, except as noted in *(b)* 3 below.

(b) Conditions under which pilots' reports of ceiling heights will be accepted for official use. Pilots' reports of ceiling heights will be accepted as official and used in airway reports under the following conditions:

1. When such reports are made while in flight over any point at which there is no official airway weather-reporting station within a radius of 1 1/2 miles.

2. When such reports are made from the ground at a landing point at which there is no official airway weather-reporting station.

3. When such reports are made at a point where there is an official airway weather-reporting station and the personnel have not been able to obtain a projector-measured ceiling height, provided the pilot obtained his value while in flight over, or within 1 1/2 miles of the boundary of, the airport.

(c) Entry of pilots' reports of ceiling heights in regular reports. Reports of the type outlined in *(b)*1 and *(b)*2 above may be added as remarks to the regular report, using symbols and abbreviations, while reports of the type outlined under *(b)*3 above will be used as the official ceiling value in the body of the report, preceded by an "A". ~~See paragraph 8-101(g).~~ Cancelled 7-1-45.

(d) Reports by other than official weather observers where an official weather-reporting station is located. Estimates or measurements of ceiling made by ground personnel of any transport or aviation company, or of the airport personnel, or of pilots on the ground at any point where there is an official weather-reporting station within a radius of 1 1/2 miles, cannot be accepted as official and included in any airway weather report unless verified or accepted by the official observer on duty.

(e) Basis of pilots' reports of ceiling height and cloud height values. Pilots' reports of ceiling heights and cloud heights made from the ground must be in terms of feet ABOVE THE SURFACE at the point at which the observation is taken, and in this case only the proper figures will be entered. Pilots' reports of ceiling and

CHAPTER XVI

CONDITIONS UNDER WHICH PILOTS' OBSERVATIONS MAY BE ACCEPTED AS OFFICIAL AIRWAY WEATHER REPORTS

2-170. Necessity and Purpose and Rules Governing Use of Pilots' Reports.—Cases have arisen where observations of ceilings and other elements made by the Weather Bureau personnel at a particular point have been at variance with the opinions of pilots and transport operators at the same point concerning the values of these same elements. In order that there will be no confusion with regard to the proper procedure in such cases, the following instructions will be adhered to:

(*a*) *Conditions under which Weather Bureau reports will govern.*—The Weather Bureau reports of ceilings and other elements shall govern in all cases where official observations are taken at the point in question by personnel holding a "Certificate of Authority to Take Airway Weather Observations," or regular Weather Bureau personnel, and when the values used in such reports have been obtained by approved methods of measurement. Approved methods of measurement of ceiling include values obtained by use of ceiling projectors, ceiling balloons, pilot balloons, or observation of the unobscured portions of towers, buildings, etc. (excluding land elevations), located within a radius of 1½ miles of the station and the height of which are definitely known.

(*b*) *Conditions under which transport or commercial pilots' reports accepted for official use.*—Transport or commercial pilots' reports of ceiling values may be accepted as official and used in airway reports under the following conditions:

1. When such reports are made while in flight over any point at which there is no official airway weather-reporting station within a radius of 1½ miles.
2. When such reports are made from the ground at a landing point at which there is no official airway weather-reporting station.
3. When such reports are made at a point where there is an official airway weather-reporting station and the personnel have not been able to obtain a direct measurement by approved methods and the pilot has obtained his value within a radius of 1½ miles of the station through direct observation while *taking off* from or *landing* at the field in question, provided that the official weather observer has no reason to question the accuracy of the report.

(*c*) *Adding of pilots' reports to regular reports.*—Reports of the type outlined in "b (1) and (2)" above may be added as remarks to the regular report, using symbols and abbreviations "PIREPS 6⊕3 MUSCATINE," "PIREPS 8⊕◐2 SE STN," etc., while reports of the type outlined under "b (3)" above should be used as the official ceiling value—without the word "estimated"—in the body of the report.

(*d*) *Reports by other than authorized Weather Bureau observers where an official weather-reporting station is located.*—Estimates or measurements of ceiling made by ground personnel of any transport or aviation company, or of the airport personnel, or of pilots on the ground at any point where there is an official weather-reporting station within a radius of 1½ miles, cannot be accepted as official and included in any airway weather report unless verified or accepted by the official observer on duty.

(*e*) *Clearance of pilots' reports through the Weather Bureau.*—All reports made by pilots must be cleared through the Weather Bureau before being placed in official use.

(*f*) *Basis of pilots' reports of ceiling values.*—Pilots' reports of ceiling values made from the ground must be in terms of feet above the surface at the point at which the observation is taken, and in this case only the proper figures will be entered. Pilots' reports of ceiling made while in flight must be in feet above sea level. Such values which will be reported under "Remarks" must carry the abbreviation "MSL" to indicate the reference plane is mean sea level. Care must be exercised by the official ob-

servers to see that misunderstandings in this connection do not occur when ceiling-height reports are accepted.

(*g*) *Holding of "Certificates of authority" by pilots and ground personnel.*—From the above it will be seen that it is not necessary for pilots to hold Weather Bureau "Certificates of authority to take airway weather observations." Moreover, ground personnel of airports or air-transport operators should not hold "Certificates of authority to take airway observations" when such personnel are regularly employed within a radius of 1½ miles of an official airway weather-reporting station, operated by Army, Navy, Coast Guard, Weather Bureau, or Civil Aeronautics Administration personnel.

2–171. Adding data from pilots' reports in "Remarks."—The foregoing instructions will permit the adding of important data from pilots' observations in the remarks of the station receiving the reports. The right to include such data should not, however, be exercised by any station to the extent that sequence or reports are unduly lengthened, only reports of interest to *all concerned* being handled in this manner.

2–172. Examples.—Illustrations of application of the foregoing instructions follow:

(*a*) *Pilot reporting while in flight.*—Pilot reporting from over Ashland, about 20 miles west of Omaha, with his report being added to Omaha report:

OH X 3⊕2⊕1R–F– 061/32/32←5/967/PIREPS ASHLAND NEBR 1035C MSL 18⊕ 1/2ZR–F 30 TOP 6 THSD HVY ICG

(*b*) *Pilot reporting when on the ground at point where no Weather Bureau station is located.*—A pilot down at Kearney, Nebr., intermediate field, where there is no official weather-reporting station reports to his Omaha office by radio from where it is communicated to Weather Bureau at airport and included in next report:

OH C 20⊕5H 159/76/68↗12/003/PIREPS KEARNEY NEBR 1050C E2⊕1/4T+R+ ↘35E+↑1035C

2–173. Miscellaneous Data from Pilots.—In addition, individual reports of tops of clouds, turbulence, icing conditions, and upper-air winds of over 60 miles per hour should be included under "Remarks". It should be emphasized here that the reporting of weather conditions by airline pilots is not mandatory but rather in the spirit of cooperation which exists between the Weather Bureau, the Civil Aeronautics Administration, and the airlines. It is not practicable to give detailed instructions to cover all cases, but the instructions which follow will govern when pilots' reports of icing conditions and upper-air winds of over 60 miles per hour are to be transmitted.

(I) ICING CONDITIONS

1. Intensity of icing condition, using the word "ICE" to indicate moderate icing.
"—ICE" [word ICE, preceded by minus sign (—)] to indicate light icing, and
"+ICE" [word ICE, preceded by plus sign (+)] to indicate heavy icing.
2. Location and geographical extent of icing area.

The location and geographical extent of the icing area will be expressed in miles, followed by appropriate abbreviations indicating its direction from either the reporting station or another well-known teletype or radio point. If pilot reports icing conditions with respect to some little known place, it will be the responsibility of the person preparing the report for teletype or radio transmission to express the conditions with respect to some well-known geographical location. However, if icing conditions are restricted to a limited and well-known area, such as over a definite mountain top or range, it will be satisfactory to give this area in the report.

3. The top and base of the icing area, expressed in hundreds of feet above sea level, will be given in a figure group at the end of the report, as follows:

"85–40" = Top 8500; base 4000.
"115–//" = Top 11,500; base unknown.
"//–65" = Top unknown; base 6500.

servers to see that misunderstandings in this connection do not occur when ceiling-height reports are accepted.

(*g*) *Holding of "Certificates of authority" by pilots and ground personnel.*—From the above it will be seen that it is not necessary for pilots to hold Weather Bureau "Certificates of authority to take airway weather observations." Moreover, ground personnel of airports or air-transport operators should not hold "Certificates of authority to take airway observations" when such personnel are regularly employed within a radius of 1½ miles of an official airway weather-reporting station, operated by Army, Navy, Coast Guard, Weather Bureau, or Civil Aeronautics Administration personnel.

2–171. Adding data from pilots' reports in "Remarks."—The foregoing instructions will permit the adding of important data from pilots' observations in the remarks of the station receiving the reports. The right to include such data should not, however, be exercised by any station to the extent that sequence or reports are unduly lengthened, only reports of interest to *all concerned* being handled in this manner.

2–172. Examples.—Illustrations of application of the foregoing instructions follow:

(*a*) *Pilot reporting while in flight.*—Pilot reporting from over Ashland, about 20 miles west of Omaha, with his report being added to Omaha report:

OH X 3⊕2⦶1R–F– 061/32/32←5/967/PIREPS ASHLAND NEBR 1035C MSL 18⊕ 1/2ZR–F 30 TOP 6 THSD HVY ICG

(*b*) *Pilot reporting when on the ground at point where no Weather Bureau station is located.*—A pilot down at Kearney, Nebr., intermediate field, where there is no official weather-reporting station reports to his Omaha office by radio from where it is communicated to Weather Bureau at airport and included in next report:

OH C 20⊕5H 159/76/68↗12/003/PIREPS KEARNEY NEBR 1050C E2⊕1/4T+R+ ↘35E+↑1035C

2–173. Miscellaneous Data from Pilots.—In addition, individual reports of tops of clouds, turbulence, icing conditions, and upper-air winds of over 60 miles per hour should be included under "Remarks". It should be emphasized here that the reporting of weather conditions by airline pilots is not mandatory but rather in the spirit of cooperation which exists between the Weather Bureau, the Civil Aeronautics Administration, and the airlines. It is not practicable to give detailed instructions to cover all cases, but the instructions which follow will govern when pilots' reports of icing conditions and upper-air winds of over 60 miles per hour are to be transmitted.

(I) ICING CONDITIONS

1. Intensity of icing condition, using the word "ICE" to indicate moderate icing.
"−ICE" [word ICE, preceded by minus sign (−)] to indicate light icing, and
"+ICE" [word ICE, preceded by plus sign (+)] to indicate heavy icing.

2. Location and geographical extent of icing area.

The location and geographical extent of the icing area will be expressed in miles, followed by appropriate abbreviations indicating its direction from either the reporting station or another well-known teletype or radio point. If pilot reports icing conditions with respect to some little known place, it will be the responsibility of the person preparing the report for teletype or radio transmission to express the conditions with respect to some well-known geographical location. However, if icing conditions are restricted to a limited and well-known area, such as over a definite mountain top or range, it will be satisfactory to give this area in the report.

3. The top and base of the icing area, expressed in hundreds of feet above sea level, will be given in a figure group at the end of the report, as follows:

"85–40" = Top 8500; base 4000.
"115–//" = Top 11,500; base unknown.
"//–65" = Top unknown; base 6500.

cloud heights made while in flight must be in feet ABOVE MEAN SEA LEVEL. Such values which are reported under "Remarks" must carry the abbreviation "MSL" to indicate the reference plane is mean sea level. *Extreme care must be exercised by the official observers to see that misunderstandings in this connection do not occur when ceiling- and cloud-height reports are accepted.*

(f) Clearance of pilots' reports through official weather observers.--All reports made by pilots must be cleared through official weather observers before being placed in official use.

(g) Holding of "Certificates of Authority" by pilots and ground personnel.—From the foregoing it will be seen that it is not necessary for pilots to hold Weather Bureau "Certificates of Authority to Take Airway Weather Observations." Moreover, ground personnel of airports or air-transport operators should not hold "Certificates of Authority to Take Airway Weather Observations" when such personnel are regularly employed within a radius of 1½ miles of an official airway weather-reporting station, operated by Army, Navy, Marine, Coast Guard, Indian Affairs, Civil Aeronautics Administration, or Weather Bureau personnel.

2-171. **Use and Dissemination of Pireps.**—Information on meteorological phenomena which pilots encounter in flight is frequently as important to the movement of aircraft as meteorological information obtained from surface observation stations. All observers should, therefore, give careful weight to the reports of conditions aloft which pilots have furnished and the important data should be disseminated for use of other aircraft and for use of meteorological personnel. The reporting of weather conditions by pilots is not mandatory but rather in the spirit of cooperation which exists between the Weather Bureau, C.A.A., and aircraft operators. Dissemination of pilots' reports will be accomplished by one of two methods depending on the data contained in the report and the time at which it is received at the station. These two distribution methods are as follows:

(a) Adding data from pilots' reports in "Remarks".—Pilots' reports will be added as remarks to the next record or special observation of the station receiving them unless the data requires faster distribution as provided in *(b)* following.

(b) Transmitting of "Specials" containing only pilots' reports.—If pilots' reports of (1) icing conditions, (2) aircraft experiencing electrical discharge or lightning stroke, (3) turbulence, (4) upper air winds of over 60 MPH, or (5) tops of overcast are received more than 10 minutes prior to the next record observation, such information will be filed as a special observation containing only the PIREPS*. If reports of any of these phenomena are received within 10 minutes of the next record observation, or if local weather conditions necessitate the filing of a special weather report before a pilot's report can be handled as a separate "SPL PIREPS", the data will be included in remarks of the record or special observation and the SPL PIREPS will *not* be filed.

2-172. **Preparation of SPL PIREPS for Transmission.**—A SPL PIREPS will be filed in the same manner and given the same distribution as a special weather report, and will contain the following:

a. Station designator of originating station.
b. SPL

*Such reports will be referred to as "SPL PIREPS" in these instructions.

cloud heights obtained from direct observations while in flight must be in feet ABOVE MEAN SEA LEVEL. Such values which are reported under "Remarks" should carry the abbreviation "MSL" to indicate the reference plane is mean sea level while values which are used in the body of the report under conditions outlined in subparagraph *(b)* 3 above will be corrected by the observer to indicate feet above the ground. *Extreme care must be exercised by the official observers to see that misunderstandings do not occur when ceiling- and cloud-height reports are accepted, and in each case the reference plane on which the pilot has based the data should be obtained.*

(f) Clearance of pilots' reports through official weather observers.—All reports made by pilots must be cleared through official weather observers before being placed in official use.

(g) Holding of "Certificates of Authority" by pilots and ground personnel.—From the foregoing it will be seen that it is not necessary for pilots to hold Weather Bureau "Certificates of Authority to Take Airway Weather Observations." Moreover, ground personnel of airports or air-transport operators should not hold "Certificates of Authority to Take Airway Weather Observations" when such personnel are regularly employed within a radius of 1½ miles of an official airway weather-reporting station, operated by Army, Navy, Marine, Coast Guard, Indian Affairs, Civil Aeronautics Administration, or Weather Bureau personnel.

2-171. Use and Dissemination of Pireps.—Information on meteorological phenomena which pilots encounter in flight is frequently as important to the movement of aircraft as meteorological information obtained from surface observation stations. All observers should, therefore, give careful weight to the reports of conditions aloft which pilots have furnished and the important data should be disseminated for use of other aircraft and for use of meteorological personnel. The reporting of weather conditions by pilots is not mandatory but rather in the spirit of cooperation which exists between the Weather Bureau, C.A.A., and aircraft operators. Dissemination of pilots' reports will be accomplished by one of two methods depending on the data contained in the report and the time at which it is received at the station. These two distribution methods are as follows:

(a) Adding data from pilots' reports in "Remarks".—Pilots' reports will be added as remarks to the next record or special observation of the station receiving them unless the data requires faster distribution as provided in *(b)* following.

(b) Transmitting of "Specials" containing only pilots' reports.—If pilots' reports of (1) icing conditions, (2) aircraft experiencing electrical discharge or lightning stroke, (3) turbulence, (4) upper air winds of over 60 MPH, or (5) tops of overcast are received more than 10 minutes prior to the next record observation, such information will be filed as a special observation containing only the PIREPS*. If reports of any of these phenomena are received within 10 minutes of the next record observation, or if local weather conditions necessitate the filing of a special weather report before a pilot's report can be handled as a separate "SPL PIREPS", the data will be included in remarks of the record or special observation and the SPL PIREPS will *not* be filed.

2-172. Preparation of SPL PIREPS for Transmission.—A SPL PIREPS will be filed in the same manner and given the same distribution as a special weather report, and will contain the following:

a. Station designator of originating station.
b. SPL

*Such reports will be referred to as "SPL PIREPS" in these instructions.

cloud heights obtained from direct observations while in flight must be in feet ABOVE MEAN SEA LEVEL. Such values which are reported under "Remarks" should carry the abbreviation "MSL" to indicate the reference plane is mean sea level while values which are used in the body of the report under conditions outlined in subparagraph (b) 3 above will be corrected by the observer to indicate feet above the ground. Extreme care must be exercised by the official observers to see that misunderstandings do not occur when ceiling- and cloud-height reports are accepted, and in each case the reference plane on which the pilot has based the data should be obtained.

(f) Clearance of pilots' reports through official weather observers.--All reports made by pilots must be cleared through official weather observers before being placed in official use.

(g) Holding of "Certificates of Authority" by pilots and ground personnel.--From the foregoing it will be seen that it is not necessary for pilots to hold Weather Bureau "Certificates of Authority to Take Airway Weather Observations." Moreover, ground personnel of airports or air-transport operators should not hold "Certificates of Authority to Take Airway Weather Observations" when such personnel are regularly employed within a radius of 1 1/2 miles of an official airway weather-reporting station operated by Army, Navy, Marine, Coast Guard, Indian Affairs, Civil Aeronautics Administration, or Weather Bureau personnel.

▼ 2-171. Use and Dissemination of Pireps.--Meteorological phenomena reported by pilots in flight are frequently as important to the movement of aircraft as meteorological information obtained from surface observation stations. These in-flight weather reports are obtained and distributed through the cooperative efforts of the Weather Bureau, the Civil Aeronautics Administration, and aircraft operators. For convenience, radio operators will handle such reports in a form closely similar to a standard position report. In fact, under ordinary conditions, Pireps will often become available as additional information given by a pilot at the time of an actual scheduled position report. In general, the form of these reports as received by radio operators will be as follows:

1. Flight identification
   Operation Company or Agency, Flight Number or Direction of Flight, and Type of Aircraft
2. Location
3. Time
4. Altitude
5. Estimated time over next fix
6. Flight conditions
7. Cloud conditions
8. Temperature
9. Weather
   Thunderstorms, turbulence, icing, rain or snow, fronts, squall lines, etc.
10. Winds at flight level

Weather Bureau personnel will be responsible for the further preparation and handling of these reports for transmission in accordance with the provisions of this circular, using whichever of the following procedures applies to the particular report.

(a) Pireps as remarks.--Pireps will be added as remarks to the next record or special observation of the station receiving them, unless the provisions of (b) or (c) below apply.

(b) Pireps transmitted alone as specials.--If received more than ten minutes prior to the next record observation (filing time), Pireps will be transmitted as special observations containing only the Pireps when any of the following phenomena are reported:

(1) Icing conditions
(2) Aircraft experiencing electrical discharge or lightning stroke
(3) Turbulence
(4) Hail
(5) Upper air wind velocities over 60 miles per hour
(6) Tops of overcast

EXAMPLES

(*a*) Pilot flying between Cheyenne, Wyo., and Salt Lake City, Utah, reports to Cheyenne heavy icing conditions 15 to 80 miles west of Cheyenne, with base at 7000 feet MSL and top 8500 feet MSL.

This report will be added to the next regular or special CX report, as follows:

PIREPS +ICE 15–80 W CX 85–70

(*b*) Pilot flying between Seattle and Oakland reports to Medford moderate icing conditions 5 to 20 miles north of Eugene, Oreg., with base at 2000 feet MSL, top unknown.

Medford will add the following to its next regular or special report:

PIREPS ICE 5–20 N EU //–20

(*c*) Pilot flying between Oakland and Burbank reports light icing conditions over mountain tops north of Burbank, with top at 11,500 feet MSL, base unknown.

This report will be added to the next Burbank report, as follows:

PIREPS –ICE MTNS N BU 115–//

(II) WINDS OF OVER 60 MILES PER HOUR

1. Wind data in pilots' reports will be introduced by the abbreviation "WND" following the abbreviation "PIREPS".

2. The direction from which wind is blowing will be indicated in teletype reports by figures representing the degrees of the compass from which the wind is blowing, which will be followed immediately by figures indicating the force in miles per hour.

3. As high winds are not so localized horizontally or vertically as icing conditions, only the approximate location and altitude of such winds need be indicated. For instance, a report need indicate only that winds of over 60 miles per hour were encountered east, west, north, or south of a certain station, or between two stations on an airway, at a certain altitude.

EXAMPLE

Pilot flying between Fargo and Billings reports to Bismarck he encountered a northwest wind of 95 miles per hour west of Bismarck at 6,000 feet.

Bismarck will add the following to its next regular or special report:

PIREPS WND 315 95 W RK 60

CHAPTER XVII

EXAMPLES OF AIRWAY REPORTS AS TRANSMITTED BY TELETYPE AND RADIO OR BY TELEGRAPH AND TELEPHONE

2–174. In order that observers may have a clear understanding of the foregoing instructions, there follows a number of examples in which attempt has been made to present as many typical weather situations as possible. The observer should study these very carefully and in each case determine to his own satisfaction why the various elements were required to be entered as shown. The letters given in the left-hand column represent the respective elements of a report, as follows:

(*a*) =Station.
(*b*) =Classification.
(*c*) =Type of report.
(*d*) =Time of report.
(*e*) =Ceiling.
(*f*) =Sky.
(*g*) =Visibility.
(*h*) =Weather.
(*i*) =Obstructions to vision.
(*j*) =Barometric pressure.
(*k*) =Temperature.
(*l*) =Dew point.
(*m*)=Wind (followed by wind-shift data when appropriate).
(*n*) =Altimeter setting.
(*o*) =Remarks.

c. Four figure time group followed immediately by E, C, M, or P to indicate time zone.
d. PIREPS.
e. Information on icing conditions, aircraft experiencing electrical discharge or lightning stroke, turbulence, upper air winds over 60 MPH, or tops of overcast.

(a) Examples:—The following are examples of SPL PIREPS as transmitted (for instructions relative to coding see paragraph 2-173 below):

FV SPL 1711C PIREPS ICG- 15-75 N FV 55-80 MSL

AZ SPL 1638E PIREPS DISCHARGE 10 N AZ 35 MSL

BU SPL 1313P PIREPS TURBC- OVR MTNS N

BI SPL 1458M PIREPS WND 315 95 W RK 65 MSL

NT SPL 0441C PIREPS TOVC 85 MSL

(b) Recording of SPL PIREPS on WB Form 1130.—A SPL PIREPS will be recorded on WB Form 1130 after the last observation or SPL PIREPS in the following manner:

a. Enter "S" in the column for type of report.
b. Enter filing time (24-hour clock) in column for time.
c. Enter "PIREPS - - - - - - - " in remarks column.
d. Enter initials in proper column.

2-173. Coding of Pilots' Reports for Transmission.—It is not practicable to give detailed coding instructions to cover all meteorological phenomena that may be reported by pilots; however, instructions for coding phenomena which may be sent as SPL PIREPS is given below and these may be used as guides for coding other phenomena. In this latter connection, reports on meteorological data for which explicit instructions are not contained herein will not be monitored for coding other than that data should be given in a clear and concise manner and authorized abbreviations and symbols used where possible. Pilots' reports should be preceded by the authorized phrase contraction "PIREPS", and figures for heights should always be followed by "MSL" when representing altitudes above mean sea level.

(I) ICING CONDITIONS

A uniform terminology on degrees of icing has been adopted by the Air Transport Association of America and approved by the C.A.A. and Weather Bureau. The definitions are given here for the information of all concerned.

"Trace of Ice.—An ice accumulation of no consequence, which does not affect the performance of the aircraft but should be reported by air carrier pilots for meteorological purposes.

"Light Ice.—An icing condition which can be handled safely by the normal functioning of the airplane's de-icing equipment. On encountering light ice, it is assumed that the airplane can be flown indefinitely provided the de-icing equipment is used.

"Moderate Ice.—An icing condition which de-icing equipment will safely handle but which for practical flight purposes can be considered the signal to the pilot that it is time to alter the flight plan so as to avoid cruising in that condition.

c. Four figure time group followed immediately by E, C, M, or P to indicate time zone.
d. PIREPS.
e. Information on icing conditions, aircraft experiencing electrical discharge or lightning stroke, turbulence, upper air winds over 60 MPH, or tops of overcast.

(a) Examples:—The following are examples of SPL PIREPS as transmitted (for instructions relative to coding see paragraph 2-173 below):

FV SPL 1711C PIREPS ICG- 15-75 N FV 55-80 MSL

AZ SPL 1638E PIREPS DISCHARGE 10 N AZ 35 MSL

BU SPL 1313P PIREPS TURBC- OVR MTNS N

BI SPL 1458M PIREPS WND 315 95 W RK 65 MSL

NT SPL 0441C PIREPS TOVC 85 MSL

(b) Recording of SPL PIREPS on WB Form 1130.—A SPL PIREPS will be recorded on WB Form 1130 after the last observation or SPL PIREPS in the following manner:

a. Enter "S" in the column for type of report.
b. Enter filing time (24-hour clock) in column for time.
c. Enter "PIREPS - - - - - - - " in remarks column.
d. Enter initials in proper column.

2-173. Coding of Pilots' Reports for Transmission.—It is not practicable to give detailed coding instructions to cover all meteorological phenomena that may be reported by pilots; however, instructions for coding phenomena which may be sent as SPL PIREPS is given below and these may be used as guides for coding other phenomena. In this latter connection, reports on meteorological data for which explicit instructions are not contained herein will not be monitored for coding other than that data should be given in a clear and concise manner and authorized abbreviations and symbols used where possible. Pilots' reports should be preceded by the authorized phrase contraction "PIREPS", and figures for heights should always be followed by "MSL" when representing altitudes above mean sea level.

(I) ICING CONDITIONS*

A uniform terminology on degrees of icing has been adopted by the Air Transport Association of America and approved by the C.A.A. and Weather Bureau. The definitions are given here for the information of all concerned.

"Trace of Ice.—An ice accumulation of no consequence, which does not affect the performance of the aircraft but should be reported by air carrier pilots for meteorological purposes.

"Light Ice.—An icing condition which can be handled safely by the normal functioning of the airplane's de-icing equipment. On encountering light ice, it is assumed that the airplane can be flown indefinitely provided the de-icing equipment is used.

"Moderate Ice.—An icing condition which de-icing equipment will safely handle but which for practical flight purposes can be considered the signal to the pilot that it is time to alter the flight plan so as to avoid cruising in that condition.

*Applies to "airfoil" icing only, and not to "carburetor" icing.

c. Four figure time group followed immediately by E, C, M, or P to indicate time zone.
d. PIREPS.
e. Information on icing conditions, aircraft experiencing electrical discharge or lightning stroke, turbulence, upper air winds over 60 MPH, or tops of overcast.

(a) Examples:—The following are examples of SPL PIREPS as transmitted (for instructions relative to coding see paragraph 2-173 below):

FV SPL 091711C PIREPS ICG- 15-75 N FV 55-80 MSL

AZ SPL 091638E PIREPS DISCHARGE 10 N AZ 35 MSL

BU SPL 091313P PIREPS TURBC- OVR MTNS N

BI SPL 091458M PIREPS WND 315 95 W RK 65 MSL

NT SPL 090441C PIREPS TOVC 85 MSL

CV SPL 090850E PIREPS TOVC 80 MSL CLR ABV TURBC- ALG LAKE

(b) Recording of SPL PIREPS on WB Form 1130B.—A SPL PIREPS will be recorded on WB Form 1130B after the last observation or SPL PIREPS in the following manner:

a. Enter "S" in the column for type of report.
b. Enter filing time (24-hour clock) in column for time.
c. Enter "PIREPS - - - - - - - -" in remarks column.
d. Enter initials in proper column.

2-173. CODING OF PILOTS' REPORTS FOR TRANSMISSION.—It is not practicable to give detailed coding instructions to cover all meteorological phenomena that may be reported by pilots; however, instructions for coding phenomena which may be sent as SPL PIREPS are given below and these may be used as guides for coding other phenomena. In this latter connection, reports on meteorological data for which explicit instructions are not contained herein will not be monitored for coding other than that data should be given in a clear and concise manner and authorized abbreviations and symbols used where possible. Pilots' reports should be preceded by the authorized phrase contraction "PIREPS", and figures for heights should always be followed by "MSL" when representing altitudes above mean sea level.

(I) ICING CONDITIONS*

A uniform terminology on degrees of icing has been adopted by the Air Transport Association of America and approved by the C. A. A. and Weather Bureau. The definitions are given here for the information of all concerned.

"Trace of Ice.—An ice accumulation of no consequence, which does not affect the performance of the aircraft but should be reported by air carrier pilots for meteorological purposes.

"Light Ice.—An icing condition which can be handled safely by the normal functioning of the airplane's de-icing equipment. On encountering light ice, it is assumed that the airplane can be flown indefinitely provided the de-icing equipment is used.

"Moderate Ice.—An icing condition which de-icing equipment will safely handle but which for practical flight purposes can be considered the signal to the pilot that it is time to alter the flight plan so as to avoid cruising in that condition.

*Applies to "airfoil" icing only, and not to "carburetor" icing.

As an exception, if local weather conditions necessitate the filing of a special observation before a Pirep can be filed alone, the Pirep will be handled as in (a) instead. At the discretion of the observer, any other Pirep of importance to the safety of air traffic may be transmitted alone as a special report.

(c) Ceiling pireps transmitted as "A" ceilings.--In-flight Pireps of ceilings within 1 1/2 miles of the boundary of an airport where there is an official airway weather-reporting station will be handled as "A" ceilings, provided they are used within 15 minutes after the pilot's measurement and are still applicable, and provided that a projector-measured ceiling height cannot be obtained. Ceiling Pireps with these qualifications may be transmitted in either record or special observations, and may themselves require a special under the rules for ceiling specials. Pireps transmitted as "A" ceilings will not require remarks unless other information is included. Pireps so used, however, and Pireps not used because too old or because a projector measurement was obtained, will be entered on Form 1130A as hereinafter prescribed.

2-172. Form of Pireps Entries on Form 1130A and for Transmission.--Pireps received will be entered in the "Remarks" column of WB Form 1130A, and in the following order:

1. The term "PIREPS"
2. Phenomena
3. Location
4. Altitude (if MSL, so indicate)
5. Time of pilot's observation (whenever known)
6. Type of aircraft (whenever known)

Authorized contractions, symbols, station designators, and figures will be used, or plain English words, if an abbreviation is lacking.

In addition, the following procedures apply where indicated:

(a) When a Pirep is entered alone as a special, Columns 1 and 2 of WB Form 1130A will be filled in just as for a special surface weather report, with the letter "S," serial number, and filing time. Filing and transmission procedures for special Pireps will be the same as for other special observation.

(b) When an "A" ceiling is to be used, the Pirep will be entered in the "Remarks" column on WB Form 1130A in parentheses, not for transmission, and the observation carrying the "A" ceiling will be entered on the next line below the Pirep.

(c) Likewise, if a Pirep is not used as a ceiling because a projector measurement was also obtained, the Pirep will be entered in parentheses on the form, and the observation containing the official measured ceiling will be entered on the line beneath.

(d) If a Pirep of ceiling is not used in the next record or special observation, it will be entered parenthetically on the form, and a local extra observation carrying the "A" ceiling will be entered on the next line.

2-173. Coding of Phenomena in Pireps.--It is not practicable to give detailed instructions for coding all meteorological phenomena that may be reported by pilots, but instructions for coding the more important phenomena are given below and may be used as guides for coding other phenomena. Reports of phenomena for which explicit coding instructions are not contained herein will be monitored for coding only to determine if data have been given clearly and concisely in the proper order (see par. 2-172) with authorized abbreviations and symbols used where possible. Reports of phenomena for which instructions are given will be closely monitored, as will the order and general content of all Pireps. The introductory term "PIREPS" must always be used in coding, and figures representing altitudes above mean sea level must always be followed by the abbreviation "MSL."

"*Heavy Ice.*—An icing condition which de-icing equipment *cannot* handle. On encountering heavy ice, the pilot will change altitude or return to a suitable airport and land, inasmuch as to continue under this condition of icing would render the aircraft unairworthy."

Pilots' reports on icing conditions will be coded as follows:

1. By use of the authorized abbreviation "ICG" and expressing the intensity by means of appropriate symbols as follows:

"ICG--" = Trace of ice.
"ICG- " = Light icing condition.
"ICG " = Moderate icing condition (abbreviation without symbol).
"ICG+ " = Heavy icing condition.

2. By giving the location and geographical extent of icing area. The location and geographical extent of the icing area will be expressed in miles followed by appropriate abbreviations indicating its direction from either the reporting station or another well-known teletype or radio point. If a pilot reports icing conditions with respect to some little known place, it will be the responsibility of the person preparing the report for teletype or radio transmission to express the conditions with respect to some well-known geographical location. However, if icing conditions are restricted to some well-known geographical area, such as over a definite mountain top of range, it will be satisfactory to give this area in the report.

3. By giving the top and base of the icing area, expressed in hundreds of feet above mean sea level, as shown in the following examples:

"40-85 MSL" = Base 4,000 ft., top 8,500 ft. MSL
"//-115 MSL" = Base unknown, top 11,500 ft. MSL
"65-// MSL" = Base 6,500 ft., MSL, top unknown

EXAMPLES

(a) Pilot flying between Cheyenne, Wyoming, and Salt Lake City, Utah, reports to Cheyenne moderate icing conditions 15 to 80 miles west of Cheyenne, with base at 9,000 feet MSL and top 10,500 feet MSL.

This report will be sent as a SPL PIREPS or added to the next regular or special CX report, depending on the time it was received, as follows:

PIREPS ICG 15-80 W CX 90-105 MSL

(b) Pilot flying between Seattle and Oakland reports to Medford light icing conditions 5 to 20 miles north of Eugene, Oregon, with base at 2,000 feet MSL, top unknown.

Medford will report the following:

PIREPS ICG- 5-20 N EU 20-// MSL

(c) Pilot flying between Oakland and Burbank reports heavy icing conditions over mountain tops north of Burbank, with top at 11,500 feet MSL, base unknown.

This report will be coded:

PIREPS ICG+ MTNS N BU //-115 MSL

(I) ICING* CONDITIONS

A uniform terminology for degrees of icing has been adopted by the Air Transport Association of America and approved by the Civil Aeronautics Administration and the Weather Bureau. The definitions are quoted below for the information of all concerned.

Trace of Ice.--An ice accumulation of no consequence, which does not affect the performance of the aircraft but should be reported by air carrier pilots for meteorological purposes.

Light Ice.--An icing condition which can be handled safely by the normal functioning of the airplane's de-icing equipment. On encountering light ice, it is assumed that the airplane can be flown indefinitely provided the de-icing equipment is used.

Moderate Ice.--An icing condition which de-icing equipment will safely handle but which for practical flight purposes can be considered the signal to the pilot that it is time to alter the flight plan so as to avoid cruising in that condition.

Heavy Ice.--An icing condition which de-icing equipment cannot handle. On encountering heavy ice, the pilot will change altitude or return to a suitable airport and land, inasmuch as to continue under this condition of icing would render the aircraft unairworthy.

Icing phenomena will be coded in Pireps as follows:

1. By use of the contraction "ICG," modified as authorized below to indicate intensity:

"ICG TRACE" = Trace of ice
"LGT ICG" = Light icing condition
"MDT ICG" = Moderate icing condition
"HVY ICG" = Heavy icing condition

2. The location and geographical extent of the icing area will be expressed by figures representing miles, followed by appropriate abbreviations indicating its direction from the reporting station or another well-known teletype or radio point. If icing conditions are restricted to some well-known geographical area, such as over a definite mountain top or range, it will be satisfactory to give this area in the report. If a pilot reports icing by reference to some little-known place, the person preparing the report for transmission will report the icing area with reference to some well-known station or geographical location, instead.

3. The base and top of the icing area will be given, expressed in hundreds of feet above mean sea level, as in examples below:

"40-85 MSL" = Base 4,000 ft., top 8,500 ft. MSL
"//-115 MSL" = Base unknown, top 11,500 ft. MSL
"65-// MSL" = Base 6,500 ft. MSL, top unknown

EXAMPLES OF ICING PIREPS

(a) A pilot of a DC-3 flying between Cheyenne, Wyoming, and Salt Lake City, Utah, reports to Cheyenne that at 1050 MWT he encountered moderate icing conditions which existed from 15 to 80 miles west of Cheyenne, with base at 9,000 feet MSL and top 10,500 feet MSL:

"PIREPS MDT ICG 15-80 W CX 90-105 MSL 1050M DC3."

(b) The pilot of a Stinson, flying between Seattle and Oakland, reports to Medford that at 0700 PWT he found light icing conditions 5 to 20 miles north of Eugene, Oregon, with base at 2,000 feet MSL, top unknown:

"PIREPS LGT ICG 5-20 N EU 20-// MSL 0700P STSN."

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*Applies to "airfoil" icing only, and not to "carburetor" icing.

(II) AIRCRAFT EXPERIENCING ELECTRICAL DISCHARGE OR LIGHTNING STROKE

When a pilot reports that his aircraft has experienced an electrical discharge or lightning stroke, such information will be coded for transmission either in a SPL PIREPS or in remarks of the next record of special observation as follows:

1. The word "DISCHARGE". (Phrases such as "experienced electrical discharge" or "lightning stroke", etc., will *not* be used.)
2. Location of aircraft when experiencing the phenomenon. This can usually be accomplished by giving the distance and direction from the reporting station or some well-known reference point.
3. Altitude to nearest hundred feet above mean sea level (reporting 1,000 ft. as "10", 2,500 ft. as "25"; etc.) at which discharge was experienced.

EXAMPLES

(a) Pilot flying between Richmond, Virginia, and Washington, D. C., reports to Washington that his aircraft experienced an electrical discharge 20 miles south of Washington at an elevation of 5,000 ft. MSL.

This would be coded as follows:

PIREPS DISCHARGE 20 S WA 50 MSL

(b) Pilot flying between San Antonio, Texas, and Shreveport, Louisiana, reports to Tyler that his aircraft experienced an electrical discharge 10 miles southwest of Palestine, Texas, at 4,500 ft. MSL.

This would be coded at Tyler as follows:

PIREPS DISCHARGE 10 S TPZ 45 MSL

(III) TURBULENCE

Pilots' reports on turbulence will be coded for a SPL PIREPS or remarks of the next record or special observation as follows:

1. Authorized abbreviation for turbulence and proper symbol for intensity as follows:

TURBC- = Light turbulence.
TURBC = Moderate turbulence (abbreviation without symbol).
TURBC+ = Heavy turbulence.

2. Location of turbulence area and geographical extent if reported.
3. Altitude to nearest hundred feet above mean sea level.

EXAMPLES

(a) Pilot reports to Kansas City, Mo., that heavy turbulence was encountered 10 miles northeast of Knoxville, Mo., at 6,000 ft. MSL.

This would be coded at KC as follows:

PIREPS TURBC+ 10 NE KL 60 MSL

(b) Pilot of a plane flying through Donner Summit Pass, Calif., reports to Reno, Nev., that moderate turbulence is experienced.

This information would be coded at RP as follows:

PIREPS TURBC OVR DS

(c) The pilot of a P-38, flying between Oakland and Burbank, reports heavy icing conditions encountered at 0925 PWT over mountains north of Burbank, with top at 11,500 feet MSL, base unknown:

"PIREPS HVY ICG MTNS N BU //-115 MSL 0925P P38."

(II) AIRCRAFT EXPERIENCING ELECTRICAL DISCHARGE OR LIGHTNING STROKE

The phenomenon of electrical discharge or lightning stroke experienced by an aircraft will be coded in Pireps as follows:

1. By use of the single word "DISCHARGE."
2. Location of aircraft at time of phenomenon, giving direction and distance from reporting station or some well-known point.
3. Altitude of aircraft, in hundreds of feet above mean sea level, at time of phenomenon.

EXAMPLES OF DISCHARGE PIREPS

(a) A pilot flying a PBY between Richmond, Virginia, and Washington, D. C., reports to Washington that at 1620 EWT his aircraft experienced an electrical discharge 20 miles south of Washington at an altitude of 5,000 feet MSL:

"PIREPS DISCHARGE 20 S WA 50 MSL 1620E PBY."

(b) The pilot of a Flying Fortress en route from St. Louis, Missouri, to Chicago, Illinois, reports to Chicago that at 1515 CWT his plane experienced an electrical discharge over the Kankakee River at an altitude of 2500 feet MSL:

"PIREPS DISCHARGE 15 S JO 25 MSL 1515C B17."

(III) TURBULENCE

The phenomenon of turbulence experienced by an aircraft will be coded in Pireps as follows:

1. By use of the contraction "TURBC," modified as authorized below to indicate intensity:

"LGT TURBC" = Light turbulence
"MDT TURBC" = Moderate turbulence
"HVY TURBC" = Heavy turbulence

2. Location of turbulence area, and geographical extent if reported.
3. Altitude to nearest hundred feet above mean sea level.

EXAMPLES OF TURBULENCE PIREPS

(a) Pilot reports to Kansas City, Missouri, that his C-54 encountered heavy turbulence at 2330 CWT, 10 miles northeast of Knoxville, Missouri, at 6,000 feet MSL:

"PIREPS HVY TURBC 10 NE KL 60 MSL 2330C C54."

(b) The pilot of a DC-3 flying, at 10,000 feet MSL through Donner Summit Pass, California, reports to Reno, Nevada, that moderate turbulence is being experienced, 1050 PWT:

"PIREPS MDT TURBC OVR DS 100 MSL 1050P DC3."

(IV) HAIL

Hail will be coded in Pireps by use of the symbols "A+," "A," "A-," and "AU" to indicate heavy hail, moderate hail, light hail, and hail of unknown intensity, respectively.

(IV) WINDS OVER 60 MILES PER HOUR

Wind data obtained from pilots' reports will be coded for a SPL PIREPS or for remarks of the next record or special observation as follows:

1. Authorized abbreviation for wind, "WND".
2. The wind direction by means of figures representing the degrees of the compass from which the wind is blowing.
3. The wind velocity in figures of miles per hour.
4. Approximate location and altitude (MSL) of high winds. As high winds are not so localized horizontally or vertically as other conditions encountered aloft, only the approximate location and altitude need be indicated. For instance, a report need indicate only that winds of over 60 miles per hour were encountered east, west, north, or south of a certain station, or between two stations on an airway, at a certain altitude.

EXAMPLE

(a) Pilot flying between Fargo and Billings reports to Bismarck that a northwest wind of 95 miles per hour west of Bismarck is encountered at 6,000 feet MSL. Bismarck will code this report as follows:

PIREPS WND 315 95 W RK 60 MSL

(V) TOPS OF OVERCASTS

Tops of overcast will be reported as follows:

1. By means of the authorized abbreviation "TOVC" for top of overcast.
2. Location.
3. Height to nearest hundred feet above MSL.

EXAMPLES

(a) A pilot flying over Navasota, Texas, reports to the station that the top of the overcast is 8,500 feet MSL.

Navasota would code the data as follows:

PIREPS TOVC 85 MSL

If the plane had been 15 miles southeast of Navasota when determining the top of overcast the report would be:

PIREPS TOVC 15 SE NT 85 MSL

(VI) MISCELLANEOUS EXAMPLES

(a) Pilot reporting while in flight.—Pilot reporting at 1015C from over Ashland, about 20 miles west of Omaha, gives the following information to the latter point: ceiling 1,800 feet mean sea level; overcast; visibility ½ mile; moderate rain; moderate fog; temperature 33°F. Omaha would add this report to its next special or record observation:

OH X 3⊕2⦶1R-F- 061/32/32←5/967/PIREPS ASHLAND NEB
1015C MSL 18⊕1/2RF 33

(b) Pilot reporting when on the ground at point where no weather reporting station is located.—A pilot down at Kearney, Nebr., intermediate field where there is no official weather observing station, reports to his Omaha office by radio at 1050C that the following conditions prevail at that point: ceiling estimated 200

(IV) WINDS OVER 60 MILES PER HOUR

Wind data obtained from pilots' reports will be coded for a SPL PIREPS or for remarks of the next record or special observation as follows:

1. Authorized abbreviation for wind, "WND".
2. The wind direction by means of figures representing the degrees of the compass from which the wind is blowing.
3. The wind velocity in figures of miles per hour.
4. Approximate location and altitude (MSL) of high winds. As high winds are not so localized horizontally or vertically as other conditions encountered aloft, only the approximate location and altitude need be indicated. For instance, a report need indicate only that winds of over 60 miles per hour were encountered east, west, north, or south of a certain station, or between two stations on an airway, at a certain altitude.

EXAMPLE

(a) Pilot flying between Fargo and Billings reports to Bismarck that a northwest wind of 95 miles per hour west of Bismarck is encountered at 6,000 feet MSL.

Bismarck will code this report as follows:

PIREPS WND 315 95 W RK 60 MSL

(V) TOPS OF OVERCASTS

Tops of overcast will be reported as follows:

1. By means of the authorized abbreviation "TOVC" for top of overcast.
2. Location.
3. Height to nearest hundred feet above MSL.

EXAMPLES

(a) A pilot flying over Navasota, Texas, reports to the station that the top of the overcast is 8,500 feet MSL.

Navasota would code the data as follows:

PIREPS TOVC 85 MSL

If the plane had been 15 miles southeast of Navasota when determining the top of overcast the report would be:

PIREPS TOVC 15 SE NT 85 MSL

(VI) MISCELLANEOUS EXAMPLES

(a) Pilot reporting while in flight.—Pilot reporting at 1015C from over Ashland, about 20 miles west of Omaha, gives the following information to the latter point: ceiling 1,800 feet mean sea level; overcast; visibility ½ mile; moderate rain; moderate fog; temperature 33°F. Omaha would add this report to its next special or record observation:

OH X M3⊕2⊙1R-F- 061/32/32←5/967/PIREPS ASHLAND NEB
1015C MSL 18⊕1/2RF 33

(b) Pilot reporting when on the ground at point where no weather reporting station is located.—A pilot down at Kearney, Nebr., intermediate field where there is no official weather observing station, reports to his Omaha office by radio at 1050C that the following conditions prevail at that point: ceiling estimated 200

EXAMPLES OF HAIL PIREPS

(a) The pilot of a DC-4 reports to Omaha, Nebraska, at 1617 CWT that he is flying through moderate hail 10 miles south at an altitude of 3,500 feet MSL:

"PIREPS A 10 S OH 35 MSL 1617C DC4."

(b) Hail, especially heavy hail, is usually associated with heavy thunderstorms in which turbulence, heavy rain, icing, or a discharge might also be experienced. Since it is therefore unlikely that only hail will be reported, it may be anticipated that other phenomena will often be included in the Pireps. At 1628 CWT the pilot of the above-mentioned aircraft reports that he is flying in light hail, heavy rain, and moderate turbulence at 3,000 feet MSL, 15 miles west of Omaha, and that at 5,000 feet MSL his plane experienced a discharge:

"PIREPS MDT TURBC R+A- 15 W OH 30 MSL DISCHARGE 50 MSL 1628C DC4."

WINDS ALOFT OVER 60 MILES PER HOUR

Winds aloft exceeding 60 miles per hour will be coded in Pireps as follows:

1. The authorized contraction, "WND."
2. Direction from which the wind is blowing, given in figures representing the degrees of the compass ("true" direction).
3. Figures representing the wind velocity in miles per hour.
4. Approximate location and altitude (MSL) of high winds. The report need only indicate east, west, north, or south of a certain station, or between two stations on an airway, at a certain altitude.

EXAMPLE OF HIGH WINDS ALOFT PIREPS

(a) At 0845 CWT the pilot of a P-47 reports to Bismarck, North Dakota, that he is encounterning a 95-mile wind west of Bismarck at 6,000 feet MSL, wind direction 315 degrees:

"PIREPS WND 315 95 W RK 60 MSL 0845C P47."

(VI) TOPS OF OVERCAST

Tops of overcast will be coded in Pireps as follows:

1. Using the authorized abbreviation, "TOVC."
2. Location, if elsewhere than over the reporting station.
3. Height to nearest hundred feet above MSL.

EXAMPLES OF TOVC PIREPS

(a) The pilot of a B-24 flying over Navasota, Texas, at 0613 CWT reports to Navasota that the top of the overcast is at 8,500 feet MSL:

"PIREPS TOVC 85 MSL 0613C B24."

(b) If the plane had been 15 miles southeast of Navasota when the pilot determined the height of the top of the overcast, the coded report would have read:

"PIREPS TOVC 15 SE NT 85 MSL 0613C B24."

feet; overcast; visibility 1/4 mile; heavy thunderstorm; heavy rain; wind northwest estimated 35 mph with strong gusts; severe south wind shift at 1035C. The dispatching office relays this information to the Weather Bureau where it is included in the next report:

OH C 20⊕5H 159/76/68↗12/003/PIREPS KEARNEY NEB
1050C E2⊕1/4T+R+↘35E+↑1035C+

Chapter XVII

EXAMPLES OF AIRWAY REPORTS AS TRANSMITTED BY TELETYPE AND RADIO OR BY TELEGRAPH AND TELEPHONE

2-174. In order that observers may have a clear understanding of the foregoing instructions, there follows a number of examples in which attempt has been made to present as many typical weather situations as possible. The observer should study these very carefully and in each case determine to his own satisfaction why the various elements were required to be entered as shown. The letters given in the left-hand column represent the respective elements of a report as follows:

(a) = Station
(b) = Classification
(c) = Type of report
(d) = Time of report
(e) = Ceiling
(f) = Sky
(g) = Visibility
(h) = Weather
(i) = Obstructions to vision
(j) = Barometric pressure
(k) = Temperature.
(l) = Dew point
(m) = Wind (followed by wind-shift data when appropriate)
(n) = Altimeter setting
(o) = Remarks

feet; overcast; visibility 1/4 mile; heavy thunderstorm; heavy rain; wind northwest estimated 35 mph with strong gusts; heavy south wind shift at 1035C. The dispatching office relays this information to the Weather Bureau where it is included in the next report:

OH C 20⊕5H 159/76/68↗12/003/PIREPS KEARNEY NEB
1050C E2⊕1/4T+R+↘35E+↑1035C+

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(j) = Barometric pressure
(k) = Temperature.
(l) = Dew point
(m) = Wind (followed by wind-shift data when appropriate)
(n) = Altimeter setting
(o) = Remarks

~~feet; overcast; visibility 1/4 mile; heavy thunderstorm; heavy rain; wind northwest estimated 35 mph with strong gusts; heavy south wind shift at 1035C. The dispatching office relays this information to the Weather Bureau where it is included in the next report:~~ cancelled 7-1-45.

~~OH C M20D5H 159/76/68/12/003/PIREPS KEARNEY NEB~~
~~1050C E2D1/4T+R+\35E+↑1035C+~~

Chapter XVII

EXAMPLES OF AIRWAY REPORTS AS TRANSMITTED BY TELETYPE AND RADIO OR BY TELEGRAPH AND TELEPHONE

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(h) = Weather
(i) = Obstructions to vision
(j) = Barometric pressure
(k) = Temperature.
(l) = Dew point
(m) = Wind (followed by wind-shift data when appropriate)
(n) = Altimeter setting
(o) = Remarks

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 1**, "record" observation
(a)	CX		Cheyenne, Wyo.
(b)	C	Contact	Satisfactory for contact flight.
(c)			Not a "special" or "local extra" observation; therefore, no "type of report" designation required.
(d)			Same as above no "time of observation" required in teletype report; telegraphed report will show time filed on message as received.
(e)			Ceiling unlimited, value omitted.
(f)	○	Clear	Sky clear.
(g)			Visibility 10 miles or more, no report required.
(h)			No weather.
(i)			No obstructions to vision.
(j)	163	10163	1016.3 millibars.
(k)	0	Zero	Temperature 0° F.
(l)	−3	Minus 3	Dew point −3° F.
(m)	↓9	North 9	North, 9 miles per hour.
(n)	964	2964	29.64 inches.
(o)			None.

Written thus on teletype:
CX C○ 163/0/-3↓9/964
Sent thus as body of telegram:
CONTACT CLEAR 10163 ZERO MINUS 3 NORTH 9 2964

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 2**, "record" observation
(a)	GI		Grand Island, Nebr.
(b)			Not a controlled airport.
(c)	}		Not a "special" or "local extra" observation, therefore no "type of report" or "time of report" designation required.
(d)			
(e)	E30	Estimated 3000	Estimated 3000 feet.
(f)	⦶/⦶	High scattered lower broken.	High scattered, lower broken clouds.
(g)	4	4	4 miles.
(h)	R−	Light rain	Light rain.
(i)	K−	Light smoke	Light smoke.
(j)	159	10159	1015.9 millibars.
(k)	70	70	70° F.
(l)	66	66	66° F.
(m)	→15	West 15	West 15 miles per hour.
(n)	003	3003	30.03 inches.
(o)			None.

Written thus on teletype:
GI E30⦶/⦶4R−K−159/70/66→15/003
Sent thus as body of telegram:
ESTIMATED 3000 HIGH SCATTERED LOWER BROKEN 4 LIGHT RAIN LIGHT SMOKE 10159 7066 WEST 15 3003

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 1,** "record" observation
(*a*)	CX		Cheyenne, Wyo.
(*b*)	C	Contact	Satisfactory for contact flight. cancelled 7-1-45
(*c*)			Not a "special" or "local extra" observation; therefore, no "type of report" designation required.
(*d*)			Same as above no "time of observation" required in teletype report; telegraphed report will show time filed on message as received.
(*e*)			Ceiling unlimited, value omitted.
(*f*)	○	Clear	Sky clear.
(*g*)			Visibility 10 miles or more, no report required.
(*h*)			No weather.
(*i*)			No obstructions to vision.
(*j*)	163	10163	1016.3 millibars.
(*k*)	0	Zero	Temperature 0° F.
(*l*)	−3	Minus 3	Dew point −3° F.
(*m*)	↓9	North 9	North, 9 miles per hour.
(*n*)	964	2964	29.64 inches.
(*o*)			None.

Written thus on teletype:
CX C○ 163/0/−3↓9/964
Sent thus as body of telegram:
~~CONTACT~~ CLEAR 10163 ZERO MINUS 3 NORTH 9 2964 Cancelled 7-1-45

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 2,** "record" observation
(*a*)	GI		Grand Island, Nebr.
(*b*)			~~Not a controlled airport.~~ cancelled 7-1-45,
(*c*) } (*d*) }			Not a "special" or "local extra" observation, therefore no "type of report" or "time of report" designation required.
(*e*)	E30	Estimated 3000	Estimated 3000 feet.
(*f*)	◐/◐	High scattered lower broken.	High scattered, lower broken clouds.
(*g*)	4	4	4 miles.
(*h*)	R−	Light rain	Light rain.
(*i*)	K−	Light smoke	Light smoke.
(*j*)	159	10159	1015.9 millibars.
(*k*)	70	70	70° F.
(*l*)	66	66	66° F.
(*m*)	→15	West 15	West 15 miles per hour.
(*n*)	003	3003	30.03 inches.
(*o*)			None.

Written thus on teletype:
GI E30◐/◐4 R− K−159/70/66→15/003
Sent thus as body of telegram:
ESTIMATED 3000 HIGH SCATTERED LOWER BROKEN 4 LIGHT RAIN LIGHT SMOKE 10159 7066 WEST 15 3003

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 3**, "local extra" observation
(*a*)	TL	NOTE.—Since this is a "local extra" report, it would not be telegraphed.	Toledo, Ohio.
(*b*)	X		Closed to landings and take-offs.
(*c*)	LCL		"Local extra" observation.
(*d*)	1215E		12:15 p. m., E. S. T.
(*e*)	E7V		Estimated 700 feet, variable.
(*f*)	⊕2⦶		Overcast, lower scattered clouds at 200 feet
(*g*)	1/2V		½ mile, variable.
(*h*)	SSQ		Moderate snow; moderate snow squalls occurring at time of observation or within 15 minutes.
(*i*)			Not required in "local extra" observations.
(*j*)			
(*k*)			
(*l*)			
(*m*)			
(*n*)			
(*o*)			None.

Written thus on local teletype circuit:
TL X LCL 1215E E7V⊕2⦶1/2VSSQ

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 4**, "record" observation
(*a*)	PS		Memphis, Tenn.
(*b*)	C	Contact	Satisfactory for contact flight.
(*c*)			Regular sequence record observation, no "type of report" or "time of report" designation required.
(*d*)			
(*e*)	12	1200	1,200 feet (measured).
(*f*)	⦶	Broken	Broken clouds.
(*g*)	8	8	8 miles.
(*h*)	SW−	Light snow showers	Light snow showers.
(*i*)			None.
(*j*)	152	10152	1015.2 millibars.
(*k*)	25	25	25° F.
(*l*)	19	19	19° F.
(*m*)	→↘20+	West northwest 20, strong gusts.	West northwest 20 miles per hour, strong gusts.
(*n*)	997	2997	29.97 inches.
(*o*)			None.

Written thus on teletype:
PS C 12⦶8SW− 152/25/19→↘20+/997
Sent thus as body of telegram:
CONTACT 1200 BROKEN 8 LIGHT SNOW SHOWERS 10152 2519 WEST NORTHWEST 20 STRONG GUSTS 2997

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 3, "local extra" observation
(a)----	TL	Note: Since this is a "local extra" report, it would not be telegraphed.	Toledo, Ohio.
(b)----	X	----------	Closed to landings and take-offs.
(c)----	LCL	----------	"Local extra" observation.
(d)----	1215E	----------	12:15 p.m., E.S.T. #
(e)----	P7V	----------	Precipitation ceiling 700 feet, variable.
(f)----	⊕2⦶	----------	Overcast, lower scattered clouds at 200 ft.
(g)----	1/2V	----------	1/2 mile, variable.
(h)----	SSQ	----------	Moderate snow, moderate snow squalls.
(i)----	----------	----------	
(j)----	----------	----------	
(k)----	----------	----------	
(l)----	----------	----------	Not required in "local extra" observations.
(m)----	----------	----------	
(n)----	----------	----------	
(o)----	----------	----------	

Written thus on local teletype circuit:

TL X LCL 1215E P7V⊕2⦶1/2VSSQ

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 4, "record" observation
(a)----	PS	----------	Memphis, Tenn.
(b)----	C	Contact----------	Satisfactory for contact flight.
(c)----	----------	----------	"Record" observation, no "type of report" or "time of report" required.
(d)----	----------	----------	
(e)----	M12	Measured 1200--------	Measured 1200 feet.
(f)----	⦶	Broken----------	Broken clouds.
(g)----	8	8----------	8 miles.
(h)----	SW-	Light snow showers----	Light snow showers.
(i)----	----------	----------	None.
(j)----	152	10152----------	1015.2 millibars.
(k)----	25	25----------	25° F.
(l)----	19	19----------	19° F.
(m)----	→↘20+	West northwest 20, strong gusts-------	West northwest 20 miles per hour, strong gusts.
(n)----	997	2997----------	29.97 inches.
(o)----	----------	----------	None.

Written thus on teletype:

PS C M12⦶8SW- 152/25/19→↘20+/997

Sent thus as body of telegram:

CONTACT MEASURED 1200 BROKEN 8 LIGHT SNOW SHOWERS 10152 2519 WEST NORTHWEST 20 STRONG GUSTS 2997

War Time is being used for the duration.

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

Example No. 3, local extra observation

Element	Teletype symbol	Translation
(a)--------	TL	Toledo, Ohio.
(b)--------	N	~~Below contact flight minimums.~~ Cancelled 7-1-45
(c)--------	LCL	Local extra observation.
(d)--------	151215E	12:15 p. m., E. S. T.* on the 15th.
(e)--------	P7	Precipitation ceiling 700 feet.
(f)--------	⊕2Ⓓ	Overcast, lower scattered clouds at 200 feet.
(g)--------	1/2	1/2 mile.
(h)--------	SWSQ	Moderate snow showers, moderate snow squalls.

Written thus on local teletype circuit: TL ~~N~~ LCL 151215E P7⊕2Ⓓ1/2SWSQ
Cancelled 7-1-45.

Example No. 4, record observation

Element	Teletype symbol	Translation
(a)--------	PS	Memphis, Tenn.
(b)--------	C	~~Satisfactory for contact flight.~~ Cancelled 7-1-45.
(c)--------	----------	"Record" observation, no "type of report" or "time of report" required.
(d)--------	----------	
(e)--------	M12	Measured 1200 feet.
(f)--------	Ⓓ	Broken clouds.
(g)--------	8	8 miles.
(h)--------	SW-	Light snow showers.
(i)--------	----------	None.
(j)--------	152	1015.2 millibars.
(k)--------	25	25° F.
(l)--------	19	19° F.
(m)--------	→↘20+	West northwest 20 miles per hour, strong gusts.
(n)--------	997	29.97 inches.
(o)--------	————	None.

Written thus on teletype: PS ~~C~~ M12ⒹⒹ8SW- 152/25/19→↘20+/997 cancelled 7-1-45.

Sent thus as body of telegram: ~~CONTACT~~ MEASURED 1200 BROKEN 8 LIGHT SNOW SHOWERS 10152 2519 WEST NORTHWEST 20 STRONG GUSTS 2997

*War Time is being used for the duration.

Example No. 3, Local Extra Observation

Element	Teletype Symbol	Translation
(a)———	TL	Toledo, Ohio.
(b)———		(Cancelled)
(c)———	LCL	Local extra observation.
(d)———	1220E	12:20 p.m., e.s.t.
(e)———	P7	Precipitation ceiling 700 feet.
(f)———	X20	Sky obscured, lower scattered clouds at 200 feet.
(g)———	1/2	1/2 mile visibility.
(h)———	SWSQ	Moderate snow showers, moderate snow squalls.

Written thus on local teletype circuit: TL LCL 1220E P7X201/2SWSQ

Example No. 4, Record Observation

Element	Teletype Symbol	Translation
(a)———	PS	Memphis, Tenn.
(b)———		(Cancelled)
(c)———		Record observation, type not required.
(d)———		Time not required.
(e)———	M12	Measured 1200 feet.
(f)———	0	Broken clouds.
(g)———	8	8 miles visibility.
(h)———	SW-	Light snow showers.
(i)———		None.
(j)———	152	1015.2 millibars.
(k)———	25	25° F.
(l)———	19	19° F.
(m)———	→↘20+	West northwest 20 miles per hour, strong gusts.
(n)———	997	29.97 inches.
(o)———		None.

Written thus on teletype: PS M120 8SW- 152/25/19→↘20+/997

Sent thus as body of telegram: MEASURED 1200 BROKEN 8 LIGHT SNOW SHOWERS 10152 2519 WEST NORTHWEST 20 STRONG GUSTS 2997

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 5**, "special" observation
(*a*)	CG		Chicago, Ill.
(*b*)	X	Closed	Closed to landings and take-offs.
(*c*)	SPL	Special	Special observation.
(*d*)	0312C		3:12 a. m., C. S. T.
(*e*)	0	0	Ceiling zero.
(*f*)			Omitted, actual sky condition not observable due to heavy snow.
(*g*)	1/8	⅛	⅛ mile.
(*h*)	S+	Heavy snow	Heavy snow.
(*i*)			None, other than snow.
(*j*)	061	10061	1006.1 millibars.
(*k*)	30	30	30° F.
(*l*)	25	25	25° F.
(*m*)	↘40+↑0308C+	Northwest 40 Strong gusts severe south wind shift 0308 Central Standard.	Northwest 40 miles per hour, strong gusts, severe wind shift from south to northwest at 3:08 a. m., C. S. T.
(*n*)	967	2967	29.67 inches.
(*o*)			None.

Written thus on teletype:
CG X SPL 0312C 01/8S+ 061/30/25↘40+↑0308C+/967
Sent thus as body of telegram:
CLOSED SPECIAL 01/8 HEAVY SNOW 10061 3025 NORTHWEST 40 STRONG GUSTS SEVERE SOUTH WIND SHIFT 0308 CENTRAL STANDARD 2967

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 6**, "record" observation
(*a*)	JM		Jamestown, N. Dak.
(*b*)			Not a controlled airport.
(*c*)			Regular sequence "record" observation, no "type of report" or "time of report" designation required.
(*d*)			
(*e*)			Unlimited.
(*f*)	10⦶	Scattered 1000	Scattered clouds at 1,000 feet.
(*g*)	1/4V	1/4 variable	¼ mile, variable.
(*h*)			None.
(*i*)	GS+	Thick drifting snow	Thick drifting snow.
(*j*)	193	10193	1019.3 millibars.
(*k*)	12	12	12° F.
(*l*)	−2	Minus 2	−2° F.
(*m*)	→28+	West 28 strong gusts	West 28 miles per hour, strong gusts.
(*n*)	999	2999	29.99 inches.
(*o*)			None.

Written thus on teletype:
JM 10⦶1/4VGS+ 193/12/-2→28+/999
Sent thus as body of telegram:
SCATTERED 1000 1/4 VARIABLE THICK DRIFTING SNOW 10193 12 MINUS 2 WEST 28 STRONG GUSTS 2999

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 5, "special" observation
(a)	CG		Chicago, Ill.
(b)	X	Closed	Closed to landings and take-offs.
(c)	SPL	Special	Special observation.
(d)	0312C		3:12 a. m., C. S. T.
(e)	0	0	Ceiling zero.
(f)			Omitted, actual sky condition not observable due to heavy snow.
(g)	1/8	⅛	⅛ mile.
(h)	S+	Heavy snow	Heavy snow.
(i)			None, other than snow.
(j)	061	10061	1006.1 millibars.
(k)	30	30	30° F.
(l)	25	25	25° F.
(m)	↘40+↑0308C+	Northwest 40 Strong gusts heavy south wind shift 0308 Central Standard.	Northwest 40 miles per hour, strong gusts, heavy wind shift from south to northwest at 3:08 a. m., C. S. T.
(n)	967	2967	29.67 inches.
(o)			None.

Written thus on teletype:
OG X SPL 0312C 01/8S+ 061/30/25↘40+↑0308C+/967
Sent thus as body of telegram:
CLOSED SPECIAL 01/8 HEAVY SNOW 10061 3025 NORTHWEST 40 STRONG GUSTS HEAVY SOUTH WIND SHIFT 0308 CENTRAL STANDARD 2967

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 6, "record" observation
(a)	JM		Jamestown, N. Dak.
(b)			Not a controlled airport.
(c)			Regular sequence "record" observation, no "type of report" or "time of report" designation required.
(d)			
(e)			Unlimited.
(f)	10⦶	Scattered 1000	Scattered clouds at 1,000 feet.
(g)	1/4V	1/4 variable	¼ mile, variable.
(h)			None.
(i)	GS+	Heavy drifting snow	Heavy drifting snow.
(j)	193	10193	1019.3 millibars.
(k)	12	12	12° F.
(l)	−2	Minus 2	−2° F.
(m)	→28+	West 28 strong gusts	West 28 miles per hour, strong gusts.
(n)	999	2999	29.99 inches.
(o)			None.

Written thus on teletype:
JM 10⦶1/4VGS+ 193/12/−2→28+/999
Sent thus as body of telegram:
SCATTERED 1000 1/4 VARIABLE HEAVY DRIFTING SNOW 10193 12 MINUS 2 WEST 28 STRONG GUSTS 2999

18-6770

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 5, "special" observation
(a)-----	CG	----------	Chicago, Ill.
(b)-----	X	Closed----------	Closed to landings and take-offs.
(c)-----	SPL	Special----------	Special observation.
(d)-----	0312C	----------	3:12 a.m., C.S.T.
(e)-----	PO	Precipitation 0-------	Precipitation zero.
(f)-----	----------	----------	Omitted, actual sky condition not observable due to heavy snow.
(g)-----	1/8	1/8----------	1/8 mile.
(h)-----	S+	Heavy snow----------	Heavy snow.
(i)-----	----------	----------	None, other than snow.
(j)-----	961	9961----------	996.1 millibars.
(k)-----	30	30----------	30° F.
(l)-----	25	25----------	25° F.
(m)-----	↘40+↑0308C+	Northwest 40, strong gusts heavy south wind shift 0308 Central.	Northwest 40 miles per hour, strong gusts, heavy wind shift from south to northwest at 3:08 a.m., C.S.T.
(n)-----	967	2967----------	29.67 inches.
(o)-----	----------	----------	None.

Written thus on teletype:

CG X SPL 0312C PO1/8S+ 961/30/25↘40+↑0308C+/967.

Sent thus as body of telegram:

CLOSED SPECIAL PRECIPITATION 01/8 HEAVY SNOW 9961 3025 NORTHWEST 40 STRONG GUSTS HEAVY SOUTH WIND SHIFT 0308 CENTRAL 2967

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 6, "record" observation
(a)-----	JM	----------	Jamestown, N. Dak.
(b)-----	----------	----------	Not a controlled airport.
(c)-----	----------	----------	Regular observation.
(d)-----	----------	----------	No time required.
(e)-----	----------	----------	Unlimited.
(f)-----	10Φ	Scattered 1000-------	Scattered clouds at 1,000 feet.
(g)-----	1/4V	1/4 variable---------	1/4 mile, variable.
(h)-----	----------	----------	None.
(i)-----	GS+	Heavy drifting snow--	Heavy drifting snow.
(j)-----	193	10193----------	1019.3 millibars.
(k)-----	12	12----------	12° F.
(l)-----	-2	Minus 2----------	-2° F.
(m)-----	→28+	West 28 strong gusts-	West 28 miles per hour, strong gusts.
(n)-----	999	2999----------	29.99 inches.
(o)-----	----------	----------	None.

Written thus on teletype:

JM 10Φ 1/4VGS+ 193/12/-2→28+/999

Sent thus as body of telegram:

SCATTERED 1000 1/4 VARIABLE HEAVY DRIFTING SNOW 10193 12 MINUS 2 WEST 28 STRONG GUSTS 2999

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

Example No. 5, special observation

Element	Teletype symbol	Translation
(a)--------	CG	Chicago, Illinois.
(b)--------	N	Below contact flight minimums.
(c)--------	SPL	Special observation.
(d)--------	160312C	3:12 a. m. C. S. T.* on the 16th.
(e)--------	PO	Precipitation zero.
(f)--------	----------	Omitted, actual sky condition not observable due to heavy snow.
(g)--------	1/8	1/8 mile.
(h)--------	S+	Heavy snow.
(i)--------	----------	None, other than snow.
(m)--------	↖40+↑0308C+	Northwest 40 miles per hour, strong gusts, heavy wind shift from south at 3:08 a. m.
(o)--------	----------	None

Written thus on teletype: CG N SPL 160312C PO1/8S+ ↖40+↑0308C+

Sent thus as body of telegram: INSTRUMENT SPECIAL PRECIPITATION 01/8 HEAVY SNOW NORTHWEST 40 STRONG GUSTS HEAVY SOUTH WIND SHIFT 0308 CENTRAL

Example No. 6, record observation

Element	Teletype symbol	Translation
(a)--------	JM	Jamestown, N. Dak.
(b)--------	----------	Not a controlled airport.
(c)--------	----------	Regular observation.
(d)--------	----------	No time required.
(e)--------	----------	Unlimited.
(f)--------	10Ø	Scattered clouds at 1,000 feet.
(g)--------	1/4	1/4 mile.
(h)--------	----------	None.
(i)--------	GS+	Heavy drifting snow.
(j)--------	193	1019.3 millibars.
(k)--------	12	12° F.
(l)--------	-2	-2° F.
(m)--------	→28+	West 28 miles per hour, strong gusts.
(n)--------	999	29.99 inches.
(o)--------	----------	None.

Written thus on teletype: JM 10Ø1/4GS+ 193/12/-2→28+/999

Sent thus as body of telegram: SCATTERED 1000 1/4 HEAVY DRIFTING SNOW 10193 12 MINUS 2 WEST 28 STRONG GUSTS 2999

*War Time is being used for the duration.

Example 5, Special Observation

Element	Teletype symbol	Translation
(a)-------	CG	Chicago, Illinois
► (b)-------		(Cancelled)
► (c)-------	S6	Sixth special observation of the day.
► (d)-------	0312C	3:12 a.m. C.S.T.*
(e)-------	PO	Precipitation ceiling zero.
► (f)-------	X	Sky obscured.
(g)-------	1/8	1/8 mile visibility.
(h)-------	S+	Heavy snow.
(i)-------		None, other than snow.
(m)-------	↘40+↑0308C+	Northwest 40 miles per hour, strong gusts, heavy wind shift from south at 3:08 a.m.
(o)-------		None.

Written thus on teletype: CG S6 0312C POX1/8S+ ↘40+↑0308C+

Sent thus as body of telegram: SIXTH SPECIAL PRECIPITATION ZERO OBSCURED 1/8 HEAVY SNOW NORTHWEST 40 STRONG GUSTS HEAVY SOUTH WIND SHIFT 0308 CENTRAL

Example 6, Record Observation

Element	Teletype symbol	Translation
(a)-------	JM	Jamestown, N. Dak.
► (b)-------		(Cancelled)
(c)-------		Regular observation.
(d)-------		No time required.
(e)-------		Ceiling unlimited.
(f)-------	10Ⓓ	Scattered clouds at 1,000 feet.
(g)-------	1/4	1/4 mile visibility.
(h)-------		None.
(i)-------	GS+	Heavy drifting snow.
(j)-------	193	1019.3 millibars.
(k)-------	12	12° F.
(l)-------	-2	-2° F.
(m)-------	→28+	West 28 miles per hour, strong gusts.
(n)-------	999	29.99 inches.
(o)-------		None.

Written thus on teletype: JM 10Ⓓ1/4GS+ 193/12/-2→28+/999

Sent thus as body of telegram: SCATTERED 1000 1/4 HEAVY DRIFTING SNOW 10193 12 MINUS 2 WEST 28 STRONG GUSTS 2999

*War Time is being used for the duration.

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 7**, "special" observation
(*a*)	WA		Arlington, Va.
(*b*)	X	Closed	Closed to landings.
(*c*)	SPL	Special	Special observation.
(*d*)	1122E		11:22 a. m., E. S. T.
(*e*)	0	0	Zero.
(*f*)			Sky condition not observable.
(*g*)	0	0	Zero.
(*h*)			None.
(*i*)	FF	Dense fog	Dense fog.
(*j*)	159	10159	1015.9 millibars.
(*k*)	42	42	42° F.
(*l*)	42	42	42° F.
(*m*)	←2	East 2	East, 2 miles per hour.
(*n*)	999	2999	29.99 inches.
(*o*)			None.

Written thus on teletype:
WA X SPL 1122E 00FF 159/42/42←2/999
Sent thus as body of telegram:
CLOSED SPECIAL 00 DENSE FOG 10159 4242 EAST 2 2999

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 8**, "record" observation
(*a*)	NA		Nashville, Tenn.
(*b*)	X	Closed	Closed to landings and take-offs.
(*c*)			"Record" observation, no "type of report" or "time of report" designation required.
(*d*)			
(*e*)	0	0	Zero.
(*f*)			Sky not observable.
(*g*)	1/8	1/8	⅛ mile.
(*h*)	ZL+	Heavy freezing drizzle.	Heavy freezing drizzle.
(*i*)	FFK	Dense fog moderate smoke.	Dense fog, moderate smoke.
(*j*)	142	10142	1014.2 millibars.
(*k*)	31	31	31° F.
(*l*)	31	31	31° F.
(*m*)	←↙4	East northeast 4	East northeast, 4 miles per hour.
(*n*)	992	2992	29.92 inches.
(*o*)	VSBY OCNLY ½ N	Visibility occasionally 1/2 north.	Visibility occasionally ½ mile to north.

Written thus on teletype:
NA X 01/8ZL+FFK 142/31/31←↙4/992/VSBY OCNLY 1/2 N
Sent thus as body of telegram:
CLOSED 01/8 HEAVY FREEZING DRIZZLE DENSE FOG MODERATE SMOKE 10142 3131 EAST NORTHEAST 4 2992 VISIBILITY OCCASIONALLY 1/2 NORTH.

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 7, "special" observation
(a)	WA		Arlington, Va.
(b)	X	Closed	Closed to landings.
(c)	SPL	Special	Special observation.
(d)	1122E		11:22 a. m., E. S. T.
(e)	0	0	Zero.
(f)			Sky condition not observable.
(g)	0	0	Zero.
(h)			None.
(i)	F⊕	Heavy fog	Heavy fog.
(j)	159	10159	1015.9 millibars.
(k)	42	42	42° F.
(l)	42	42	42° F.
(m)	←2	East 2	East, 2 miles per hour.
(n)	999	2999	29.99 inches.
(o)			None.

Written thus on teletype:
WA X SPL 1122E 00F⊕159/42/42←2/999
Sent thus as body of telegram:
CLOSED SPECIAL 00 HEAVY FOG 10159 4242 EAST 2 2999

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 8, "record" observation
(a)	NA		Nashville, Tenn.
(b)	X	Closed	Closed to landings and take-offs.
(c)			"Record" observation, no "type of report" or "time of report" designation required.
(d)			
(e)	0	0	Zero.
(f)			Sky not observable.
(g)	1/8	1/8	⅛ mile.
(h)	ZL+	Heavy freezing drizzle.	Heavy freezing drizzle.
(i)	F+K	Heavy fog moderate smoke.	Heavy fog, moderate smoke.
(j)	142	10142	1014.2 millibars.
(k)	31	31	31° F.
(l)	31	31	31° F.
(m)	←↙4	East northeast 4	East northeast, 4 miles per hour.
(n)	992	2992	29.92 inches.
(o)	VSBY OCNLY ½ N	Visibility occasionally 1/2 north.	Visibility occasionally ½ mile to north.

Written thus on teletype:
NA X 01/8ZL+F+K 142/31/31←↙4/992/VSBY OCNLY 1/2 N
Sent thus as body of telegram:
CLOSED 01/8 HEAVY FREEZING DRIZZLE HEAVY FOG MODERATE SMOKE 10142 3131 EAST NORTHEAST 4 2992 VISIBILITY OCCASIONALLY 1/2 NORTH.

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 7, "special" observation
(a)----	WA	----------	Washington National Airport (D.C.).
(b)----	X	Closed----------	Closed to landings and take-offs.
(c)----	SPL	Special----------	Special observation.
(d)----	1122E	----------	11:22 a.m., E.S.T.) #
(e)----	Z0	Indefinite 0---------	Indefinite zero.
(f)----	----------	----------	Sky condition not observable.
(g)----	0	0----------	Zero.
(h)----	----------	----------	None.
(i)----	F+	Heavy fog----------	Heavy fog.
(j)----	159	10159----------	1015.9 millibars.
(k)----	42	42----------	42° F.
(l)----	42	42----------	42° F.
(m)----	←2	East 2----------	East, 2 miles per hour.
(n)----	999	2999----------	29.99 inches
(o)----	----------	----------	None.

Written thus on teletype:

WA X SPL 1122E Z00F+ 159/42/42←2/999

Sent thus as body of telegram:

CLOSED SPECIAL INDEFINITE 00 HEAVY FOG 10159 4242 EAST 2 2999

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 8, "record" observation
(a)----	NA	----------	Nashville, Tenn.
(b)----	X	Closed----------	Closed to landings and take-offs.
(c)----	----------	----------	"Record" observation, no "type of report" or "time of report" required.
(d)----	----------	----------	
(e)----	Z0	Indefinite 0---------	Indefinite zero.
(f)----	----------	----------	Sky condition not observable.
(g)----	1/8	1/8----------	1/8 mile.
(h)----	ZL+	Heavy freezing drizzle	Heavy freezing drizzle.
(i)----	F+K	Heavy fog moderate smoke	Heavy fog, moderate smoke.
(j)----	142	10142	1014.2 millibars.
(k)----	31	31----------	31° F.
(l)----	31	31----------	31° F.
(m)----	←↙4	East northeast 4------	East northeast, 4 miles per hour.
(n)----	992	2992----------	29.92 inches.
(o)----	VSBY OCNLY 1/2 N	Visibility occasionally 1/2 north.	Visibility occasionally 1/2 mile to north.

Written thus on teletype:

NA X Z01/8ZL+F+K 142/31/31←↙4/992/VSBY OCNLY 1/2 N

Sent thus as body of telegram:

CLOSED INDEFINITE 01/8 HEAVY FREEZING DRIZZLE HEAVY FOG MODERATE SMOKE 10142 3131 EAST NORTHEAST 4 2992 VISIBILITY OCCASIONALLY 1/2 NORTH.

War Time is being used for the duration.

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 7, "special" observation
(a)----	WA	----------	Washington National Airport (D.C.).
(b)----	X	Closed----------	Closed to landings and take-offs.
(c)----	SPL	Special----------	Special observation.
(d)----	1122E	----------	11:22 a.m., E.S.T. #
(e)----	WO	Indefinite 0---------	Indefinite zero.
(f)----	----------	----------	Sky condition not observable.
(g)----	0	0----------	Zero.
(h)----	----------	----------	None.
(i)----	F+	Heavy fog----------	Heavy fog.
(j)----	159	10159----------	1015.9 millibars.
(k)----	42	42----------	42° F.
(l)----	42	42----------	42° F.
(m)----	←2	East 2----------	East, 2 miles per hour.
(n)----	999	2999----------	29.99 inches
(o)----	----------	----------	None.

Written thus on teletype:

WA X SPL 1122E WOOF+ 159/42/42←2/999

Sent thus as body of telegram:

CLOSED SPECIAL INDEFINITE 00 HEAVY FOG 10159 4242 EAST 2 2999

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 8, "record" observation
(a)----	NA	----------	Nashville, Tenn.
(b)----	X	Closed----------	Closed to landings and take-offs.
(c)----	----------	----------	"Record" observation, no "type of report" or "time of report" required.
(d)----	----------	----------	
(e)----	WO	Indefinite 0---------	Indefinite zero.
(f)----	----------	----------	Sky condition not observable.
(g)----	1/8	1/8----------	1/8 mile.
(h)----	ZL+	Heavy freezing drizzle	Heavy freezing drizzle.
(i)----	F+K	Heavy fog moderate smoke	Heavy fog, moderate smoke.
(j)----	142	10142	1014.2 millibars.
(k)----	31	31----------	31° F.
(l)----	31	31----------	31° F.
(m)----	←↙4	East northeast 4------	East northeast, 4 miles per hour.
(n)----	992	2992----------	29.92 inches.
(o)----	VSBY OCNLY 1/2 N	Visibility occasionally 1/2 north.	Visibility occasionally 1/2 mile to north.

Written thus on teletype:

NA X WO1/8ZL+F+K 142/31/31←↙4/992/VSBY OCNLY 1/2 N

Sent thus as body of telegram:

CLOSED INDEFINITE 01/8 HEAVY FREEZING DRIZZLE HEAVY FOG MODERATE SMOKE 10142 3131 EAST NORTHEAST 4 2992 VISIBILITY OCCASIONALLY 1/2 NORTH.

War Time is being used for the duration.

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

Example No. 7, special observation

Element	Teletype symbol	Translation
(a)--------	WA	Washington, D. C.
(b)--------	N	Below contact flight minimums.
(c)--------	SPL	Special observation.
(d)--------	161122E	11:22 a. m., E. S. T.* on the 16th.
(e)--------	WO	Indefinite zero.
(f)--------	———	Sky condition not observable.
(g)--------	0	Zero.
(h)--------	———	None.
(i)--------	F+	Heavy fog.
(o)--------	———	None.

Written thus on teletype: **WA N SPL 161122E WOOF+**

Sent thus as body of telegram: INSTRUMENT SPECIAL INDEFINITE OO HEAVY FOG

Example No. 8, record observation

Element	Teletype symbol	Translation
(a)--------	NA	Nashville, Tennessee.
(b)--------	N	Below contact flight minimums.
(c)--------	———	Record observation, no type of report indicated.
(d)--------	———	Record observation, no time of report indicated.
(e)--------	WO	Indefinite zero.
(f)--------	———	Sky condition not observable.
(g)--------	1/8	1/8 mile.
(h)--------	ZL+	Heavy freezing drizzle.
(i)--------	F+K	Heavy fog, moderate smoke.
(j)--------	142	1014.2 millibars.
(k)--------	31	31° F.
(l)--------	31	31° F.
(m)--------	←4	East northeast, 4 miles per hour.
(n)--------	992	29.92 inches.
(o)--------	VSBY N 1/2 OCNLY	Visibility north 1/2 occasionally.

Written thus on teletype: **NA N WO1/8ZL+F+K 142/31/31←4/992/VSBY N1/2**

Sent thus as body of telegram: INSTRUMENT INDEFINITE O1/8 HEAVY FREEZING DRIZZLE HEAVY FOG MODERATE SMOKE 10142 3131 EAST NORTHEAST 4 2992 VISIBILITY NORTH 1/2 OCCASIONALLY

*War Time is being used for the duration.

Example 7, Special Observation

Element	Teletype symbol	Translation
(a)-------	WA	Washington, D. C.
► (b)-------		(Cancelled)
► (c)-------	S7	Seventh special observation of the day.
► (d)-------	1122E	11:22 a.m. E.S.T.*
(e)-------	WO	Indefinite ceiling zero.
► (f)-------	X	Sky obscured.
(g)-------	0	Zero visibility.
(h)-------		None.
(i)-------	F+	Heavy fog.
► (m)-------	↖2	Southeast 2 miles per hour.
(o)-------		None.

Written thus on teletype: WA S7 1122E WOXOF+ ↖2

Sent thus as body of telegram: SEVENTH SPECIAL INDEFINITE ZERO OBSCURED ZERO HEAVY FOG SOUTHEAST 2

Example 8, Record Observation

Element	Teletype symbol	Translation
(a)-------	NA	Nashville, Tenn.
► (b)-------		(Cancelled)
(c)-------		Record observation, no type of report indicated.
(d)-------		Record observation, no time of report indicated.
(e)-------	WO	Indefinite ceiling zero.
► (f)-------	X	Sky obscured.
(g)-------	1/8	1/8 mile visibility.
(h)-------	ZL+	Heavy freezing drizzle.
(i)-------	F+K	Heavy fog, moderate smoke.
(j)-------	142	1014.2 millibars.
(k)-------	31	31° F.
(l)-------	31	31° F.
(m)-------	←↖4	East northeast, 4 miles per hour.
(n)-------	992	29.92 inches.
(o)-------	VSBY N 1/2 OCNLY	Visibility north 1/2 occasionally.

Written thus on teletype: NA WOX1/8ZL+F+K 142/31/31←↖4/992/VSBY N1/2 OCNLY

Sent thus as body of telegram: INDEFINITE ZERO OBSCURED 1/8 HEAVY FREEZING DRIZZLE HEAVY FOG MODERATE SMOKE 10142 3131 EAST NORTHEAST 4 2992 VISIBILITY NORTH 1/2 OCCASIONALLY

*War Time is being used for the duration.

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 9**, "special" observation
(*a*)	NO		New Orleans, La.
(*b*)	X	Closed	Closed to landings.
(*c*)	SPL	Special	Special report.
(*d*)	1518C		3:18 p. m., C. S. T.
(*e*)	E3	Estimated 300	Estimated 300 feet.
(*f*)	+ ⊕1⦶	Dark overcast lower scattered 100.	Dark overcast, lower scattered clouds at 100 feet.
(*g*)	2	2	2 miles.
(*h*)	TORNADO SW T+RA—	Tornado southwest, heavy thunderstorm moderate rain, light hail.	Tornado to southwest of station heavy thunderstorm, moderate rain, light hail.
(*i*)			None.
(*j*)	095	10095	1009.5 millibars.
(*k*)	80	80	80° F.
(*l*)	76	76	76° F.
(*m*)	↗25+	Southwest 25 strong gusts.	Southwest 25 miles per hour, strong gusts.
(*n*)	980	2980	29. 80 inches.
(*o*)			None.

Written thus on teletype:
NO X SPL 1518C E3+⊕1⦶2 TORNADO SW T+RA— 095/80/76↗25+/980
Sent thus as body of telegram:
CLOSED SPECIAL ESTIMATED 300 DARK OVERCAST LOWER SCATTERED 100 2 TORNADO SOUTHWEST HEAVY THUNDERSTORM MODERATE RAIN LIGHT HAIL 10095 8076 SOUTHWEST 25 STRONG GUSTS 2980.

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 10**, "record" observation
(*a*)	BW		Boston, Mass.
(*b*)	C	Contact	Satisfactory for contact flight.
(*c*)			Regular sequence "record" observation, "type" and "time" of report designation not required.
(*d*)			
(*e*)	10	1000	1,000 feet (measured).
(*f*)	⊕1⦶	Overcast, lower scattered 100.	Overcast lower scattered clouds at 100 feet.
(*g*)	3	3	3 miles.
(*h*)	R—	Light rain	Light rain.
(*i*)	F—	Light fog	Light fog.
(*j*)	135	10135	1013.5 millibars.
(*k*)	47	47	47° F.
(*l*)	46	46	46° F.
(*m*)	↑↖10	South southeast 10	South southeast, 10 miles per hour.
(*n*)	992	2992	29.92 inches.
(*o*)			None.

Written thus on teletype:
BW C 10⊕1⦶3R—F— 135/47/46↑↖10/992
Sent thus as body of telegram:
CONTACT 1000 OVERCAST LOWER SCATTERED 100 3 LIGHT RAIN LIGHT FOG 10135 4746 SOUTH SOUTH EAST 10 2992

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 9, "special" observation
(a)----	NO	----------	New Orleans, La.
(b)----	X	Closed----------	Closed to landings and take-offs.
(c)----	SPL	Special----------	Special observation.
(d)----	1518C	----------	3:18 p.m., C.S.T. #
(e)----	Z3	Indefinite 300--------	Indefinite 300 feet.
(f)----	+⊕1Ⓓ	Dark overcast lower scattered 100	Dark overcast, lower scattered clouds at 100 feet.
(g)----	2	2----------	2 miles.
(h)----	TORNADO SW T+RA-	Tornado southwest, heavy thunderstorm, moderate rain, light hail	Tornado to southwest of station, heavy thunderstorm, moderate rain, light hail.
(i)----	----------	----------	None.
(j)----	095	10095----------	1009.5 millibars.
(k)----	80	80----------	80° F.
(l)----	76	76----------	76° F.
(m)----	↗25+	Southwest 25, strong gusts	Southwest 25 miles per hour, strong gusts.
(n)----	980	2980----------	29.80 inches.
(o)----	----------	----------	None.

Written thus on teletype:

NO X SPL 1518C Z3+⊕1Ⓓ 2TORNADO SW T+RA- 095/80/76↗25+/980

Sent thus as body of telegram:

CLOSED SPECIAL INDEFINITE 300 DARK OVERCAST LOWER SCATTERED 100 2 TORNADO SOUTHWEST HEAVY THUNDERSTORM MODERATE RAIN LIGHT HAIL 10095 8076 SOUTHWEST 25 STRONG GUSTS 2980.

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 10, "record" observation
(a)----	BW	----------	Boston, Mass.
(b)----	C	Contact----------	Satisfactory for contact flight.
(c)----	----------	----------	"Record" observation, no "type of report" or "time of report" required.
(d)----	----------	----------	
(e)----	A10	Aircraft 1000---------	1000 feet - reported from aircraft.
(f)----	⊕1Ⓓ	Overcast, lower scattered 100	Overcast lower scattered clouds at 100 feet.
(g)----	3	3----------	3 miles.
(h)----	R-	Light rain----------	Light rain.
(i)----	F-	Light fog----------	Light fog.
(j)----	135	10135----------	1013.5 millibars.
(k)----	47	47----------	47° F.
(l)----	46	46----------	46° F.
(m)----	↑↖10	South southeast 10----	South southeast, 10 miles per hour.
(n)----	992	2992----------	29.92 inches.
(o)----	----------	----------	None.

Written thus on teletype:

BW C A10⊕1Ⓓ3R-F- 135/47/46↑↖10/992

Sent thus as body of telegram:

CONTACT AIRCRAFT 1000 OVERCAST LOWER SCATTERED 100 3 LIGHT RAIN LIGHT FOG 10135 4746 SOUTH SOUTHEAST 10 2992.

War Time is being used for the duration.

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 9, "special" observation
(a)----	NO	----------	New Orleans, La.
(b)----	X	Closed----------	Closed to landings and take-offs.
(c)----	SPL	Special----------	Special observation.
(d)----	1518C	----------	3:18 p.m., C.S.T. #
(e)----	W3	Indefinite 300--------	Indefinite 300 feet.
(f)----	+⊕1Ⓓ	Dark overcast lower scattered 100	Dark overcast, lower scattered clouds at 100 feet.
(g)----	2	2----------	2 miles.
(h)----	TORNADO SW T+RA-	Tornado southwest, heavy thunderstorm, moderate rain, light hail	Tornado to southwest of station, heavy thunderstorm, moderate rain, light hail.
(i)----	----------	----------	None.
(j)----	095	10095----------	1009.5 millibars.
(k)----	80	80----------	80° F.
(l)----	76	76----------	76° F.
(m)----	↗25+	Southwest 25, strong gusts	Southwest 25 miles per hour, strong gusts.
(n)----	980	2980----------	29.80 inches.
(o)----	----------	----------	None.

Written thus on teletype:

NO X SPL 1518C W3+⊕1Ⓓ2TORNADO SW T+RA- 095/80/76↗25+/980

Sent thus as body of telegram:

CLOSED SPECIAL INDEFINITE 300 DARK OVERCAST LOWER SCATTERED 100 2 TORNADO SOUTHWEST HEAVY THUNDERSTORM MODERATE RAIN LIGHT HAIL 10095 8076 SOUTHWEST 25 STRONG GUSTS 2980.

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 10, "record" observation
(a)----	BW	----------	Boston, Mass.
(b)----	C	Contact----------	Satisfactory for contact flight.
(c)----	----------	----------	"Record" observation, no "type of report" or "time of report" required.
(d)----	----------	----------	
(e)----	A10	Aircraft 1000---------	1000 feet - reported from aircraft.
(f)----	⊕1Ⓓ	Overcast, lower scattered 100	Overcast lower scattered clouds at 100 feet.
(g)----	3	3----------	3 miles.
(h)----	R-	Light rain----------	Light rain.
(i)----	F-	Light fog----------	Light fog.
(j)----	135	10135----------	1013.5 millibars.
(k)----	47	47----------	47° F.
(l)----	46	46----------	46° F.
(m)----	↑↖10	South southeast 10----	South southeast, 10 miles per hour.
(n)----	992	2992----------	29.92 inches.
(o)----	----------	----------	None.

Written thus on teletype:

BW C A10⊕1Ⓓ3R-F- 135/47/46↑↖10/992

Sent thus as body of telegram:

CONTACT AIRCRAFT 1000 OVERCAST LOWER SCATTERED 100 3 LIGHT RAIN LIGHT FOG 10135 4746 SOUTH SOUTHEAST 10 2992.

War Time is being used for the duration.

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

Example No. 9, special observation

Element	Teletype symbol	Translation
(a)--------	OL	Oklahoma City, Oklahoma.
(c)--------	SPL	Special observation.
(d)--------	311518C	3:18 p. m., C. S. T.* on the 31st.
(h)--------	TORNADO SW	Tornado southwest of station.
(o)--------	MOVG SLWLY NEWD	Moving slowly northeastward.

Written thus on teletype: OL SPL 311518C TORNADO SW MOVG SLWLY NEWD

Sent thus as body of telegram: SPECIAL TORNADO SOUTHWEST MOVING SLOWLY NORTHEASTWARD

Example No. 10, record observation

Element	Teletype symbol	Translation
(a)--------	BW	Boston, Mass.
(b)--------	C	Satisfactory for contact flight.
(c)--------	----------	"Record" observation, no "type of report" or "time of report" required.
(d)--------	----------	
(e)--------	A10	1000 feet - reported from aircraft.
(f)--------	⊕1①	Overcast lower scattered clouds at 100 feet.
(g)--------	3	3 miles.
(h)--------	R-	Light rain.
(i)--------	F-	Light fog.
(j)--------	135	1013.5 millibars.
(k)--------	47	47° F.
(l)--------	46	46° F.
(m)--------	↑↖10	South southeast, 10 miles per hour.
(n)--------	992	29.92 inches.
(o)--------	----------	None.

Written thus on teletype: BW C A10⊕1①3R-F- 135/47/46↑↖10/992

Sent thus as body of telegram: CONTACT AIRCRAFT 1000 OVERCAST LOWER SCATTERED 100 3 LIGHT RAIN LIGHT FOG 10135 4746 SOUTH SOUTHEAST 10 2992.

*War Time is being used for the duration.

Example 9, Special Observation

Element	Teletype symbol	Translation
(a)-------	OL	Oklahoma City, Okla.
► (c)-------	S8	Eighth special observation of the day.
► (d)-------	1518C	3:18 p.m. C.S.T.*
(h)-------	TORNADO SW	Tornado southwest of station.
(o)-------	MOVG SLWLY NEWD	Moving slowly northeastward.

Written thus on teletype: OL S8 1518C TORNADO SW MOVG SLWLY NEWD

Sent thus as body of telegram: EIGHTH SPECIAL TORNADO SOUTHWEST MOVING SLOWLY NORTHEASTWARD

Example 10, Record Observation

Element	Teletype symbol	Translation
(a)-------	BW	Boston, Mass.
► (b)-------		(Cancelled)
(c)-------		Record observation, no type of report required.
(d)-------		Record observation, no time of report required.
(e)-------	A10	Ceiling 1000 feet - reported from aircraft.
(f)-------	⊕1①	Overcast lower scattered clouds at 100 feet.
(g)-------	3	3 miles visibility.
(h)-------	R-	Light rain.
(i)-------	F-	Light fog.
(j)-------	135	1013.5 millibars.
(k)-------	47	47° F.
(l)-------	46	46° F.
(m)-------	↑↖10	South southeast, 10 miles per hour.
(n)-------	992	29.92 inches.
(o)-------		None.

Written thus on teletype: BW A10⊕1①3R-F- 135/47/46↑↖10/992

Sent thus as body of telegram: AIRCRAFT 1000 OVERCAST LOWER SCATTERED 100 3 LIGHT RAIN LIGHT FOG 10135 4746 SOUTH SOUTHEAST 10 2992

*War Time is being used for the duration.

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 11**, "special" observation
(*a*)	OA		Oakland, Calif.
(*b*)	C	Contact	Satisfactory for contact flight.
(*c*)	SPL	Special	Special observation.
(*d*)	1519P		3:19 p. m., P. S. T.
(*e*)	E10	Estimated 1000	Estimated 1,000 feet.
(*f*)	⊕◐	Overcast, lower broken.	Overcast, lower broken clouds.
(*g*)	3	3	3 miles.
(*h*)	AP—	Light small hail	Light small hail.
(*i*)	H	Hazy	Hazy.
(*j*)	129	10129	1012.9 millibars.
(*k*)	40	40	40° F.
(*l*)	38	38	38° F.
(*m*)	↓8	North 8	North, 8 miles per hour.
(*n*)	994	2994	29.94 inches.
(*o*)	E60⊕	Overcast estimated 6000.	Overcast estimated at 6,000 feet.

Written thus on teletype:
OA C SPL 1519P E10⊕◐3AP—H 129/40/38↓8/994/E60⊕
Sent thus as body of telegram:
CONTACT SPECIAL ESTIMATED 1000 OVERCAST LOWER BROKEN 3 LIGHT SMALL HAIL HAZY 10129 4038 NORTH 8 2994 OVERCAST ESTIMATED 6000

Element	Teletype symbol	Form if same report telegraphed	Translation, example **No. 12**, "special" observation
(*a*)	SL		Salt Lake City, Utah.
(*b*)	C	Contact	Satisfactory for contact flight.
(*c*)	SPL	Special	Special observation.
(*d*)	1722M		5:22 p. m. M. S. T.
(*e*)	E15	Estimated 1500	Estimated 1,500 feet.
(*f*)	⊕◐	Overcast lower broken.	Overcast, lower broken clouds.
(*g*)	5	5	5 miles.
(*h*)	TA—	Thunderstorm light hail.	Thunderstorm, light hail.
(*i*)			None other than hail.
(*j*)	102	10102	1010.2 millibars.
(*k*)	62	62	62° F.
(*l*)	50	50	50° F.
(*m*)	→↘35+	West northwest 35 strong gusts.	West northwest 35 miles per hour, strong gusts.
(*n*)	993	2993	29.93 inches.
(*o*)	BRM RSG RPDLY 75⊕ FQT LTNG CLD TO GND NW	Barometer rising rapidly overcast 7500 frequent lightning cloud to ground northwest.	Barometer rising rapidly, overcast at 7,500 feet, frequent lightning cloud to ground in northwest.

Written thus on teletype:
SL C SPL 1722M E15⊕◐5TA— 102/62/50→↘35+/993/BRM RSG RPDLY 75⊕ FQT LTNG CLD TO GND NW
Sent thus as body of telegram:
CONTACT SPECIAL ESTIMATED 1500 OVERCAST LOWER BROKEN 5 THUNDERSTORM LIGHT HAIL 10102 6250 WEST NORTHWEST 35 STRONG GUSTS 2992 BAROMETER RISING RAPIDLY OVERCAST 7500 FREQUENT LIGHTNING CLOUD TO GROUND NORTHWEST

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 11, "special" observation
(a)	OA		Oakland, Calif.
(b)	C	Contact	Satisfactory for contact flight.
(c)	SPL	Special	Special observation.
(d)	1519P		3:19 p. m., P. S. T.
(e)	E10	Estimated 1000	Estimated 1,000 feet.
(f)	⊕◐	Overcast, lower broken.	Overcast, lower broken clouds.
(g)	3	3	3 miles.
(h)	AP—	Light small hail	Light small hail.
(i)	H	Hazy	Hazy.
(j)	129	10129	1012.9 millibars.
(k)	40	40	40° F.
(l)	38	38	38° F.
(m)	↓8	North 8	North, 8 miles per hour.
(n)	994	2994	29.94 inches.
(o)	E60⊕	Overcast estimated 6000.	Overcast estimated at 6,000 feet.

Written thus on teletype:
OA C SPL 1519P E10⊕◐3AP—H 129/40/38↓8/094/E60⊕
Sent thus as body of telegram:
CONTACT SPECIAL ESTIMATED 1000 OVERCAST LOWER BROKEN 3 LIGHT SMALL HAIL HAZY 10129 4038 NORTH 8 2994 OVERCAST ESTIMATED 6000

Element	Teletype symbol	Form if same report telegraphed	Translation, example No. 12, "special" observation
(a)	SL		Salt Lake City, Utah.
(b)	C	Contact	Satisfactory for contact flight.
(c)	SPL	Special	Special observation.
(d)	1722M		5:22 p. m. M. S. T.
(e)	E15	Estimated 1500	Estimated 1,500 feet.
(f)	⊕◐	Overcast lower broken.	Overcast, lower broken clouds.
(g)	5	5	5 miles.
(h)	TA—	Thunderstorm light hail.	Thunderstorm, light hail.
(i)			None other than hail.
(j)	102	10102	1010.2 millibars.
(k)	62	62	62° F.
(l)	50	50	50° F.
(m)	→↘35+	West northwest 35 strong gusts.	West northwest 35 miles per hour, strong gusts.
(n)	993	2993	29.93 inches.
(o)	BRM RSG RPDLY E75⊕ FQT LTNG CLD TO GND NW	Barometer rising rapidly, overcast estimated 7,500 frequent lightning cloud to ground northwest.	Barometer rising rapidly, overcast estimated at 7,500 feet, frequent lightning cloud to ground in northwest.

Written thus on teletype:
SL C SPL 1722M E15⊕◐5TA— 102/62/50→↘35+/993/BRM RSG RPDLY E75⊕ FQT LTNG CLD TO GND NW
Sent thus as body of telegram:
CONTACT SPECIAL ESTIMATED 1500 OVERCAST LOWER BROKEN 5 THUNDERSTORM LIGHT HAIL 10102 6250 WEST NORTHWEST 35 STRONG GUSTS 2993 BAROMETER RISING RAPIDLY OVERCAST ESTIMATED 7500 FREQUENT LIGHTNING CLOUD TO GROUND NORTHWEST

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

Example No. 11, special observation

Element	Teletype symbol	Translation
(a)--------	OA	Oakland, California.
(b)--------	C	Satisfactory for contact flight.
(c)--------	SPL	Special observation.
(d)--------	301519P	3:19 p. m., P. S. T.* on the 30th.
(e)--------	E10	Estimated 1,000 feet.
(f)--------	⊕⊕	Overcast, lower broken clouds.
(g)--------	3	3 miles.
(h)--------	AP-	Light small hail.
(i)--------	H	Hazy.
(o)--------	E60⊕	Overcast estimated at 6,000 feet.

Written thus on teletype: OA C SPL 301519P E10⊕⊕3AP-H/E60⊕

Sent thus as body of telegram: CONTACT SPECIAL ESTIMATED 1000 OVERCAST LOWER BROKEN 3 LIGHT SMALL HAIL HAZY OVERCAST ESTIMATED 6000

Example No. 12, special observation

Element	Teletype symbol	Translation
(a)--------	SL	Salt Lake City, Utah.
(b)--------	C	Satisfactory for contact flight.
(c)--------	SPL	Special observation.
(d)--------	041722M	5:22 p. m., M. S. T.* on the 4th.
(e)--------	E15	Estimated 1,500 feet.
(f)--------	⊕⊕	Overcast, lower broken clouds.
(g)--------	5	5 miles.
(h)--------	TA-	Thunderstorm, light hail.
(i)--------	———	None, other than hail.
(m)--------	→↘35+	West northwest 35 miles per hour, strong gusts.
(o)--------	E75⊕ T NW MOVG EWD FQT LTNG CLD TO GND ALL QUADS	Overcast estimated at 7,500 feet, thunderstorms northwest moving eastward, frequent lightning cloud to ground all quadrants

Written thus on teletype: SL C SPL 041722M E15⊕⊕5TA- →↘35+/E75⊕ T NW MOVG EWD FQT LTNG CLD TO GND ALL QUADS

Sent thus as body of telegram: CONTACT SPECIAL ESTIMATED 15 OVERCAST LOWER BROKEN 5 THUNDERSTORM LIGHT HAIL WEST NORTHWEST 35 STRONG GUSTS OVERCAST ESTIMATED 7500 THUNDERSTORM NORTHWEST MOVING EASTWARD FREQUENT LIGHTNING CLOUD TO GROUND ALL QUADRANTS

*War Time is being used for the duration.

Example 11, Special Observation

Element	Teletype symbol	Translation
(a)-------	OA	Oakland, Calif.
▶(b)-------		(Cancelled)
▶(c)-------	S9	Ninth special observation of the day.
▶(d)-------	1519P	3:19 p.m. P.S.T.*
(e)-------	E10	Estimated ceiling 1,000 feet.
(f)-------	⊕⊕	Overcast, lower broken clouds.
(g)-------	3	3 miles visibility.
(h)-------	AP-	Light small hail.
▶(m)-------	↘20	Northwest, 20 miles per hour.
(o)-------	E60⊕	Overcast estimated at 6,000 feet.

Written thus on teletype: OA S9 1519P E10⊕⊕3AP- ↘20/E60⊕

Sent thus as body of telegram: NINTH SPECIAL ESTIMATED 1000 OVERCAST LOWER BROKEN 3 LIGHT SMALL HAIL NORTHWEST TWENTY OVERCAST ESTIMATED 6000

Example 12, Special Observation

Element	Teletype symbol	Translation
(a)-------	SL	Salt Lake City, Utah.
▶(b)-------		(Cancelled)
▶(c)-------	S10	Tenth special observation of the day.
▶(d)-------	1722M	5:22 p.m. M.S.T.*
(e)-------	E15	Estimated ceiling 1,500 feet.
(f)-------	⊕⊕	Overcast, lower broken clouds.
(g)-------	5	5 miles visibility.
(h)-------	TA-	Thunderstorm, light hail.
(i)-------		None, other than hail.
(m)-------	→↘35+	West northwest 35 miles per hour, strong gusts.
(o)-------	E75⊕ T NW MOVG EWD FQT LTNG CLD TO GND ALL QUADS HLSTO 3/8 INCH	Overcast estimated at 7,500 feet, thunderstorm northwest moving eastward, frequent lightning cloud to ground all quadrants, hailstone 3/8 inch diameter.

Written thus on teletype: SL S10 1722M E15⊕⊕5TA- →↘35+/E75⊕ T NW MOVG EWD FQT LTNG CLD TO GND ALL QUADS HLSTO 3/8 INCH

Sent thus as body of telegram: TENTH SPECIAL ESTIMATED 15 OVERCAST LOWER BROKEN 5 THUNDERSTORM LIGHT HAIL WEST NORTHWEST 35 STRONG GUSTS OVERCAST ESTIMATED 7500 THUNDERSTORM NORTHWEST MOVING EASTWARD FREQUENT LIGHTNING CLOUD TO GROUND ALL QUADRANTS HAILSTONE 3/8 INCH

*War Time is being used for the duration.

PART II.—ADDING OF SPECIAL DATA TO RADIO AND TELETYPE SEQUENCE REPORTS MADE AT 4:30 AND 10:30 A. M. AND P. M., E. S. T. (3-HOURLY PERIODS)

CHAPTER I

DATA TO BE ADDED

2–200. Special data as given below will be added to radio and teletype sequence reports, when appropriate, by stations reporting hourly by teletype or radio, immediately following the report proper, in the order in which they are listed below and at the times and under the conditions outlined specifically in appendix II to this circular (formerly appendix V):

(*a*) *Pressure change and characteristic.*

(*b*) *Clouds*, when appropriate.

CHAPTER II

TIMES AND CONDITIONS UNDER WHICH DATA SHALL BE ADDED

2–201. Only data as outlined above—and these only under specific conditions and times as outlined in appendix II (formerly appendix V) of this circular are authorized to be added to such reports.

PART III.—CLOUDS

CHAPTER I

REPORTING OF CLOUDS IN OBSERVATIONS

2–300. Stations authorized to report clouds as data added to sequence reports at the 3-hourly or 6-hourly periods shall do so according to instructions contained in parts II and VII of this section.

CHAPTER II

GENERAL INSTRUCTIONS REGARDING CLOUD OBSERVATIONS

2–301. Necessity of Thorough Knowledge of Cloud Types.—It is very desirable and necessary that the observer be entirely familiar with the various cloud types which he will observe during the course of rendering airway observations. This will be of great assistance to him in estimating ceiling heights and in determining whether or not a particular type of clouds observed may be classed as "high" or "lower" merely by inspection. Also, the reporting of cloud types is required in the map-sequence and 3 hourly reports from designated stations, and the observer must be familiar with them before he can make accurate reports. Further, the cloud types are to anyone somewhat versed in meteorology a good indication of imminent weather, and are thus of great value to the forecaster. All observers will, therefore, carefully study the cloud illustrations and descriptions as given in "Codes for Cloud Form and States of the Sky, According to the International System of Classification" (1938). This bulletin, known as WB No. 1249 and Circular S, is furnished to all concerned and is also available at the Central Office.

2–302. Ceiling When Cirrus Cirrostratus or Cirrocumulus Present.—When any of the first three forms appear (cirrus, cirrostratus, and cirrocumulus), it can be safely assumed that the ceiling is unlimited, as the lowest possible altitudes of these types of clouds are well above the usual range of airplanes. This will also very often be the case with the next two forms classification, that is, altostratus and altocumulus, although it will be noted in Circular S that the mean lower level for these clouds is 6,500 feet.

2–303. Distinguishing Between High and Low Cloud Types.—It is sometimes difficult to distinguish between altostratus and stratus; also, there will sometimes be doubt as to whether the cloud is altocumulus, stratocumulus, or cumulus. In such cases it is better to err on the safe side, and consider the clouds as being of the lower type and estimate the height of their base accordingly.

2–304. Some Characteristics of Lower Cloud Types with Relation to Ceilings.—Cumulonimbus is usually a detached cloud, covering but a small portion of the sky. Its presence in the sky is, therefore, of importance, not so much from the standpoint of ceiling as that it often portends the occurrence of development of a thunderstorm. The nimbostratus is the rain cloud, and is nearly always low. The stratus base is also low, varying from a few hundred feet above the ground to a few thousand. The mean upper and lower levels given on pages 1 and 2 of Circular S should be studied carefully.

PART IV.—TRANSMISSION OF REMARKS IN AIRWAY SYMBOL WEATHER REPORTS

CHAPTER I

USE AND EXAMPLES OF REMARKS

2–400. Use of Symbols and Abbreviations.—When it is necessary to include remarks in airway weather reports which are transmitted by teletype or radio, the information included in such remarks will be coded as one or more groups of symbols and abbreviations. Symbols to be used will be those authorized for use in transmission of weather reports by teletype, except that *abbreviations* will be used for *sleet, snow,* and *snow showers* in place of *symbols* when any of the three are used separately or when sleet and snow are used together in a combination. (The exception to the use of symbols in the particular cases above is to avoid confusion with wind direction abbreviations.)

The abbreviations used in remarks will be those authorized by the Civil Aeronautics Administration and published in that Administration's "Manual of Operations," chapter B, part 4, section 1.

2–401. Position in Reports.—The remarks group will be separated from the last element of the report proper by a slant mark. Remarks, if any, will always precede any special meteorological data added to the report.

2–402. When Used.—Remarks will be used to express only elements of phases of the weather which cannot be included in the body of the report. Such conditions prevailing at a distance from the observer will be included in remarks, for example, "T NW"=thunderstorm to NW; "K SE"=smoky to SE; "DUST DEVILS SW"=dust devils[1] to the SW, etc. Abbreviations will be used for directions from the station in which phenomena are observed. Intensities of weather and obstructions to vision phenomena will not be indicated except in cases where they are *pertinent* to the value of the remarks, that is, "R+ OCNLY"=Rain occasionally heavy. When it is necessary to indicate the intensity of sleet, snow, and snow showers in remarks, this will be done by placing a plus sign (+) for heavy, and a minus sign (−) for light, immediately following the abbreviation; for example, "SNW SHWR+ OCNLY"; moderate will be indicated by the abbreviation alone, but *only* when the whole remark has been so worded as to indicate that an intensity is implied.

2–403. Only Necessary Remarks To Be Included.—Observers should constantly endeavor to keep remarks as short as possible and include only those which are essential to a valuable report. Remarks which merely repeat some phase of the body of the report in another form are superfluous and should never be included, that is, when −⊕/ is sent as the sky condition, it is unnecessary and inefficient to include "lunar halo" in remarks since the lunar halo indicates a sheet of high, thin clouds reported earlier in the message. On the other hand, when snow is occurring and this snow is "wet," a remark such as "SNW WET" is pertinent and should be included.

[1] Small whirlwinds, usually of short duration, made visible by dust picked up from the ground.

PART IV.—TRANSMISSION OF REMARKS IN AIRWAY SYMBOL WEATHER REPORTS

CHAPTER I.

USE AND EXAMPLES OF REMARKS

2-400. USE OF SYMBOLS AND ABBREVIATIONS.—When it is necessary to include remarks in airway weather reports which are transmitted by teletype or radio, the information included in such remarks will be coded as one or more groups of symbols and abbreviations. Symbols to be used will be those authorized for use in transmission of weather reports by teletype, except that abbreviations will be used for sleet, snow, and snow showers in place of symbols when any of the three are used separately or when sleet and snow are used together in a combination. (The exception to the use of symbols in the particular cases above is to avoid confusion with wind direction abbreviations.)

The abbreviations used in remarks will be those authorized by the Civil Aeronautics Administration and published in that Administration's "Manual of Operations," chapter B, part 4, section 1.

2-401. POSITION IN REPORTS.—The remarks group will be separated from the last element of the report proper by a slant mark. Remarks, if any, will always precede any special meteorological data added to the report.

2-402. WHEN USED.—Remarks will be used to express only elements of phases of the weather which cannot be included in the body of the report. Such conditions prevailing at a distance from the observer will be included in remarks, for example, "T NW"=thunderstorm NW; "K SE"=moderate smoke SE; "DUST DEVILS SW"=dust devils[1] SW, etc. Abbreviations will be used for directions from the station in which phenomena are observed. Intensities of weather and obstructions to vision phenomena will be indicated, e.g., "R+ OCNLY", "VSBY S11/4". When it is necessary to indicate the intensity of sleet, snow, and snow showers in remarks, this will be done by placing a plus sign (+) for heavy, and a minus sign (-) for light, immediately following the abbreviation; for example, "SNW SHWR+ OCNLY"; moderate will be indicated by the abbreviation alone, but <u>only</u> when the whole remark has been so worded as to indicate that an intensity is implied.

2-403. ONLY NECESSARY REMARKS TO BE INCLUDED.—Observers should constantly endeavor to keep remarks as short as possible and include only those which are essential to a valuable report. Remarks which merely repeat some phase of the body of the report in another form are superfluous and should never be included, that is, when -⊕/ is sent as the sky condition, it is unnecessary and inefficient to include "lunar halo" in remarks since the lunar halo indicates a sheet of high, thin clouds reported earlier in the message. Likewise, weather or obstructions to vision given in the body of the report will not be repeated in remarks to explain differing or variable visibility. On the other hand, when snow is occurring and this snow is "wet," a remark such as "SNW WET" is pertinent and should be included.

Whenever the pressure falls and then rises rapidly, thus producing a marked "V" on the barogram, appropriate remarks will be included which give (1) the lowest sea-level pressure (in millibars—giving only tens, units, and tenths) and (2) the time of the lowest pressure. For example, lowest sea-level pressure of 999.0 millibars will be sent as: "LWST PRES 990 AT 2146C."

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[1] Small whirlwinds, usually of short duration, made visible by dust picked up from the ground.

CHAPTER I

USE AND EXAMPLES OF REMARKS

2-400. Purpose and Position of Remarks.--Remarks will be used in airway weather observations to amplify or otherwise modify the observation by reporting significant weather details that cannot be included in the body of the report. Remarks will follow the last element of the report proper, and be separated from it by a slant (/). When three-hourly or six-hourly additive data groups are also present, the remarks will precede the additive data and be separated thereform by a slant and a space.

2-401. Use of Symbols and Contractions in Remarks.--Whenever possible, remarks will be expressed in authorized symbols and contractions listed in the "Federal Airways Manual of Operations, III-B-4-1" published by the Civil Aeronautics Administration. If the information is such that symbols and contractions are not applicable, plain English words will be used where necessary. When mentioning weather or obstructions to vision, remarks will employ the symbols listed in the tables in paragraphs 2-145 to 2-149, <u>except</u> that snow, sleet, and snow showers will be expressed in contractions to avoid confusion with the standard letter abbreviations for compass directions.

(a) <u>Reporting intensity of phenomena in remarks</u>.--

1. Indicate intensity of phenomena reported in symbols by placing after the symbol a plus sign (+) for heavy, <u>no</u> sign for moderate, a minus sign (-) for light, or the letter "U" for unknown intensity.

2. Indicate intensity of phenomena reported in contractions or words by placing before the term an appropriate modifying contraction: "HVY," "MDT," "LGT," or "UNKN." Occasionally such modifiers as "FQT" or "OCNL" will be more suitable, as, for example, with respect to lightning.

2-402. Standards of Brevity and Usefulness of Remarks.--Remarks will be expressed as briefly as is consistent with full, significant information. Redundant repetition of conditions or phenomena already mentioned in the body of the report will be avoided. Thus, weather or obstructions to vision already given will not be repeated in remarks concerning variations or differences in visibility. A lunar or solar halo need not be mentioned if a high, thin overcast is being carried. Intensities need not be repeated if the remark is clear without them. If "S-" is occurring, the remark "SNW WET" is sufficient, instead of "LGT SNW WET." But, if "R-" is occurring, the remark "R INTMT" would suggest that the rain is intermittently moderate, and if this is not intended, the remakr "R- INTMT" should be used.

2-403. Required Remarks.--It will be noted that under some conditions remarks are <u>required</u>. These remarks vary with the conditions involved, and no attempt is made here to give a complete list. Among them, however, are the following:

1. Height of upper overcast or broken clouds when lower broken clouds are also present.
2. Remarks about conditions of differing or varying visibility.
3. Direction of thunderstorm from station.
4. Direction of movement of thunderstorm, if this can be determined.
5. Frequency and kind of lightning.
6. Details of tornado activity.
7. Showery or intermittent precipitation when not actually occurring at time of observation. (See par. 2-145 (g).)
8. "V"-barogram remarks, giving the lowest sea-level pressure in millibars (coded only to tens, units, and tenths) and the time of lowest pressure. For example, a lowest sea-level pressure of 999.0 millibars occurring at 2146 C.W.T. would be sent in remarks as "LWST PRES 990 AT 2146C."

2–404. Examples of Remarks.—In order to illustrate the method of coding remarks in weather reports sent by teletype or radio, the following examples of some of the more important remarks are given:

A. CEILING

"+⊕ OBSCG MTNS" Heavy clouds obscuring mountains.
"◐ ALG MTNS" Clouds along mountains.
"◐ TPG MTNS" Clouds topping mountains.

NOTE—When it is desired to represent conditions similar to the foregoing, the same sky symbol should be employed as was used in the body of the report for the clouds to which reference is made.

"E60⊕" Overcast estimated at 6,000 feet. (Used when ⊕◐ appears in the body of the report and the height of the overcast must therefore be indicated in remarks.) When in such cases it is possible to measure the height of the overcast, the "E" preceding the height figure will be omitted.
"3◐" Lower scattered clouds at 300 feet. (Used when it is necessary to indicate a third layer of clouds.)

B. SKY

"+⊕ NW" Clouds dark northwest. (The same sky symbol should be employed as was used in the body of the report for the clouds to which reference is made.)
"◐TURBT" Clouds turbulent.

C. VISIBILITY

"2F NW" Fog bank to northwest, visibility 2 miles.
"3K NE" Smoky to the northeast, visibility 3 miles. (Used to indicate visibility lower in some direction than that indicated in the body of the report.)

D. WEATHER

"T APCHG SW" Thunderstorm approaching from the southwest.
"RQ W" Rain squall to west.
"SNW SHWR E" Snow shower to east.
"CM OVHD" Mammato cumulus overhead.
"ACC INCRG" Altocumulus castellatus clouds increasing.
"R+ OCNLY" Rain occasionally heavy (when rain is indicated in body of the report).
"OCNL SLT" Occasional sleet (when sleet is not indicated in body of report).
"SNW+ OCNLY" Snow occasionally heavy (when snow is indicated in body of the report).
"ER OCNLY" [2] Sleet occasionally mixed with rain (when rain is indicated in the body of the report).
"RE OCNLY" [2] Rain occasionally mixed with sleet (when sleet is indicated in the body of the report).
"OCNL RE" [2] Occasional rain and sleet mixed (when neither sleet nor rain is indicated in body of report).
"SNW WET" Snow wet (when snow is indicated in body of report).

E. OBSTRUCTIONS TO VISION

"KF OCNLY" Smoke occasionally mixed with fog.

[2] Sleet is not used separately or in a combination with snow in this case; therefore the *symbol* "E" is used.

2-404. Examples of Remarks.—In order to illustrate the method of coding remarks in weather reports sent by teletype or radio, the following examples of some of the more important remarks are given:

A. CEILING

"+⊕ OBSCG MTNS" Heavy clouds obscuring mountains.
"◍ ALG MTNS" Clouds along mountains.
"◑ TPG MTNS" Clouds topping mountains.

NOTE—When it is desired to represent conditions similar to the foregoing, the same sky symbol should be employed as was used in the body of the report for the clouds to which reference is made.

"E60⊕" Overcast estimated at 6,000 feet. In cases of ⊕◍, ◍◍, ◑◍, or ◑◑, the height of the upper layer (preceded by a ceiling classification letter when reporting the height of a ⊕ or ◍ layer) will always be included in remarks.

"3◑" Lower scattered clouds at 300 feet. Used whenever necessary to indicate a third layer of clouds.

B. SKY

"+⊕ NW" Clouds dark northwest. (The same sky symbol should be employed as was used in the body of the report for the clouds to which reference is made.)

"◍TURBT" Clouds turbulent.

C. VISIBILITY

"2F NW" Fog bank to northwest, visibility 2 miles.
"3K NE" Smoky to the northeast, visibility 3 miles. (Used to indicate visibility lower in some direction than that indicated in the body of the report.)

D. WEATHER

"T APCHG SW" Thunderstorm approaching from the southwest.
"RQ W" Rain squall to west.
"SNW SHWR E" Snow shower to east.
"CM OVHD" Mammato cumulus overhead.
"ACC INCRG" Altocumulus castellatus clouds increasing.
"R+ OCNLY" Rain occasionally heavy (when rain is indicated in body of the report).
"OCNL SLT" Occasional sleet (when sleet is not indicated in body of report).
"SNW+ OCNLY" Snow occasionally heavy (when snow is indicated in body of the report).
"ER OCNLY"[2] Sleet occasionally mixed with rain (when rain is indicated in the body of the report).
"RE OCNLY"[2] Rain occasionally mixed with sleet (when sleet is indicated in the body of the report).
"OCNL RE"[2] Occasional rain and sleet mixed (when neither sleet nor rain is indicated in body of report).
"SNW WET" Snow wet (when snow is indicated in body of report).

E. OBSTRUCTIONS TO VISION

"KF OCNLY" Smoke occasionally mixed with fog.

[2] Sleet is not used separately or in a combination with snow in this case; therefore the *symbol* "E" is used.

2-404. Examples of Remarks.——In order to illustrate the method of coding remarks in weather reports sent by teletype or radio, the following examples of some of the more important remarks are given:

A. CEILING

"CIG VRBL 3 TO 7"	Ceiling variable from 300 to 700 feet.
"CIG RGD"	Ceiling ragged.
"CIG LWR NE TO S"	Ceiling lower from northeast to south.
"◐V◐"	Lower broken clouds variable to scattered (when broken clouds are included in the body of the report).
"E60⊕"	Overcast estimated at 6,000 feet. In cases of ⊕◐, ◐◐, ◐◐, or ◐◐, the height of the upper layer (preceded by a ceiling classification letter when reporting the height of an ⊕ or ◐ layer) will *always* be included in remarks.
"3◐"	Lower scattered clouds at 300 feet. Used whenever necessary to indicate an additional layer of clouds.

B. SKY

"LRG BRKS NW"	Large breaks northwest.
"HIER CLDS VSBL THRU OCNL BRKS"	Higher clouds visible through occasional breaks.
"ST ALG HRZN NW TO NE"	Stratus clouds along horizon from northwest to northeast.
"◐MOVD IN RPDLY FROM SW"	Broken layer moved in rapidly from the southwest.
"◐TURBT"	Broken layer turbulent.
"TWRG CU SE"	Towering cumulus clouds in the southeast.
"THDS S"	Thunderheads in the south.
"CB OVR MT TAYLOR"	Cumulonimbus over Mt. Taylor.
"CM OVHD"	Mammatocumulus overhead.
"ACC INCRG NE"	Altocumulus castellatus clouds increasing in the northeast.
"K LYRS ALF"	Smoke layers aloft.
"GF 4 FT DEEP"	Ground fog layer 4 feet deep.
"H ALF"	Haze aloft.

C. VISIBILITY

"VSBY VRBL 1/4 TO 3/4"	Visibility variable from 1/4 to 3/4 mile.
"VSBY N2E11/4S11/2W2"	Visibility in the north 2 miles, east 11/4 miles, south 11/2 miles, west 2 miles.
"VSBY NE1/4SE3/8SW1/8NW1/2"	Visibility to the northeast 1/4 mile, southeast 3/8 mile, southwest 1/8 mile, northwest 1/2 mile.
"VSBY W 2F-"	Visibility west 2 miles, light fog.
"VSBY SE 1/4K+"	Visibility southeast 1/4 mile, heavy smoke.
"VSBY IMPRG RPDLY"	Visibility improving rapidly.
"VSBY SW OCNLY 21/2"	Visibility to the southwest occasionally 21/2 miles.

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

2-404. EXAMPLES OF REMARKS.—In order to illustrate the method of coding remarks in weather reports sent by teletype or radio, the following examples of some of the more important remarks are given:

A. CEILING

"CIG VRBL 3 TO 7"	Ceiling variable from 300 to 700 feet.
"CIG RGD"	Ceiling ragged.
"CIG LWR NE TO S"	Ceiling lower from northeast to south.
"⦶V⦶"	Lower broken clouds variable to scattered (when broken clouds are included in the body of the report).
"E60⊕"	Overcast estimated at 6,000 feet. In cases of ⊕⦶, ⦶⦶, ⦶⦶, or ⦶⦶, the height of the upper layer (preceded by a ceiling classification letter when reporting the height of an ⊕ or ⦶ layer) will always be included in remarks.
"3⦶"	Lower scattered clouds at 300 feet. Used whenever necessary to indicate an additional layer of clouds.
"INTMD LYR ESTD 18 HND"	Intermediate layer at estimated 1,800 feet.

B. SKY

"LARGE BRKS NW"	Large breaks northwest.
"HIR CLDS VSB THRU OCNL BRKS"	Higher clouds visible through occasional breaks.
"ST ALG HRZN NW TO NE"	Stratus clouds along horizon from northwest to northeast.
"⦶ MOVD IN RPDLY FROM SW"	Broken layer moved in rapidly from the southwest.
"⦶ TURBT"	Broken layer turbulent.
"TWRG CU SE"	Towering cumulus clouds in the southeast.
"THDS S"	Thunderheads in the south.
"CB OVR MT TAYLOR"	Cumulonimbus over Mt. Taylor.
"CM OVHD"	Mammatocumulus overhead.
"ACC INCRG NE"	Altocumulus castellatus clouds increasing in the northeast.
"K LYRS ALF"	Smoke layers aloft.
"GF 4 FT DEEP"	Ground fog layer 4 feet deep.
"H ALF"	Haze aloft.

C. VISIBILITY

"VSBY VRBL 1/4 TO 3/4"	Visibility variable from 1/4 to 3/4 mile.
"VSBY N2E11/4S11/2W2"	Visibility in the north 2 miles, east 1-1/4 miles, south 1-1/2 miles, west 2 miles.
"VSBY NE1/4SE3/8SW1/8NW1/2"	Visibility to the northeast 1/4 mile, southeast 3/8 mile, southwest 1/8 mile, northwest 1/2 mile.

2–405. Methods To Be Used When Other Conditions Are Present.—The foregoing examples do not cover every condition, but merely illustrate the method of coding. Observers should use their best judgment in placing other remarks in the report in such a manner that they can be *easily* translated. Any remarks which are considered necessary, but which cannot be indicated in symbol form or in authorized Civil Aeronautics Administration abbreviations will be entered by means of full-length words.

D. THUNDERSTORMS

"T+ OVHD"	Heavy thunderstorm overhead.
"T SW MOVG NWD"	Thunderstorm in the southwest moving northward.
"T+ OVHD FQT INTNS LTNG CLD TO GND ALL DRCTNS"	Heavy thunderstorm overhead, frequent intense lightning cloud to ground in all directions.
"T MOVD EWD"	Thunderstorm moved eastward.
"OCNL CLD TO CLD LTNG DSNT SW"	Occasional cloud to cloud lightning in distant southwest.

E. PRECIPITATION

"R- VERY FINE"	Light rain very fine (when R- is included in the body of the report).
"OCNL SPKL"	Occasional sprinkle.
"PCPN INTMT"	Precipitation intermittent (not necessary in connection with rain showers).
"OCNL RW-"	Occasional light rain shower.
"SNW OCNLY HVY"	Snow occasionally heavy.
"R+ OCNLY"	Heavy rain occasionally.
"OCNL SLT"	Occasional sleet.
"SNW WET"	Snow wet (when snow is included in the body of the report).
"RW- W TO N"	Light rain shower from west to north.
"RQ ALG RDG W"	Rain squall along ridge west.

F. MISCELLANEOUS

"VIRGA E TO SW"	Virga east to southwest.
"RDG SW VSBL ABV GF"	Ridge southwest visible above the ground fog.
"CNDS EXTRMLY VRBL"	Conditions extremely variable.
"D DEVILS NW"	Dust devils northwest.
"OCNL BD- ON FLD"	Occasional light blowing dust on field.

4-405. Methods To Be Used When Other Conditions Are Present.—The foregoing examples do not cover every condition, but merely illustrate the method of coding. Observers should use their best judgment in so wording remarks that they may be *easily* translated. Any remarks which are considered necessary, but which cannot be indicated in symbol form or in authorized Civil Aeronautics Administration abbreviations, will be entered in full-length words.

D. THUNDERSTORMS

"T+ OVHD"	Heavy thunderstorm overhead.
"T SW MOVG NWD"	Thunderstorm in the southwest moving northward.
"T+ OVHD FQT INTS LTNG CLD TO GND ALL DRCTNS"	Heavy thunderstorm overhead, frequent intense lightning cloud to ground in all directions.
"T MOVD EWD"	Thunderstorm moved eastward.
"OCNL CLD TO CLD LTNG DSNT SW"	Occasional cloud to cloud lightning in distant southwest.

E. PRECIPITATION

"R- VERY FINE"	Light rain very fine (when R- is included in the body of the report).
"OCNL SPKL"	Occasional sprinkle.
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"OCNL RW-"	Occasional light rain shower.
"SNW OCNLY HVY"	Snow occasionally heavy.
"R+ OCNLY"	Heavy rain occasionally.
"OCNL SLT"	Occasional sleet.
"SNW WET"	Snow wet (when snow is included in the body of the report).
"RW- W TO N"	Light rain shower from west to north.
"RQ ALG RDG W"	Rain squall along ridge west.

F. MISCELLANEOUS

"VIRGA E TO SW"	Virga east to southwest.
"RDG SW VSB ABV GF"	Ridge southwest visible above the ground fog.
"CNDS XTRMLY VRBL"	Conditions extremely variable.
"D DEVILS NW"	Dust devils northwest.
"OCNL BD- ON FLD"	Occasional light blowing dust on field.

4-405. METHODS TO BE USED WHEN OTHER CONDITIONS ARE PRESENT.—The foregoing examples do not cover every condition, but merely illustrate the method of coding. Observers should use their best judgment in so wording remarks that they may be easily translated. Any remarks which are considered necessary, but which cannot be indicated in symbol form or in authorized Civil Aeronautics Administration abbreviations, will be entered in full-length words.

PART V.—ALTIMETER SETTINGS

CHAPTER I

DEFINITIONS REGARDING ALTIMETER SETTING AND SEA-LEVEL BAROMETRIC PRESSURE

2–500. Definition of Altimeter Setting.—The altimeter setting is a pressure, in inches, used for setting a pressure-scale type sensitive altimeter in an airplane so that upon landing of the airplane at an airport the pointers of the instrument will indicate very closely the field elevation above sea level; provided, that the instrument is functioning properly and is free from error, and that the setting was determined by a properly equipped station near the time and place of landing, and was furnished to the pilot just prior to landing.

The name "altimeter setting" will be used to designate the pressure setting defined above.

2–501. Definition of Sea-Level Barometric Pressure.—Sea-level barometric pressure is also called "meteorological sea-level pressure." "Sea-level barometric pressure" is intended to represent the barometric pressure at sea level under the prevailing meteorological conditions of temperature and station pressure. It is designed to give fairly smooth, consistent isobars on consecutive weather maps, so far as practicable.

2–502. Caution.—It should be noted that the altimeter setting does *not* depend on prevailing temperatures, but that the sea-level barometric pressure *does* depend on prevailing temperatures. Altimeter setting is intended for use by aviation interests for setting sensitive altimeters, but sea-level barometric pressure is intended for use by meterorologists for drawing isobars on weather maps. It is important that altimeter setting should not be confused with sea-level barometric pressure.

CHAPTER II

INSTRUCTIONS FOR SECURING AND ISSUING ALTIMETER SETTINGS

2–503. Instructions for Obtaining Altimeter Settings.—The following instructions will be effective in obtaining and recording altimeter settings:

(*a*) *Obtaining and recording altimeter settings.*—To obtain the altimeter setting for any time, (1) determine the station pressure for that time, (2) refer to the special table furnished to the station for this purpose (see sample hereunder headed "altimeter setting" for Kansas City, Mo., station), and (3) find the value in the body of the table corresponding to that station pressure. Examples are given below. No interpolations are necessary. At the left side of the table are given the station pressure arguments for each tenth of an inch, while at the top and bottom of the table are given the arguments for each hundredth of an inch.

Records of altimeter settings obtained at a station will be made by the observer on the day's WB Form 1130 in the column headed "altimeter setting," preceding the column headed "remarks."

Examples of Obtaining Altimeter Settings (see sample below of special table for Kansas City, Mo., station):

Station pressure (inches)	*Altimeter setting (inches)*
28. 33	29. 10
29. 00	29. 79
29. 16	29. 95
29. 57	30. 37

ALTIMETER SETTINGS

Standard atmosphere sea-level pressures used in setting sensitive altimeters

["Station pressure" pertaining to the Weather Bureau airport station is the only argument]

KANSAS CITY, MO., FIELD ELEVATION, 742 FEET

Station pressure (inches)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
26. 30	27. 03	27. 04	27. 05	27. 06	27. 07	27. 08	27. 09	27. 10	27. 11	27. 12
26. 40	27. 13	27. 14	27. 15	27. 16	27. 17	27. 18	27. 19	27. 20	27. 21	27. 22
26. 50	27. 23	27. 24	27. 25	27. 26	27. 27	27. 28	27. 29	27. 30	27. 31	27. 32
26. 60	27. 33	27. 35	27. 36	27. 37	27. 38	27. 39	27. 40	27. 41	27. 42	27. 43
26. 70	27. 44	27. 45	27. 46	27. 47	27. 48	27. 49	27. 50	27. 51	27. 52	27. 53
26. 80	27. 54	27. 55	27. 56	27. 57	27. 58	27. 59	27. 60	27. 61	27. 62	27. 63
26. 90	27. 64	27. 65	27. 66	27. 67	27. 68	27. 69	27. 70	27. 71	27. 72	27. 73
27. 00	27. 74	27. 75	27. 76	27. 78	27. 79	27. 80	27. 81	27. 82	27. 83	27. 84
27. 10	27. 85	27. 86	27. 87	27. 88	27. 89	27. 90	27. 91	27. 92	27. 93	27. 94
27. 20	27. 95	27. 96	27. 97	27. 98	27. 99	28. 00	28. 01	28. 02	28. 03	28. 04
27. 30	28. 05	28. 06	28. 07	28. 08	28. 09	28. 10	28. 11	28. 12	28. 13	28. 14
27. 40	28. 15	28. 16	28. 17	28. 18	28. 19	28. 20	28. 21	28. 23	28. 24	28. 25
27. 50	28. 26	28. 27	28. 28	28. 29	28. 30	28. 31	28. 32	28. 33	28. 34	28. 35
27. 60	28. 36	28. 37	28. 38	28. 39	28. 40	28. 41	28. 42	28. 43	28. 44	28. 45
27. 70	28. 46	28. 47	28. 48	28. 49	28. 50	28. 51	28. 52	28. 53	28. 54	28. 55
27. 80	28. 56	28. 57	28. 58	28. 59	28. 60	28. 61	28. 62	28. 63	28. 64	28. 65
27. 90	28. 66	28. 67	28. 69	28. 70	28. 71	28. 72	28. 73	28. 74	28. 75	28. 76
28. 00	28. 77	28. 78	28. 79	28. 80	28. 81	28. 82	28. 83	28. 84	28. 85	28. 86
28. 10	28. 87	28. 88	28. 89	28. 90	28. 91	28. 92	28. 93	28. 94	28. 95	28. 96
28. 20	28. 97	28. 98	28. 99	29. 00	29. 01	29. 02	29. 03	29. 04	29. 05	29. 06
28. 30	29. 07	29. 08	29. 09	29. 10	29. 11	29. 12	29. 14	29. 15	29. 16	29. 17
28. 40	29. 18	29. 19	29. 20	29. 21	29. 22	29. 23	29. 24	29. 25	29. 26	29. 27
28. 50	29. 28	29. 29	29. 30	29. 31	29. 32	29. 33	29. 34	29. 35	29. 36	29. 37
28. 60	29. 38	29. 39	29. 40	29. 41	29. 42	29. 43	29. 44	29. 45	29. 46	29. 47
28. 70	29. 48	29. 49	29. 50	29. 51	29. 52	29. 53	29. 54	29. 55	29. 56	29. 57
28. 80	29. 59	29. 60	29. 61	29. 62	29. 63	29. 64	29. 65	29. 66	29. 67	29. 68
28. 90	29. 69	29. 70	29. 71	29. 72	29. 73	29. 74	29. 75	29. 76	29. 77	29. 78
29. 00	29. 79	29. 80	29. 81	29. 82	29. 83	29. 84	29. 85	29. 86	29. 87	29. 88
29. 10	29. 89	29. 90	29. 91	29. 92	29. 93	29. 94	29. 95	29. 96	29. 97	29. 98
29. 20	29. 99	30. 00	30. 01	30. 02	30. 03	30. 04	30. 06	30. 07	30. 08	30. 09
29. 30	30. 10	30. 11	30. 12	30. 13	30. 14	30. 15	30. 16	30. 17	30. 18	30. 19
29. 40	30. 20	30. 21	30. 22	30. 23	30. 24	30. 25	30. 26	30. 27	30. 28	30. 29
29. 50	30. 30	30. 31	30. 32	30. 33	30. 34	30. 35	30. 36	30. 37	30. 38	30. 39
29. 60	30. 40	30. 41	30. 42	30. 43	30. 44	30. 45	30. 46	30. 47	30. 48	30. 49
29. 70	30. 50	30. 52	30. 53	30. 54	30. 55	30. 56	30. 57	30. 58	30. 59	30. 60
29. 80	30. 61	30. 62	30. 63	30. 64	30. 65	30. 66	30. 67	30. 68	30. 69	30. 70
29. 90	30. 71	30. 72	30. 73	30. 74	30. 75	30. 76	30. 77	30. 78	30. 79	30. 80
30. 00	30. 81	30. 82	30. 83	30. 84	30. 85	30. 86	30. 87	30. 88	30. 89	30. 90
30. 10	30. 91	30. 92	30. 93	30. 94	30. 95	30. 97	30. 98	30. 99	31. 00	31. 01
30. 20	31. 02	31. 03	31. 04	31. 05	31. 06	31. 07	31. 08	31. 09	------	------
Station pressure (inches)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09

Station elevation, H_b=750.0 feet. Actual elevation of barometer H_z=760.328 feet.

(*b*) *Special table headed "Altimeter setting"=Standard atmosphere sea-level pressures—Used in setting sensitive altimeters.*—These instructions regarding altimeter settings apply to each weather reporting station having a mercurial barometer and rendering airway weather reports or located at an airport. Each of these stations will be furnished by the Central Office with a special table having a heading as indicated above. The name of the station for which the table is intended is given near the top of the table. All station pressures which are referred to the special table for obtaining

altimeter settings must pertain to the station elevation used in computing the table. That is, a table is *invalid* for stations other than the one named in the heading, or, more particularly, for station elevations other than the specific station elevation used in computing the table. The latter specific elevation is given near the *foot* of the table.

(*c*) *Some cautions, definitions and remarks.*—The following facts are recalled for information of the reader: Station elevation (symbol H_b) is the elevation above sea level adopted for the station as the basis to which all pressure observations at the station are correlated. This should not be confused with field elevation (symbol H_f), or with actual elevation of the barometer (i. e., ivory point-cistern of mercurial barometer, symbol H_z). The station elevation may differ slightly from the actual elevation of the barometer. Station pressures represent pressures observed at the station, reduced to the level of the station elevation. The term "altimeter setting", defined in chapter I, and the longer technical term "standard atmosphere sea-level pressure" used in the heading of the special table have the same meaning. Care must be taken not to confuse "standard atmosphere sea-level pressure" with "meterological sea-level pressure." To avoid confusion, the term "altimeter setting" should be generally used for the former. The table for obtaining meteorological sea-level pressures is different from the special table for obtaining altimeter settings, and requires the use of a temperature argument in addition to the station-pressure argument. The distinction between the two kinds of pressure in question is discussed in chapter I.

(*d*) *Obtaining station pressures.*—Altimeter settings will only be obtained at stations having a mercurial barometer. An open-scale barograph or a reliable aneroid barometer should be installed near the mercurial barometer. Station pressures, required for obtaining altimeter settings, should be determined in accordance with existing instructions. That is, for the settings near 1:30 a. m., 7:30 a. m., 1:30 p. m., and 7:30 p. m., 75th meridian time, station pressures must be based on mercurial barometer readings to which have been applied corrections for temperature (attached thermometer) and also for instrumental errors and other factors as given under the label "Sum of corrections" on WB Form 1059. At these times, corrections to be applied to the open-scale barograph or aneroid barometer readings to give agreement with the station pressures deduced from the mercurial barometer readings should be found. These corrections should be recorded with the time on a card fastened near the open-scale barograph or aneroid barometer. Station pressures for the 6 hours *between* any consecutive two of the four times specified above may be determined by reading the open-scale barograph or aneroid barometer and applying the latest correction from the card to the reading. *Corrections to barographs or aneroid barometers should not be more than 6 hours old when used for obtaining station pressures from readings of these instruments.*

2-504. Maximum Interval Allowable Between Time of Issuance of an Altimeter Setting and the Time of Barometer Reading on Which It is Based.—An altimeter setting which is issued to represent the current value should be based on an open-scale barograph or barometer reading made *not* more than 15 minutes prior to the time of issuance. If, just prior to the time of issuance, there are occurring unusually rapid pressure changes such as those attending the passage of thunderstorms, squall lines, hurricanes, tornadoes, etc., the time interval between the open-scale barograph or barometer reading and issuance should be appreciably less than 15 minutes and as short as practicable under the circumstances. It is desired that the station pressure on which the altimeter setting is based be as closely as possible representative of the station pressure occurring at the time of issuance of the altimeter setting.

2-505. Obtaining Altimeter Settings at 1:30 a. m., 7:30 a. m., 1:30 p. m., and 7:30 p. m., 75th Meridian Time, and Issuing Data To Airport Control Tower, Air-Carrier Officials, and Others Concerned.[1]—Each weather-reporting station located at an airport, and equipped with a mercurial barometer, will obtain the altimeter setting at the times of the regular daily mercurial-barometer observations made just before 1:30 a. m., 7:30 a. m., 1:30 p. m., and 7:30 p. m., respectively, 75th meridian time. (These are regarded as the four principal times for obtaining altimeter settings.)

[1] Altimeter settings furnished in accordance with paragraph 2-505 are used four times daily at local control towers, airline operation offices, etc., to obtain correct height settings for ground altimeters so that all local interests concerned will be able to secure identical altimeter settings from these instruments at the same time, in conformity with the standard established by the Weather Bureau mercurial barometer equipment.

The altimeter settings obtained at the four principal times will be furnished promptly after determination to the proper authorities at the local airport control tower and, if practicable, also to airline (air carrier) dispatching officers or other responsible officials and such other interested parties at the airport as may require the information. It is desirable that the data be disseminated locally as widely as practicable at the four principal times through use of the interoffice airport telephone circuit. The time of the barometer reading forming the basis for any altimeter setting should be given in each case.

If a local airport control tower is not available to receive the data, the altimeter settings at the four times in question should be furnished to airline dispatching officers or other responsible officials at the local airport.

Arrangements regarding dissemination and receipt of the data at the four principal times should be made locally by responsible officials.

2-506. Obtaining Altimeter Settings for Inclusion in "Record," "Special," and "Check" Observations.—Every weather-reporting station located on teletype or radio circuits and equipped with a mercurial barometer will include the altimeter setting in each *record, special,* and *check* observation. The altimeter setting will be obtained on the basis of the station pressure existing at the time of the observation. The altimeter setting will be included in the *record, special,* and *check* observations immediately following the wind element and separated therefrom by a slant mark (/). If a station does not have a mercurial barometer, altimeter settings will be omitted in reports rendered therefrom.

The sea-level barometric pressure need not be ascertained for *check* observations, unless marked changes in weather conditions justify the making of a *special* observation at the time of the *check* observation in question and the inclusion of the sea-level barometric pressure and the altimeter setting in the *special* report.

The *check* observation, including the altimeter setting, will be broadcast as the local weather report by the local Civil Aeronautics Broadcasting Station, if any. A uniform style of broadcasting will be used, namely: "altimeter setting — — — —", for example: "Altimeter setting twenty-nine ninety-five" for 29.95 inches, "altimeter setting thirty ten" for 30.10 inches, etc. Inches will be understood.

There follow examples of (1) altimeter settings as obtained at a station on the basis of barometric observations, and (2) altimeter settings data corresponding to the values given under column (1) but shown in the form that they are recorded and transmitted in teletype and radio-sequence weather reports:

EXAMPLES

(1) Altimeter settings as obtained at station on basis of barometric observations	(2) Altimeter setting data as recorded and transmitted in sequence reports
Inches	
30.51	051
30.25	025
30.14	014
30.00	000
29.92	992
29.81	981
29.49	949
29.12	912
29.00	900
28.92	892
28.80	880

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

The altimeter settings obtained at the four principal times will be furnished promptly after determination to the proper authorities at the local airport control tower and, if practicable, also to airline (air carrier) dispatching officers or other responsible officials and such other interested parties at the airport as may require the information. It is desirable that the data be disseminated locally as widely as practicable at the four principal times through use of the interoffice airport telephone circuit. The time of the barometer reading forming the basis for any altimeter setting should be given in each case.

If a local airport control tower is not available to receive the data, the altimeter settings at the four times in question should be furnished to airline dispatching officers or other responsible officials at the local airport.

Arrangements regarding dissemination and receipt of the data at the four principal times should be made locally by responsible officials.

2-506. REPORTING ALTIMETER SETTING.—Every weather-reporting station located on teletype or radio circuits and equipped with a mercurial barometer will include the altimeter setting in each record and check observation; it will be included in special observations only as required in 2-103(c). The altimeter setting will be included in the record and check observations immediately following the wind element and separatedfrom it by a slant mark (/). In special observations the altimeter setting will be separated from preceding elements by a slant; if reported alone, it will be in form of remarks, as: ALSTG 990. If a station does not have a mercurial barometer, altimeter settings will be omitted in reports.

The check observation, including the altimeter setting, will be broadcast as the local weather report by the local Civil Aeronautics Broadcasting Station, if any. ~~A uniform style of broadcasting will be used, namely: "altimeter setting ------", for example: "Altimeter setting twenty-nine ninety-five" for 29.95 inches, "altimeter setting thirty ten" for 30.10 inches, etc. Inches will be understood.~~ Cancelled 1-1-45.

There follow examples of (1) altimeter settings as obtained at a station on the basis of barometric observations, and (2) altimeter settings data corresponding to the values given under column (1) but shown in the form that they are recorded and transmitted in teletype and radio-sequence weather reports:

EXAMPLES

(1) Altimeter settings as obtained at station on basis of barometric observations	(2) Altimeter setting data as recorded and transmitted in sequence reports
Inches	
30.51	051
30.25	025
30.14	014
30.00	000
29.92	992
29.81	981
29.49	949
29.12	912
29.00	900
28.92	892
28.80	880

As is evident from the examples, the altimeter setting data recorded and transmitted in sequence weather reports consist of the last three digits of the obtained value, expressed to inches and hundredths of an inch, with the initial 2 or 3 and the decimal point of the recorded value omitted. Inches will be understood as the units in the transmission of altimeter setting.

NOTE.—The Sea-level barometric pressure (meteorological sea-level pressure) which precedes the temperature in teletype and radio-sequence weather reports is transmitted as three digits representing the tens, units, and tenths decimal-place figures of the obtained sea-level barometric pressure expressed in *millibars*. The decimal point and the initial 9 or 10 of the recorded sea-level barometric pressure in millibars are omitted in transmission.

EXAMPLES

Sea level barometric pressure (meteorological sea-level pressure) as obtained at station on basis of barometric and temperature observations	Sea-level barometric pressure data as recorded and transmitted in sequence reports
Millibars (mb.)	
1034. 9	349
1026. 4	264
1016. 9	169
1007. 8	078
1001. 4	014
1000. 0	000
998. 1	981
994. 9	949
991. 2	912
986. 1	861
979. 3	793

Since there is possibility of confusion of sea-level barometric pressure with altimeter setting in transmitted data, it is important that the different units be properly understood in each case, *millibars* in regard to sea-level barometric pressure, and *inches* in regard to altimeter setting.

2–507. Filing of Special Observations When Change in Station Pressure Since Previous Record or Special Observation Is Marked.—The instructions of this paragraph apply to each weather-reporting station located on teletype or radio circuits and equipped with a mercurial barometer. If there occurs a marked change in station pressure since the previous *record* or *special* observation at the rate of *0.08 inch (2⅔ mb.) or more per hour*, then a *special* observation will be filed for transmission on teletype or radio circuits. *Special* observations will be filed at 15-minute intervals following the previous *record* or *special* observation as long as the above-mentioned rate of pressure change persists. The method of transmission of the data is the same as indicated in paragraph 2–506 above. The provisions of paragraph 2–504 relative to maximum interval allowable between time of issuance of an altimeter setting and the time of barometer reading on which it is based should be adhered to in spirit and observance as closely as practicable.

2–508. Furnishing of Altimeter Settings Upon Special Request.—Whenever an airport control-tower official requests an observer at a station to furnish the current value of the altimeter setting, prompt action should generally be taken to comply with the requests. In emergencies, prompt compliance with similar requests by other organizations or parties is necessary. Cases may arise when immediate fulfillment of such requests will cause interference with other essential urgent duties. In such cases, the observer must be circumspect in deciding on the best line of action, giving consideration to the relative importance of various tasks which must be carried out, and to the other factors, such as time available, effects of delay, etc., pertinent to the circumstances.

It is the intent of this program that the altimeter settings or other pressure data provided at the four principal times daily should represent basic values whereby the sensitive altimeters or other pressure-measuring instruments in airport control towers and in airline dispatching offices may be corrected to conform with the national standard

of altimetry based on reliable mercurial barometer readings. Once the control tower altimeters or other instruments have been so corrected, the needs of airmen, dispatchers, etc., for the correct local altimeters settings may be satisfied in general if those parties obtain the settings from the airport control tower. It is believed that explanation of the matter to all parties concerned will prevent excessive requests upon stations for the data; however, personnel should be cooperative toward all concerned in this program, so far as practicable.

2–509. Comparison of Mercurial Barometers by Weather Bureau Inspectors and Reports on Program.—Weather Bureau inspectors are required to carry a mercurial barometer with them on their inspection trips and to make comparative readings between the instrument carried and the mercurial barometers at the various stations visited. WB Form 1027 should be promptly rendered to the Central Office to show the results of such readings. Instruments found to be impaired must be taken out of service. Prompt action will be necessary to replace or repair such instruments.

Inspectors should carefully scrutinize the work at each station to insure that the procedures used in obtaining and disseminating altimeter settings are in accordance with instructions. The Central Office should be advised from time to time regarding the status of the program and any matters pertinent thereto which may be of special interest.

PART VI.—INSTRUCTIONS FOR THE PREPARATION AND DISPOSITION OF AIRWAY METEOROLOGICAL FORMS

CHAPTER I

IMPORTANCE OF AIRWAY METEOROLOGICAL FORMS

2-600. The conduct of the airway meteorological service requires that certain forms be prepared and rendered at all types of stations engaged in this work which have been directed to do so. These forms are mainly records of observations or compilations of observational data and constitute the only available records for use in studies, court cases, etc. As such, they are highly important and all personnel shall take care to see that the forms assigned to them shall be neatly and legibly prepared and that the data entered thereon is accurate. Instructions for the preparation and disposition of all these forms follow:

CHAPTER II

WB FORM 1130, AIRWAY WEATHER REPORTS

2-601. Purpose and Use of WB Form 1130.—This form is to be used for the recording of airway weather observations and shall be used for this purpose at all stations rendering such observations. Accordingly, it constitutes the original record of airway observations. However, this does not mean that the data must be entered directly on the form, as it may be inconvenient to carry it while making an observation in windy or rainy weather, but rather that the data entered shall be considered as constituting the original record of the observation itself.

2-602. Method of Making Entries.—Entries on WB Form 1130 shall be made by use of a moderately hard pencil. Observations shall be entered in chronological order, placing data in the proper columns as indicated in the headings on the form, using symbols, authorized English abbreviations, and figures. Ditto marks may be used, *except in record or special observations*, when the data to be entered in any column are the same as the immediately preceding data in the same column.

2-603. Entry of Station Name and Date of Form.—The name of the station and the month and year shall be entered in the space provided in the top right-hand corner of the form. This applies to all forms, irrespective of whether or not more than one sheet is used for entry of 1 day's observations. The day of the month shall be entered in the column provided at the left of the form.

2-604. Entry of "Type-of-Observation" Designation.—Types of observations shall be designated in the second column from the left, as follows: "R" for "record," a check mark (√) for "check," "L" for "local extra," and "S" for "special."

2-605. Entry of "Classification" Symbols.—If the station is within a "control zone" as defined by current circulars of the Bureau regarding this, the observations shall be classified according to the existing rules to indicate whether the weather is suitable for "contact" or "instrument" flying or whether the airport is "closed to operation" of aircraft. These classifications shall be entered in the column so indicated and shall be "C," "N," or "X," respectively, for "contact," "instrument," or "closed."

2-606. Entry of "Time of Observation."—The local time of observation shall be entered on the basis of the 24-hour clock in the column provided. Under this system four figures, the first two representing the hour and the last two the minutes, are always entered, the first hour after midnight being designated "00;" the second, "01;" the third, "02;" the fifteenth "14," etc. For example, "0001" indicates 12:01 a. m., "0235"

PART VI.—INSTRUCTIONS FOR THE PREPARATION AND DISPOSITION OF AIRWAY METEOROLOGICAL FORMS

CHAPTER I

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2-600. The conduct of the airway meteorological service requires that certain forms be prepared and rendered at all types of stations engaged in this work which have been directed to do so. These forms are mainly records of observations or compilations of observational data and constitute the only available records for use in studies, court cases, etc. As such, they are highly important and all personnel shall take care to see that the forms assigned to them shall be neatly and legibly prepared and that the data entered thereon is accurate. Instructions for the preparation and disposition of all these forms follow:

CHAPTER II

WB FORM 1130B, AIRWAY WEATHER REPORTS

2-601. PURPOSE AND USE OF WB FORM 1130B.—This form is to be used for the recording of airway weather observations and shall be used for this purpose at all stations rendering such observations. Accordingly, it constitutes the original record of airway observations. However, this does not mean that the data must be entered directly on the form, as it may be inconvenient to carry it while making an observation in windy or rainy weather, but rather that the data entered shall be considered as constituting the original record of the observation itself.

2-602. METHOD OF MAKING ENTRIES.—Entries on WB Form 1130B shall be made by use of a moderately hard pencil. Observations shall be entered in chronological order, placing data in the proper columns as indicated in the headings on the form, using symbols, authorized English abbreviations, and figures. Ditto marks may be used, except in record or special observations, when the data to be entered in any column are the same as the immediately preceding data in the same column.

2-603. GENERAL ENTRIES.—The Standard Time Zones established by the Interstate Commerce Commission will be the basis for time zone indicators used in making weather reports, e.g., E = Eastern, C = Central, etc. The meridian classification is the meridian of time corresponding to the time actually being used at the station. The following table is a guide:

Meridian of time	60th	75th	90th	105th	120th
Standard Time	AST	EST	CST	MST	PST
War Time	EWT	CWT	MWT	PWT	YWT
To convert to GCT add	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs

Enter the meridian classification; enter the number of hours necessary to convert time entries to Greenwich Civil Time, and indicate if it is to be added or subtracted by drawing a line through the inapplicable word. Enter the actual height above sea level of the ivory point of the mercurial barometer (Hz). No entry for "Security Classification" need be made at Weather Bureau stations unless specifically instructed to make such entries. Enter station name in upper right corner, and latitude and longitude to degrees and minutes. Enter month, day, and year in the spaces provided at the lower right corner of the form. A new sheet will be begun at midnight each day and as many continuation sheets as are necessary will be used.

PART VI.——INSTRUCTIONS FOR THE PREPARATION AND DISPOSITION OF AIRWAY METEOROLOGICAL FORMS

CHAPTER I

IMPORTANCE OF AIRWAY METEOROLOGICAL FORMS

2-600.0. The conduct of the airway meteorological service requires that certain forms be prepared and rendered at all types of stations engaged in this work which have been directed to do so. These forms are mainly records of observations or compilations of observational data and constitute the only available records for use in studies, court cases, etc. As such, they are highly important and all personnel will take care to see that the forms assigned to them are neatly and legibly prepared and that the data entered are accurate. Instructions for the preparation and disposition of these forms follow:

CHAPTER II

WB FORM 1130A, AIRWAY WEATHER REPORTS

2-601.0. General.--This form will be used at all stations for recording surface observations and will constitute the original record. A new page will be started for each day's observations beginning with the first observation at or following 0000 local standard time, as defined below. The date and year will be entered in the space provided in the lower right corner. The name of the station and its latitude and longitude will be entered in the upper right corner of the form. No entry will be made in the security classification space without specific instructions to that effect. Use a moderately hard pencil for making entries. Enter observations in chronological order, restricting data, so far as possible, to the columns appropriate to them as indicated by the headings of the respective columns. Ditto marks will not be used on this form. Entries will be confined to the elements of the observation that are actually observed by the observer or a qualified reporter, e.g., pilot. Reference to operational usage is for stations where WB Form 1130A is used by the communications operator directly without his preparing the message for transmission on a separate blank (WB Form 3024B).

2-601.1. Correction of entries.--Data on these forms may not be erased or obliterated. When incorrect data have been entered, corrections will be made as follows:

2-601.11. If the error is discovered before the report is filed, draw a red line through the incorrect report and enter the corrected observation on the next line. Carbon copies need not be corrected in red.

2-601.12. If the observation has been filed and the error discovered within one hour of filing time, a corrected report will be filed immediately regardless of special observations that might have been transmitted in the meantime. The report will be preceded by the letters "CQN" signifying "correction." These letters will be entered in Column (1). Only the elements that are in error will be corrected. For example, CQN 1330 (time of erroneous observation) Dew Point 32. In this case a red line will be drawn through the erroneous entry only, and the correction will be entered in red immediately above it.

2-601.13. When an observation has been filed and more than an hour has elapsed before discovering an error, correction will be made in red on the form without obliterating the original entry, but a corrected report will not be filed for transmission. However, WB Form 3069 will be filled out and routed according to current instructions printed on the form. In the event that a monitoring station first finds the error, this unit will send WB Form 3069 to the station for correction, signature, and routing.

2-602.0. Time.--For the purpose of securing a uniform understanding of time for use on the WBAN-10A form, certain definitions are established as follows:

2-602.1. Greenwich Civil Time (GCT) is sometimes called "universal time" because time used in most other parts of the world is derived from G.C.T. Greenwich Civil Time is the local civil time, standard time, and zone time within the time zone of Greenwich (0° longitude).

2-602.2. Local Standard Time.--In the United States, standard time zones have been established by law, and the time within these zones is the mean solar time at the following meridians, respectively:

indicates 2:35 a. m., "1346" indicates 1:46 p. m., "2305" indicates 11:05 p. m., etc. The standard of local time in use shall be indicated by entry of the letters "E" for eastern, "C" for central, "M" for mountain, and "P" for Pacific standard time, following the time figures for the first entry on each sheet, e. g., "0042E" indicates 12:42 a. m., eastern standard time; "1515C" indicates 3:15 p. m., central standard time, etc.

2-607. Entry of "Ceiling" Data.—The ceiling shall be entered in figures in the "ceiling" column. When estimated, i. e., not measured by approved methods, the letter E, meaning "estimated," shall be entered immediately preceding the figure. At stations located on teletype or radio circuits the ceiling value may be entered only to hundreds of feet, i. e., the figures for the tens and digits shall be dropped. For example, 3,000 feet would be entered as "30," 1,500 feet would be entered as "15," 300 feet as "3," zero as "0", etc. Stations reporting by telephone or telegraph will enter the complete figures for the value.

2-608. Entries of "Sky," "Weather," and "Obstructions to Vision."—At stations on teletype or radio circuits, sky, weather, and obstructions to vision shall be entered according to symbols given in this circular. At other stations these elements may be entered in authorized English abbreviations. The height of scattered clouds, recorded as instructed in this circular shall be entered at teletype stations in the sky-condition column *preceding* the "scattered" symbol and *following* the word "scattered" at stations reporting by the telephone or telegraph.

2-609. Entries of "Visibility," "Temperature," "Dew Point," and "Barometer".—Visibility, temperature, dew point, and barometer shall be entered in figures. Temperature and dew point, entered to whole degrees, shall be separated by a slant mark (/), the temperature being entered first. The station pressure shall be entered in inches and hundredths in the column provided. The sea-level pressure is to be entered in millibars and tenths of millibars. At stations on teletype or radio circuits the sea-level pressure shall be entered in three figures representing the tens, units, and tenths of millibars, the thousands and hundreds figures being dropped; that is, 1000.2 would be entered as "002", 996.8 would be entered as "968", etc. The sea-level pressure will be separated from the temperature by a slant mark. Corrected readings of wet- and dry-bulb thermometers are to be entered to tenths in the columns provided.

2-610. Entries of "Wind" Data.—At stations on teletype and radio circuits the wind direction shall be entered by use of arrows. At other stations wind directions shall be entered by use of authorized abbreviations. The velocity shall be in figures immediately following the direction. Character of gustiness, when appropriate, shall be entered immediately following the velocity, by use of a minus (—) sign to indicate "fresh" and a plus (+) sign to indicate "strong" gusts at teletype and radio stations and by the abbreviated words "Frsh gsts" or "Stg gsts" at other stations. When the wind velocity is estimated at stations located on radio or teletype circuits, this should be indicated by entry of the letter "E" immediately following the velocity; at other stations, the abbreviation "Etd" will be used.

2-611. Entries of "Altimeter Setting" Data.—The altimeter setting shall be entered in inches and hundredths of an inch in the column provided. At stations on teletype or radio circuits, the altimeter setting shall be entered in units, tenths, and hundredths of inches, the tens figures being dropped, that is, 29.92 would be entered as "992", 30.03 would be entered as "003", etc. The altimeter setting will be separated from the wind entry by a slant mark.

2-612. Entries of "Remarks" and "Miscellaneous Data."—Remarks shall be entered according to instructions contained in part IV of this section. At stations adding special data to 3-hourly observations, these data shall be entered in the prescribed form in the "Remarks" column, following any remarks entered therein and separated from the remarks by a slant mark and one space (the slant mark to be added to the last figure, symbol, or word of the remarks). The same procedure shall also be used at stations which add meteorological data to its observations at the 6-hourly periods.

Entries shall be made in the "Precipitation" column only by stations not recording the data on WB Form 1083 (unless otherwise instructed) and then only at the observations taken at 1:30 and 7:30 a. m. and p. m., E. S. T. The amount of precipitation

indicates 2:35 a. m., "1346" indicates 1:46 p. m., "2305" indicates 11:05 p. m., etc. The standard of local time in use shall be indicated by entry of the letters "E" for eastern, "C" for central, "M" for mountain, and "P" for Pacific standard time, following the time figures for the first entry on each sheet, e. g., "0042E" indicates 12:42 a. m., eastern standard time; "1515C" indicates 3:15 p. m., central standard time, etc.

2-607. Entry of "Ceiling" Data.—The ceiling shall be entered in figures in the "ceiling" column preceded by the appropriate ceiling classification letter. At stations located on teletype or radio circuits the ceiling value will be entered only to hundreds of feet, i. e., the figures for the tens and digits shall be dropped. For example, 3,000 feet would be entered as "30," 1,500 feet as "15," 300 feet as "3," zero as "0," etc. Stations reporting by telephone or telegraph will enter the complete figures for the values.

2-608. Entries of "Sky," "Weather," and "Obstructions to Vision."—At stations on teletype or radio circuits, sky, weather, and obstructions to vision shall be entered according to symbols given in this circular. At other stations these elements may be entered in authorized English abbreviations. The height of scattered clouds, recorded as instructed in this circular shall be entered at teletype stations in the sky-condition column *preceding* the "scattered" symbol and *following* the word "scattered" at stations reporting by the telephone or telegraph.

2-609. Entries of "Visibility," "Temperature," "Dew Point," and "Barometer".—Visibility, temperature, dew point, and barometer shall be entered in figures. Temperature and dew point, entered to whole degrees, shall be separated by a slant mark (/), the temperature being entered first. The station pressure shall be entered in inches and hundredths in the column provided. The sea-level pressure is to be entered in millibars and tenths of millibars. At stations on teletype or radio circuits the sea-level pressure shall be entered in three figures representing the tens, units, and tenths of millibars, the thousands and hundreds figures being dropped; that is, 1000.2 would be entered as "002", 996.8 would be entered as "968", etc. The sea-level pressure will be separated from the temperature by a slant mark. Corrected readings of wet- and dry-bulb thermometers are to be entered to tenths in the columns provided.

2-610. Entries of "Wind" Data.—At stations on teletype and radio circuits the wind direction shall be entered by use of arrows. At other stations wind directions shall be entered by use of authorized abbreviations. The velocity shall be in figures immediately following the direction. Character of gustiness, when appropriate, shall be entered immediately following the velocity, by use of a minus (—) sign to indicate "fresh" and a plus (+) sign to indicate "strong" gusts at teletype and radio stations and by the abbreviated words "Frsh gsts" or "Stg gsts" at other stations. When the wind velocity is estimated at stations located on radio or teletype circuits, this should be indicated by entry of the letter "E" immediately following the velocity; at other stations, the abbreviation "Etd" will be used.

2-611. Entries of "Altimeter Setting" Data.—The altimeter setting shall be entered in inches and hundredths of an inch in the column provided. At stations on teletype or radio circuits, the altimeter setting shall be entered in units, tenths, and hundredths of inches, the tens figures being dropped, that is, 29.92 would be entered as "992", 30.03 would be entered as "003", etc. The altimeter setting will be separated from the wind entry by a slant mark.

2-612. Entries of "Remarks" and "Miscellaneous Data."—Remarks shall be entered according to instructions contained in part IV of this section. At stations adding special data to 3-hourly observations, these data shall be entered in the prescribed form in the "Remarks" column, following any remarks entered therein and separated from the remarks by a slant mark and one space (the slant mark to be added to the last figure, symbol, or word of the remarks). The same procedure shall also be used at stations which add meteorological data to its observations at the 6-hourly periods.

Entries shall be made in the "Precipitation" column only by stations not recording the data on WB Form 1083 (unless otherwise instructed) and then only at the observations taken at 1:30 and 7:30 a. m. and p. m., E. S. T. The amount of precipitation

2-604. "TYPE."—Types of observations will be designated in the first column, as follows: "R" for record, a check mark (✓) for check, "L" for local extra, and "S" for special.

2-605. "TIME."—The local time of observation will be entered on the basis of the 24-hour clock in the second column. Under this system, four figures are always entered, the first two representing the hour and the last two the minute. For example, "0000" indicates 12:00 midnight, "0235" indicates 2:35 a. m., "1346" indicates 1:46 p. m.

2-606. "CLASSIFICATION."—If the station is within a "control zone" as defined in par. 2-127, the observations will be classified in accordance with existing rules to indicate whether the weather is suitable for contact or instrument flying. Classifications will be entered in the third column, and will be "C" or "N" for contact or instrument respectively.

2-607. "CEILING" DATA.—The ceiling will be entered in figures in the fourth column preceded by the appropriate ceiling classification letter. At stations located on teletype or radio circuits the ceiling value will be entered only to hundreds of feet, i.e., the figures for the tens and units will be dropped. For example, 3,000 feet would be entered as "30," 1,500 feet as "15", 300 feet as "3," etc. Stations reporting by telephone or telegraph will enter the complete figures for the values.

2-608. "SKY," "WEATHER," AND "OBSTRUCTIONS TO VISION."—At stations on teletype or radio circuits, sky, weather, and obstructions to vision will be entered according to symbols given in this circular. At other stations these elements may be entered in authorized English abbreviations. The height of scattered clouds will be entered at teletype stations in the sky-condition column preceding the "scattered" symbol and following the word "scattered" at stations reporting by telephone or telegraph.

2-609. "VISIBILITY," "TEMPERATURE," "DEW POINT," AND "SEA-LEVEL PRESSURE."—Visibility, temperature, dew point, and sea-level pressure will be entered in figures. Temperature and dew point, to whole degrees, will be separated by a slant (/). The sea-level pressure at stations on teletype or radio circuits will be entered in three figures representing the tens, units, and tenths of millibars, the thousands and hundreds figures being dropped; that is 1000.2 would be entered as "002," 996.8 would be entered as "968." The sea-level pressure will be separated from the temperature by a slant (/).

2-610. At stations on teletype and radio circuits the wind direction will be entered by use of arrows. At other stations wind directions will be entered by use of authorized abbreviations. The velocity will be in figures immediately following the direction. Character of gustiness, when appropriate, will be entered immediately following the velocity by use of a minus (-) to indicate "fresh" and a plus (+) to indicate "strong" gusts at teletype and radio stations and by the abbreviated words "Frsh gsts" or "Stg gsts" at other stations. When the wind velocity is estimated at stations located on radio or teletype circuits, this will be indicated by entry of the letter "E" immediately following the velocity; at other stations the abbreviation "Estd" will be used.

2-611. "ALTIMETER SETTING."—The altimeter setting will be entered in units, tenths, and hundredths of inches, the tens figure being dropped, at stations on radio or teletype circuits. For example, 29.92 would be entered as "992," and 30.03 as "003." The altimeter setting will be separated from the wind entry by a slant (/).

Standard Time Zone	Meridian
Eastern Standard Time (EST)	75° W
Central Standard Time (CST)	90° W
Mountain Standard Time (MST)	105° W
Pacific Standard Time (PST)	120° W
Yukon Standard Time (YST)	135° W
Alaskan Standard Time (AST)	150° W
Bering Standard Time (BST)	165° W

2-602.3. War Time.--For the duration of the war, the clocks in the United States have been advanced one hour; thus, "War Time" is the standard time of the time zone immediately to the east, and is based upon the following meridian classification:

War Time Zone	Meridian
Eastern War Time (EWT)	60° W
Central War Time (CWT)	75° W
Mountain War Time (MWT)	90° W
Pacific War Time (PWT)	105° W
Yukon War Time (YWT)	120° W
Alaskan War Time (AWT)	135° W
Bering War Time (BWT)	150° W

2-602.4. Converting to G.C.T.--The time based upon any of the standard time meridians listed above can be converted to G.C.T. by adding one hour for each 15° of longitude west from Greenwich. A conversion table follows:

Meridian of Time	To Convert to G.C.T., Add
60° W	4 hours
75° W	5 hours
90° W	6 hours
105° W	7 hours
120° W	8 hours
135° W	9 hours
150° W	10 hours
165° W	11 hours

2-603.0. Time Entries.--All time entries on Form WBAN-10A are made in the clock time kept at the observing station.

2-603.1. Time (Meridian of and GCT).--The standard meridian at which standard time is identical to the clock time kept at the observing station will be determined in accordance with the definitions and tables given, and entered in the space provided. The number of hours by which clock time differs from G.C.T. will be entered in the space provided, and either "add" or "subtract" lined out, as appropriate. (West longitude time add to get G.C.T.; east longitude, subtract.)

2-603.2. Time (Column (2)).--All entries will be made in local clock time. The first entry in the column is the clock time corresponding to the first observation made at or after 0000 local standard time.

2-603.3. Summary of day.--Midnight to midnight refers to the interval of time, 0000 to 2359, local standard time, and only columnar data for that interval are included on the same sheet, regardless of the clock time entries in Column (2). Time of sunrise and sunset will be entered in clock time, as are all other time entries.

2-603.4. Six-hourly observations.--The time of observations will be entered in clock time corresponding to the prescribed G.C.T. time of observation. The midnight observation will be made and recorded at midnight local standard time.

2-604.0.--Data will be entered in the various columns in accordance with instructions in the following paragraphs.

2-604.01. Type (Column (1)).--The type of report will be indicated by entering "R" for record observation. At stations taking them, "S" will be used for special observation, followed by the number of the special observation for the day; "L" for local extra observation; and a check mark (✓) for check observation. If there is coincidence in types of observations, precedence will be given to the highest

Standard Time Zone	Meridian
Eastern Standard Time (EST)	75° W
Central Standard Time (CST)	90° W
Mountain Standard Time (MST)	105° W
Pacific Standard Time (PST)	120° W
Yukon Standard Time (YST)	135° W
Alaskan Standard Time (AST)	150° W
Bering Standard Time (BST)	165° W

2-602.4. Converting to G.C.T.--The time based upon any of the standard time meridians listed above can be converted to G.C.T. by adding one hour for each 15° of longitude west from Greenwich. A conversion table follows:

Meridian of Time	To Convert to G.C.T., Add
60° W	4 hours
75° W	5 hours
90° W	6 hours
105° W	7 hours
120° W	8 hours
135° W	9 hours
150° W	10 hours
165° W	11 hours

2-603.0. Time Entries.--All time entries on Form WBAN-10A are made in the clock time kept at the observing station.

2-603.1. Time (Meridian of and GCT).--The standard meridian at which standard time is identical to the clock time kept at the observing station will be determined in accordance with the definitions and tables given, and entered in the space provided. The number of hours by which clock time differs from G.C.T. will be entered in the space provided, and either "add" or "subtract" lined out, as appropriate. (West longitude time add to get G.C.T.; east longitude, subtract.)

2-603.2. Time (Column (2)).--All entries will be made in local clock time. The first entry in the column is the clock time corresponding to the first observation made at or after 0000 local standard time.

2-603.3. Summary of day.--Midnight to midnight refers to the interval of time, 0000 to 2359, local standard time, and only columnar data for that interval are included on the same sheet, regardless of the clock time entries in Column (2). Time of sunrise and sunset will be entered in clock time, as are all other time entries.

2-603.4. Six-hourly observations.--The time of observations will be entered in clock time corresponding to the prescribed G.C.T. time of observation. The midnight observation will be made and recorded at midnight local standard time.

2-604.0. Data will be entered in the various columns in accordance with instructions in the following paragraphs.

▶ 2-604.01. Type (Column (1)).--The type of report will be indicated by entering "R" for record observation, "S" followed by the serial number for special observation, "RS" with the serial number for record-special, "L" for local extra observation, and "✓" for check observation. If a check observation requires local extra procedure, "L" will be entered.

measured at the observation will be placed on the line used for the observation and *underscored twice.* Amounts of precipitation measured at previous 6-hourly observations may be brought forward, when necessary, from one sheet to another for convenience in addition, using as many lines downward as needed. The amounts brought forward and the total will then be set off in brackets. (See fig. 5, p. 84.) Additional instructions for entry of precipitation data and instructions for coding, etc., are contained in appendix II to this circular.

2-613. Entry of Initials of Observer.—The initials of the observer taking the observation shall be entered in each case in the column provided at the right of the form in his (or her) own handwriting.

2-614. Entries Required Regarding Care of Instruments.—Instruments shall be properly cared for as instructed in this circular, and the dates when this work is done shall be entered in the spaces provided at the bottom of the form. *These dates must be carried forward to each new sheet* in order that any sheet will show the dates when instruments were last cleaned, oiled, checked, etc.

2-615. Corrections to Entries.—All personnel taking weather observations and entering these on WB Form 1130 for transmission or broadcast by Civil Aeronautics Administration personnel are instructed to make certain that original observation are entered on WB Form 1130, to which a specific time has been assigned, and which are given to the Civil Aeronautics Administration personnel for use in a specific transmission or broadcast, are not changed subsequent to giving them to the operator. If a change must be reported, due to error in the original entries, then a complete new observation containing the revised data, with the time of entry, shall be entered on WB Form 1130 below the original observation. It will not, of course, be necessary to take a complete new observation but only to enter applicable data from the original observation, along with the revised data. Any such changes shall be given immediately to the Civil Aeronautics Administration as, in many cases, it may be that the transmission or broadcast in which the original observation is included may not be finished and the operator will be able to include the revised data as a correction. Such observations will be indicated by entry of the letters "CQN" in the second column of WB Form 1130, signifying "correction." If the revision is made, due to a change in weather conditions since the original observation was taken and such change is of such nature as to require a "special" observation, then instructions regarding the rendering of "special" observations will apply. The same would be true as concerns "check" observations and "local extra" observations.

2-616. Disposition of WB Form 1130.—Disposition of WB Form 1130 prepared at airway substations will vary with respect to whether or not the station concerned is manned by paid Weather Bureau observers. The disposition of forms rendered by Army and Navy stations shall be arranged in each case by the Central Office, upon recommendation of the general supervising station. The following contains specific instructions covering all other classes of stations:

(*a*) *Stations manned by Civil Aeronautics Administration personnel or Weather Bureau airway observers serving without pay.*—Stations falling in this class shall, as a rule, prepare an original and one carbon copy of WB Form 1130, and shall forward the original copy to the general supervising station for filing within 5 days after the end of each calendar month, unless otherwise instructed by that station. In cases, however, where a Weather Bureau city office in the same city exercises direct supervision of a substation of this class, a second carbon copy shall be prepared and forwarded to the city office within 5 days after the end of each calendar month. One carbon copy will be retained in the station files for 1 year, after which it will be disposed of by the airway inspector.

(*b*) *Stations manned by paid Weather Bureau observers.*—Three copies of WB Form 1130 shall be prepared, one original and two carbons. The original shall be forwarded to the general supervising station and one carbon copy to the direct supervising station within 5 days after the end of each calendar month. If the general and direct supervision are exercised by one station, only the original and one carbon will be made, and the original will be forwarded to that station within 5 days after the end of the calendar month. One carbon copy will be retained in the station files for one year, after which it will be disposed of by the airway inspector.

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

2-612. "REMARKS AND SUPPLEMENTAL CODED DATA."—Remarks will be entered according to instructions contained in part IV of this section. At stations adding special 3-hourly data to observations, these data will be entered in the prescribed form, following any remarks and separated from them by a slant (/) and one space. The same procedure will also be used at stations which add meteorological data to observations at the 6-hourly periods.

2-612a. "PRECIPITATION."—Entry will be made in Column 18 only by stations not recording the data on WB Form 1083 (unless otherwise instructed) and then only at the observations taken at 1:30 and 7:30 a. m. and p. m. E. S. T. The amount of precipitation measured at the observation will be placed on the line used for the observation and underscored twice. Amounts of precipitation measured at previous 6-hourly observations may be brought forward, when necessary, from one sheet to another for convenience in addition, using as many lines downward as needed. The amounts brought forward and the total will then be set off in brackets. Additional instructions for entry of precipitation data and instructions for coding, etc., are contained in appendix II to this circular.

2-613. "STATION PRESSURE," "DRY BULB," "WET BULB."—Station pressure will be entered to hundredths of an inch, e.g., "29.81," in Column 25. Corrected dry- and wet-bulb temperatures will be entered to tenths of a degree, e.g., "62.1," "54.0," in columns 26 and 27.

2-614. "OBSERVER'S INITIALS."—The observer will initial each observation in Column 30.

2-615. CORRECTION TO ENTRIES.—No erasures or obliterations will be permitted on WB Form 1130B. If an error is discovered before an observation is filed, a line will be drawn through the complete report, and the correct complete observation will be entered on the next line. If the error is discovered after the observation has been filed, the original entries will not be changed or deleted in any manner, but a corrected report will be filed immediately. Such an observation will be indicated by entry of the letters "CQN," signifying correction, in the first column of WB Form 1130B and the time entry will be that of the observation for which the correction was made. If the error is discovered too late to transmit a correct report by teletype, WB Form 3069 will be filled out and routed according to current instructions; if WB Form 3069 is received from another station, the observer responsible for the error will check the form to see that the correct data are entered, sign the form, and give it to the Official in Charge for routing. WB Form 1130B will then be corrected by drawing a red line through the erroneous data and entering the correct data in red.

2-616. DISPOSITION OF WB FORM 1130B.—Instructions for disposition of WB Form 1130B will be issued by the several Regional Offices.

~~classification, i.e., record, special, local, check; e.g., if a check observation requires local extra procedure, "L" will be entered. Record observations will not be designated as specials.~~

2-604.02. Time entries (Column (2)).--These entries will be made as defined above on the basis of the 24-hour clock to the nearest minute, clock time. Four figures will always be entered; the first two representing the hour, and the last two, the minute. For example, 0000 indicates the beginning of the day; 0235 indicates 2:35 a.m.; 1346 indicates 1:46 p.m. Entries for more than one "time zone" or "meridian" will not be made on the same sheet. At mobile stations and on shipboard a new sheet will be started whenever a time-zone boundary is crossed.

2-604.03. Classification (Column (3)).--No entry will be made in this column.

2-604.04. Ceiling (Column (4)).--The ceiling will be entered in figures in this column, preceded by the appropriate ceiling classification letter or symbol taken from the table below. The ceiling height will be entered to hundreds of feet from the surface to 5,000 feet; to the nearest 500 feet from 5,000 feet to 10,000 feet; and, when authorized, to the nearest 1,000 feet above 10,000 feet. For example, 3,000 feet would be entered as "30," 1,500 feet as "15," 300 feet as "3," etc. No entry will be made when the ceiling is unlimited. When the ceiling is below 2,000 feet and is varying or changing rapidly, a "V" will be entered immediately following the ceiling value, and the range of variability will be entered in "Remarks," (Column (15)). When the ceiling is variable but 2,000 feet or higher, the range of variability will be explained in "Remarks."

Ceiling Classification Table

M = Measured ceiling
E = Estimated ceiling
W = Indefinite ceiling
B = Balloon ceiling
P = Precipitation ceiling
A = Ceiling reported from aircraft
+ = Ceiling higher than last observed height of balloon

2-604.05. Sky (Column (5)).--This entry will be made at all stations by means of standard teletype symbols, or combinations of them, given in the table below. An entry will always be made in this column. A plus sign (+) will be used preceding a sky symbol to indicate dark clouds, a minus sign (-) to indicate thin clouds, and a slant (/) following the symbol to indicate high clouds. The height of scattered clouds will be entered to hundreds of feet using the same intervals as those for ceiling height, and will precede the "scattered" (⦶) symbol, thus: 20⦶

Symbols for Recording "Sky"

O Clear. No clouds or less than one-tenth of cloud cover is present.

⦶ Scattered. One-tenth to not more than five-tenths of sky is covered by clouds.

⦷ Broken. More than five-tenths to not more than nine-tenths of sky is covered by clouds.

⊕ Overcast. More than nine-tenths of sky is covered by clouds.

X Obscured. Precipitation or obstructions to vision prevent observation of the sky.

2-604.06. Visibility (Column (6)).--Entries in this column will be in miles and fractions of miles, in accordance with the table below. If the visibility is varying rapidly and is less than two miles, the symbol "V" will be entered immediately after the visibility value, and the range of variability will be entered in remarks; if it is two miles or more, explanatory and qualifying terms will be entered in remarks.

WB Form 1130
U. S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

AIRWAY WEATHER REPORTS

Enter data in columns indicated by dotted and solid lines.

Station Newark, N. J. (City) (State)

Month and year June, 1941

Day of month	Type	Time E.S.T.	Classification	Ceiling (feet)	Sky	Visibility (miles)	Weather and/or obstructions to vision	Sea-level pressure (millibars)	Temperature and dew point	Wind direction, velocity, character, shifts	Altimeter setting (inches)	Remarks and 6- or 3-hourly coded data	Precipitation	Station pressure (inches)	Thermometers Dry	Thermometers Wet	Observer's initials
20	R	0330	C	16	⦶7⦶	7		132	74/72	↑12	991			29.89	73.5	72.2	J.C.H.
"	✓	0348	"	"	"	"			"	"	"			"	"	"	W.H.B.
"	S	0400	N	7	⊕⦶	5	F-	129	74/72	↑8	990	16⊕		29.88	73.6	72.2	W.H.B.
"	✓	0420	"	"	"	"	"		"	"	"	"		"	"	"	W.H.B.
"	SR	(0422) 0430	N	5V	⊕	1½V	F-	129	73/72	↑↖8	990	605 50023		29.88	73.1	72.0	W.H.B.
"	S	0440	X	4	⊕	1½V	R-F-	129	73/72	↑↖7	990			29.88	73.1	72.0	W.H.B.
"	✓	0448	"	"	"	"	"		"	"	"			"	"	"	W.H.B.
"	L	0455	"	"	"	1½V	"										W.H.B.
"	S	0509	N	8	⊕	1½	TR-F-	129	73/72	↑↖9	990	T SW OCNL THDR		29.88	73.1	72.0	W.H.B.
"	✓	0520	"	"	"	"	"		"	"	"	" " "		"	"	"	W.H.B.
"	R	0530	N	6	⊕⦶	1½	TR-F-	129	73/72	↑↖7	990	T SW OCNL THDR		29.88	72.9	72.1	W.H.B.
"	✓	0548	"	"	"	"	"		"	"	"	" " "		"	"	"	W.H.B.
"	S	0602	N	E6	⊕⦶	2V	R-F-	132	73/72	↑↖9	991	E10⊕		29.89	72.9	72.1	W.H.B.
"	✓	0620	"	"	"	"	"		"	↑↖5	992	"		29.90	"	"	W.H.B.
"	SR	(0622) 0630	N	8	⊕⦶	4	R-F-	135	73/70	↑↖8	992	E10⊕		29.90	72.9	70.8	J.M.
"	✓	0648	"	E7	"	3	"		"	"	991	VSBY 2 N		29.89	"	"	J.M.
"	S	0657	C	10	⊕5⦶	5	R-F-	126	73/71	↑↖17	989	R INTMT		29.87	73.1	71.6	J.M.
"	✓	0720	"	"	"	"	"		"	↑↖14	"	"		"	"	"	J.M.
"	R	0730	C	10	⊕5⦶	5	R-F-	129	73/71	↑↖18	990	R INTMT/ 50237 62043	0.30	29.88	73.1	71.7	J.M.
"	✓	0748	"	"	"	"	"		"	"	"	"	0.01	"	"	"	J.M.
"	S✓	0820	N	E8	⊕5⦶	5	R-F-	132	73/71	↑↖17	991		0.02	29.89	73.1	71.7	J.M.
"	S	0824	X	4V	⊕⦶	4	R-F-	132	73/71	↖10	991	E8⊕	0.04	29.89	73.1	71.7	J.M.
"	R	0830	X	4V	⊕⦶	4	R-F-	132	73/72	↖8	991	E8⊕	0.37	29.89	72.9	71.8	W.G.R.
"	S	0843	N	6	⊕⦶	4	R-F-	132	73/72	↖9	991	E9⊕		29.89	72.9	71.8	W.G.R.

Anemometer oiled 6/16/41 Cleaned 6/16/41 Ceiling projector cleaned and checked 6/15/41 Wind vane checked 4/10/41 Psychrometer muslin changed 6/18/41

Note.—See Circular N, 1941, for instructions for preparing this form. Begin new form with first observation in any month; at other times a date will, if necessary, be carried forward from one sheet to the next. Ditto marks may be used on "Local Extra" and "Check" observations only.

FIGURE 5.—Illustrating the entry of observations and other data on the retained copy of Form 1130 at a station equipped with teletype.

WB Form 1130
U. S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

AIRWAY WEATHER REPORTS

Enter data in columns indicated by dotted and solid lines

Station Chicago, Ill. (City) (State)

Month and year June, 1943

Day of month	Type	Time C.W.T.	Classification	Ceiling (feet)	Sky	Visibility (miles)	Weather and/or obstructions to vision	Sea-level pressure (millibars)	Temperature and dew point	Wind direction, velocity, character, shifts	Altimeter setting (inches)	Remarks and 6- or 3-hourly coded data	Precipitation	Station pressure (inches)	Thermometers Dry	Thermometers Wet	Observer's initials
2	S	0400	N	M8	⊕	8		973	62/58	↑↖ 8	945	4F SE		28.80			RCH
"								(0406C	ABC14	PIPEPS	CIG 11)						RCH
"	L	0409	N	M8	⊕	7						4F SE					RCH
"	R	0430	N	M9	⊕	7		966	62/59	↑ 9	943	3F SE TO SW / 906 5004		28.78	62.7	60.1	RCH
"	S	0500	C	M12	⊕◐	5	F-	966	62/59	↑↖ 11	942	E30⊕ 2F SE TO SW		28.77			RCH
"	SR	0530	C	M12	⊕◐	5	RW-F-	959	60/57	↑ 12	940	E30⊕ 2F SE TO SW		28.75	60.1	58.2	RCH
"	✓	0600	"	"	"	4	"		"	"	939	" " "		28.74			JCH
"	S	0617	N	Z8V	⊕	2V	RW-F-	959	60/57	↑ 13	939	CIG VRBL 6 TO 11 VSBY VRBL 1 TO 4		28.74			JCH
"	SR	0630	X	P4V	⊕	3/4	RW+	949	59/58	↑ 18-	937	CIG VRBL 2 TO 6 VSBY N3/4E3/4S3/4W1¼		28.72	58.8	58.2	JCH
"	S	0637	N	Z7V	⊕◐	1¼	RW	949	59/58	→25+ ↑0634C	937	E30⊕ CIG VRBL 5 TO 8		28.72			JCH
"	✓	0700	N	Z9V	"	"	"		"	↘ 23+	939	E33⊕ ◐V⊕ CIG VRBL 6 TO 11		28.74			JCH
"	SR	0730	X	Z6	⊕	3/4V	RW	970	54/54	↘ 18	943	VSBY VRBL ½ TO 1½ / 40061 9007 54		28.78	54.2	53.9	JCH
"					53490	81428	28428	97054	00400	54754	70607	80361 08709					JCH
"	L	0745	X	Z6	⊕	5/8	RW										JCH
"	S	0754	X	P3	⊕	3/8	RW+	970	54/54	↘ 15	946	VSBY NE3/4SE1/8 SW3/8 NW3/8		28.81			JCH
"	✓	0800	"	"	"	"	"		"	"	"	"					CE
"	L	0815	"	P4	"	1/2	"										CE
"	SR	0830	N	P8V	⊕	1¾	RW-	997	53/51	↓↘ 14	950	CIG VRBL 6 TO 12 VSBY N½E3/4S1½W1¾		28.85	51.8	51.4	CE
"								(0839C	XY241	PIPEPS	CIG 14)						CE
"	S	0841	C	A14	⊕	3	RW-	997	52/51	↓↘ 12	951	BINOVC		28.86			CE
"	S	0900	C	E35	◐15◐	6	RW-	997	52/51	↘ 10	952	PCPN INTMT CLRG W TO N		28.87			CE
"	SR	0930	C		35◐			014	49/46	↓↘ 10	955	ALL CLDS IN SE QUAD		28.90	48.7	47.4	CE
"	✓	1000	C		○					"	957			28.92			CE
"	R	1030	C		○			027	49/46	↓↘ 10	959	327		28.94	48.1	46.9	CE

Anemometer oiled 5/27/43 Cleaned 5/27/43 Ceiling projector cleaned and checked 5/31/41 Wind vane checked 5/27/43 Psychrometer muslin changed 6/1/43

Note.—See Circular N, 1941, for instructions for preparing this form. Begin new form with first observation in any month; at other times a date will, if necessary, be carried forward from one sheet to the next. Ditto marks may be used on "Local Extra" and "Check" observations only.

FIGURE 5.—Illustrating the entry of observations and other data on Form 1130 at a station equipped with teletype.

18-4653

WB Form 1130
U. S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

AIRWAY WEATHER REPORTS

Enter data in columns indicated by dotted and solid lines

Station Chicago, Ill. (City) (State)

Month and year Dec. 1943

Day of month	Type	Time CW	Classification	Ceiling (feet)	Sky	Visibility (miles)	Weather and/or obstructions to vision	Sea-level pressure (millibars)	Temperature and dew point	Wind direction, velocity, character, shifts	Altimeter setting (inches)	Remarks and 6- or 3-hourly coded data	Precipitation	Station pressure (inches)	Thermometers Dry	Thermometers Wet	Observer's initials
15	S	0400	N	M8	⊕	8		973	62/58	↑↖ 8	945	4F SE		28.80			RCH
"								(0407C ABC 14 PIREPS CIG 11)									RCH
"	L	0409	N	M8	⊕	7						4F SE					RCH
"	R	0430	N	M9	⊕	7		966	62/59	↑ 9	943	3F SE to SW / 906 5004		28.78	62.4	60.1	RCH
"	S	0500	C	M12	⊕⦶	5	F-	966	62/59	↑↖ 11	942	E30⊕ 2F SE to SW		28.77			RCH
"	SR	0530	C	M12	⊕⦶	5	RW-F-	959	60/57	↑ 12	940	E30⊕ 2F SE to WSW		28.75	60.1	58.2	RCH
"	✓	0600	"	"	"	4	"	"	"	"	939	" "		28.74			RAP
"	S	0617	N	W8V	⊕	2V	RW-F-	959	60/57	↑ 13	939	CIG VRBL 6 to 11 VSBY VRBL 1 to 4		28.74			RAP
"	SR	0630	X	P4V	⊕	3/4	RW+	949	59/58	↑ 18-	937	CIG VRBL 2 to 5 VSBY N3/8 E3/4 S3/4 W1 1/4		28.72	58.8	58.2	RAP
"	S	0637	N	W7V	⊕⦶	1 1/4	RW	949	59/58	→ 25+ 0634C	937	CIG VRBL 5 to 8 W30⊕		28.72			RAP
"	✓	0700	N	W9V	"	"	"	"	"	↘ 23+	939	CIG VRBL 6 to 11 W30⊕ ⦶V⊕		28.74			RAP
					53490	81428	28428	97054	00400	54754	70607	80361 08709					RAP
"	SR	0730	X	W6	⊕	3/4V	RW	970	54/54	↘ 18	943	VSBY VRBL 1/2 to 1 3/4 / 40061 9007 54		28.78	54.2	53.9	RAP
"	L	0745	X	"	"	5/8	"					"					RAP
"	S	0754	X	P3	⊕	3/8	RW+	970	54/54	↘ 15	946	VSBY NE 3/4 SE 1/8 SW 3/8 NW 3/8		28.81			RAP
"	✓	0800	"	"	"	"	"	"	"	"	"	"					Ⓔ
"	S	0815	X	P6	⊕	3/4	RW+	970	54/54	↘ 15	948			28.83			Ⓔ
"	SR	0830	N	P8V	⊕	1 3/4	RW-	997	52/51	↓↘ 14	950	CIG VRBL 6 to 12 VSBY N2E 3/4 S1 1/2 W1 3/4		28.85	51.8	51.4	Ⓔ
"								(0839C XYZ 41 PIREPS CIG 14)									Ⓔ
"	S	0841	C	A14	⊕	3	RW-	997	52/51	↓↘ 12	951	BINOVC		28.86			Ⓔ
"	S	0900	C	E35	⦶15⦶	6	RW-	997	52/51	↘ 10	952	CLRG W to N		28.87			Ⓔ
"	SR	0930	C		35⦶			014	49/46	↓↘ 10	955	ALL CLDS IN SE QUAD		28.90	48.7	47.4	Ⓔ
"	✓	1000	C		O					"	957			28.92			Ⓔ
"	R	1030	C		O			027	48/46	↓↘ 10	959	327		28.94	48.1	46.9	Ⓔ

Anemometer oiled 12/5/43 Cleaned 12/5/43 Ceiling projector cleaned and checked 12/13/43 Wind vane checked 12/5/43 Psychrometer muslin changed 12/10/43

Note.—See Circular N, 1941, for instructions for preparing this form. Begin new form with first observation in any month; at other times a date will, if necessary, be carried forward from one sheet to the next. Ditto marks may be used on "Local Extra" and "Check" observations only.

FIGURE 5.—Illustrating the entry of observations and other data on Form 1130 at a station equipped with teletype.

WB Form 1180
U. S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

AIRWAY WEATHER REPORTS

Enter data in columns indicated by dotted and solid lines

WEATHER BUREAU AIRPORT STATION

Station CHICAGO, ILL. (City) (State)

Month and year Oct 1944

Day of month	Type	Time G.M.T.	Classification	Ceiling (feet)	Sky	Visibility (miles)	Weather and/or obstructions to vision	Sea-level pressure (millibars)	Temperature and dew point	Wind direction, velocity, character, shifts	Altimeter setting (inches)	Remarks and 6- or 3-hourly coded data	Precipitation	Station pressure (inches)	Thermometers Dry	Thermometers Wet	Observer's initials
2	S	0400	C	W11	⊕	8		973	62/58	↑↖8	945	SE 4F-		28.80			Ⓔ
"								(0407C ABC 14 PIREPS CIG 8)									Ⓔ
"	S	0409	N	A8	⊕	7		973	62/58	↑ 9	944	SE 4F-		28.79			Ⓔ
"	R	0428	N	M9	⊕	7		966	62/59	↑ 9	943	SE TO SW 3F-/906 5004		28.78	62.4	60.1	Ⓔ
"	S	0459	C	M12	⊕ ⦶	5	F-	966	62/59	↑↖11	942	E 30⊕ SE TO SW 2F-		28.77			Ⓔ
"	SR	0527	C	M10	⊕ ⦶	5	RW-F-	959	60/57	↑ 12	940	E 30⊕ SE TO WSW 2F-		28.75	60.1	58.2	Ⓔ
"	✓	0601	"	"	"	4	"		"	↑↖13	939	" " "		28.74			Ⓔ
"	S	0617	N	W8V	⊕	2V	RW-F-	959	60/57	↑ 13	939	CIG VRBL 6 TO 11 VSBY VRBL 1 TO 4		28.74			RCH
"	SR	0628	X	P4V	⊕	3/4	RW+	949	59/58	↑ 18-	937	CIG VRBL 2 TO 5 VSBY N 3/8 E 3/4 S 3/4 W 1 1/4		28.72	58.8	58.2	RCH
"	S	0637	N	W7V	⊕ ⦶	1 1/4	RW	949	59/58	→25+ 0634C	937	CIG VRBL 5 TO 8 W30⊕		28.72			RCH
"	✓	0702	N	W9V	⊕ ⦶	"	"		"	↘23+	939	CIG VRBL 6 TO 11 W30⊕ ⦶V⊕		28.74			RCH
"					53490 81428 28428 97054 00400 54754 70607 80361 08709												RCH
"	SR	0726	X	W6	⊕	3/4V	RW	970	54/54	↘ 18	943	VSBY VRBL 1/2 TO 1 3/4 /40061 9007 54		28.78	54.2	53.9	RCH
"	L	0741	X	W6	"	5/8	"					"					NYD
"	S	0754	X	P3	⊕	3/8	RW+	970	54/54	↘ 15	946	VSBY NE 3/4 SE 1/8 SW 3/8 NW 3/8		28.81			NYD
"	✓	0800	"	"	"	"	"		"	↘ 16	"	"		"			NYD
"	S	0815	X	P6	⊕	3/4	RW+	970	54/54	↘ 15	948			28.83			NYD
"	SR	0828	N	P8V	⊕	1 3/4	RW-	997	52/51	↓↖14	950	CIG VRBL 6 TO 12 VSBY N2 E3/4 S 1 1/2 W 1 3/4		28.85	51.8	51.4	NYD
"	S	0848	C	B14	⊕	3	RW-	997	52/51	↓↖12	951	BINOVC W		28.86			NYD
"	✓	0901	C	E14	⊕ ⦶	5	RW-	997	52/51	↘ 10	952	E 35⊕ CLRG W TO N		28.87			NYD
"	R	0928	C	B15	⦶ ⦶	5	RW-	014	49/46	↓↖10	955	E 35⦶		28.90	48.7	47.4	NYD
"	S	1000	C		⦶15⦶	9		014	47/46	↘ 11	957	35⦶ ALL CLDS IN SE QUAD		28.92			NYD
"	R	1028	C		○			027	48/46	↓↖10	959	327		28.94	48.1	46.9	NYD
"	✓	1059	C		⦶				"	↓ 10	960			28.95			NYD

Anemometer oiled 9/25/44 Cleaned 9/25/44 Ceiling projector cleaned and checked 9/30/44 Wind vane checked 9/25/44 Psychrometer muslin changed 10/1/44

Note.—See Circular N, 1941, for instructions for preparing this form. Begin new form with first observation in any month; at other times a date will, if necessary, be carried forward from one sheet to the next. Ditto marks may be used on "Local Extra" and "Check" observations only.

FIGURE 5.—Illustrating the entry of observations and other data on Form 1180

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

84-3R (Eff. 10/1/44)

WB Form 1130B

Time entries on this form are 60 th meridian time

To convert to G. C. T. { add / subtract } 4 hours

Height of Barometer 10.72 Ft. (MSL)

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

SURFACE WEATHER OBSERVATIONS

(LAND STATION)
WBAN — 10 B

Security Classification _____

Station Tampa, FLORIDA

Lat. 27°55'N Long. 82°27'W

Type (1)	Time (2)	Classification (3)	Ceiling (Hundreds of feet) (4)	Sky (5)	Visibility (Miles) (6)	Weather and/or obstructions to vision (7)	Sea-level pressure (Mbs.) (8)	Temp. (°F) (9)	Dew pt. (°F) (10)	Wind direction (11)	Wind velocity (M.P.H.) (12)	Wind character and shifts (13)	Altimeter (Inches) (14)	Remarks and supplemental coded data (For transmission) (15)	Pres. tend. (16)	Net 3-hr. change (Inches) (17)	Precip. (Inches) (18)	Clouds Low amt., type, direction (19)	Clouds Low height (Hdds. or Ft.) (20)	Clouds Middle amt., type, direction (21)	Clouds Middle height (Hdds. or Ft.) (22)	Clouds High amt., type, direction (23)	Clouds High height (Hdds. or Ft.) (24)	Station pressure (Inches) (25)	Dry bulb (°F) (26)	Wet bulb (°F) (27)	Water temp. (°F) (28)	(29)	Obs. init. (30)
3/5/45 0000 SR	0528	N	PO		0	R+RQ+	709	M	M	↙	60	+	867	GSTS TO 75MPH BRM FLG RPDLY/															ZFA
														891 5001															ZFA
S	0544													ALSTG 854 BRM FLG RPDLY															ZFA
L✓	0600	N	PO		0	R+RQ+				↙	48	+	854	GSTS TO 60 MPH										28.54					ZFA
S	0615	N	P1	⊕	1	RRQ+								VSBY NE ¼ SE ¾ SW1 NW1½										28.54					ZFA
SR	0627	N	W2V	⊕	2	R-RQ+	672	74	74	↙	44	+	856	CIG VRBL 2 TO 4 GSTS TO 60MPH															ZFA
S	0636									↙	8													28.56	74.4	74.3			ZFA
3/5/45 S	0646	N	W4	⊕	3	R-								CNTR OF HURCN OVR STN VSBY															ZFA
														VRBL 2 TO 4															ZFA
L✓	0700	N	W4	⊕	3	R-				↙	6		854	CNTR OF HURCN OVR STN										28.54					ZFA
S	0715									↘	8	↙	0713	E-/862/BRM RSG RPDLY										28.62					ZFA
SR	0724	N	E3	⊕	2	R-	698	74	74	↘	9		864	CNTR OF HURCN PASSED STN										28.64	74.0	73.8			ZFA
														BRM RSG RPDLY															ZFA
S	0739									↘	36	+	872	BRM RSG RPDLY										28.72					ZFA
L	0754	N	B3	⊕	2	R-																							ZFA
S	0759													ALSTG 880 BRM RSG RPDLY										28.80					ZFA
S	0813													ALSTG 884 BRM RSG RPDLY										28.84					ZFA
SR	0828	N	B3	⊕	3	R-	783	75	72	↓↘	36	+	889	VSBY N2 BRM RSG RPDLY/										28.89	74.8	73.0			ZFA
														THREE 33710 5006 74															ZFA
SR	1125	N	B8	⊕	5	R-	895	72	67	↘	28	+	922	PCPN INTMT RAFRZ 207 MSL RH										29.22	72.3	69.0			NC4
														50/358 5006															NC4
S	1140													ALSTG 926										29.26					NC4
✓	1201	N	B9	⊕	7					↘	28		927	R-INTMT										29.27					NC4
S	1206													PIREPS TOVC 35 MSL HIR CLDS															NC4
														ABV															NC4
SR	1226	N	B7	⊕	5	R-	929	72	67	↘	32	+	932	BRM RSG RPDLY PIREPS										29.32	72.3	69.0			NC4
														TURBC 20E TM 50 MSL															NC4
R	1428	N	A6	⊕+⊙	6	R-	990	71	68	→↘	21	−	949	PIREPS TOP LWR LYR 15 MSL										29.49	71.2	69.1			NC4
														BASE OVC 20 MSL/34617 6206 69															NC4
✓	1459	N	E6	⊕⊙	7	R-				→	19	−	949	E20⊕ BINOVC ⊙V⊙										29.49					NC4
SR	1527	N	E8	⊙			996	71	68	→	14	/	951											29.51	76.0	69.0			NC4
R	2328	C	M24	⊙6⊙			041	68	65	→	8		965	CIG VRBL 22 TO 28										29.66	68.4	66.3			KK.

Month October Day 19 Year 1944

FIGURE 5.--Illustrating the entry of observations and other data on WB Form 1130B

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE

84-4R (Eff. 2/15/45)

U. S. GOVERNMENT PRINTING OFFICE 16—61518-2

WB Form 1139A

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE
UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

84-5R
Eff. 7-1-45

Security Classification _____

Station Sample City, Tenn.

Lat. 35° 58' Long. 85° 47'

Time entries on this form are 75 th meridian time

To convert to G. C. T. { add / ~~subtract~~ } 5 hours

Height of Barometer 1070 Ft. (MSL)

SURFACE WEATHER OBSERVATIONS

(LAND STATION)

WBAN—10 A

TYPE (1)	TIME (2)	CLASSIFICATION (3)	CEILING (Hundreds of feet) (4)	SKY (5)	VISIBILITY (Miles) (6)	WEATHER AND/OR OBSTRUCTIONS TO VISION (7)	SEA-LEVEL PRESSURE (Mbs.) (8)	TEMP. (°F) (9)	DEW PT. (°F) (10)	WIND DIRECTION (11)	WIND VELOCITY (M.P.H.) (12)	WIND CHARACTER AND SHIFTS (13)	ALTIMETER (Inches) (14)	REMARKS AND SUPPLEMENTAL CODED DATA (For Transmission) (15)	PRES. TEND. (16)	NET 3-HR. CHANGE (Inches) (17)	PRECIP. (Inches) (18)	CLOUDS LOW AMT., TYPE, DIRECTION (19)	CLOUDS LOW HEIGHT (Hnds. of Ft.) (20)	CLOUDS MIDDLE AMT., TYPE, DIRECTION (21)	CLOUDS MIDDLE HEIGHT (Hnds. of Ft.) (22)	CLOUDS HIGH AMT., TYPE, DIRECTION (23)	CLOUDS HIGH HEIGHT (Hnds. of Ft.) (24)	STATION PRESSURE (Inches) (25)	DRY BULB (°F) (26)	WET BULB (°F) (27)	WATER TEMP. (°F) (28)	Total Cloudiness (29)	OBS. INIT. (30)
✓	0100			-⦶/	8					↗	7		/019											29.040					akO.
R	0128			⦶/40⦶	8		213	70	52	↗	10		/019	/LTNG IN CLDS SW/ 506 3035/2 89	5	035	0.00	3Cb →	E40	0		3Ci ↗	E230	29.043	70.3	59.4		4	akO.
S1	0140													PIREPS MDT TURBC 15 E NA 65 MSL															akO.
														0135C DC3															akO.
✓	0158		E80	⦶40⦶	8					→↗	6		/018	/FQT LTNG CLD TO GND SW										29.030					akO.
S2	0212		M70	⦶⦶	7						c			/E80⦶ FQT LTNG IN HVY CU S TO WSW															akO.
R	0228		M40	⊕	7	T	224	65	52	→	13		/021	/T W APCHG STN INTSTY INCRG FQT			0.00							29.060	65.4	57.5		10	akO.
														LTNG W CLD TO GND PIREPS HPITS															akO.
														10 S XM 55 MSL 0221C B17															akO.
S3	0235		M40	⊕	5	TRW-				→	24	+		/T OVHD MVG E LTNG IN CLDS ALL QUADS															akO
S4	0239									→↘	51	+	/019	/BRM FLG RPDLY										29.040					akO.
S5	0244		P2	X	1/4	T+RW+A+				→↘	44	+		/T OVHD MVG E FQT LTNG IN CLDS ALL															akO.
														QUADS HLSTO 3/8 INCH															akO.
S6	0252		P3	X	3/4V	TRW				↘	36	+	/027	/T OVHD MVG E LTNG IN CLDS OVHD AND										29.120					akO.
														E VSBY VRBL 1/2 TO 1 BRM RSG															akO.
														RPDLY LWST PRES 217 AT 0247C															akO.
S7	0258		P8	X	1V	TRW-				↘	20	+	/022	/T DSIPTG VSBY VRBL 1/2 TO 2 BRM										29.070					akO.
														UNSTDY															akO.
S8	0309		M10	⊕	2	RW--				↘	8			/VSBY NE1SE11/2SW2NW2															akO.
R	0328		M12	⊕⦶	3	RW-	224	70	69	↘	6		/021	/E20⊕ BINOVC VSBY ENE 1 1/2			0.56							29.055	69.8	69.3		9+	akO.
														(0336 ABCHI PIREPS CIG 33 MSL)															akO.
S9	0343		M22	⦶12⦶	3	RW-				→↘	4																		akO.
S10	0351		M22	⦶12⦶	7					→↘	3																		akO.
✓	0402		M28	⦶⦶	7					→	2		/022	/E90⦶15⦶										29.070					akO.
R	0428		M30	⦶/⦶	7		230	70	68	→	2		/023	/18⦶/ 206 9636/2	2	035	0.04	2Fc → 7Cb ↘	E18 M30	0		4Ci	E250	29.080	70.2	68.8		10	akO.
S11	0501			-⦶/30⦶	8					→↗	4																		akO.
R	0527			-⦶/	8		227	71	65	→↗	4		/023				0.00							29.080	71.2	67.0		7	akO.
✓	0600			-⦶/	9					→↗	5		/023											29.080					akO.
R	0628			O	15		224	75	64	↗	8		/019				0.00							29.060	75.1	67.6		1-	akO.
✓	0700			O	20					↗	10		/025											29.095					akO.

SUMMARY OF DAY (midnight to midnight)

Time of sunrise 0539 Time of sunset 1940

24-hr. Max. Temp. 86.1 °F. 24-hr. Min. Temp. 65.0 °F.

24-hr. Precip. (water equivalent) 0.60 in. 24-hr. Snowfall (unmelted) 0.0 in.

Total hours of fog: Light 0 Moderate 0 Heavy 0

Max. wind (5 min.) 48 (m.p.h., ~~knots~~) Direction NW Time 0240

Extreme wind (fastest single mile) 56 (m. p. h., ~~knots~~) Direction NW Time 0240

Peak gust – (m.p.h., knots) Direction – Time –

Thickness of ice on water – in.

Ground frozen from – in. to – in.

6-HOURLY OBSERVATIONS

Time of Obs.	0105	0707	1308	1906	Midnight
Precip. (in.)	0.00	0.60	0.00	0.00	0.00
Snowfall (in.)	0.0	0.0	0.0	0.0	0.0
Snow Depth (in.)	0.0	0.0	0.0	0.0	0.0
Max. Temp.	83.6	80.6	82.8	86.1	76.2
Min. Temp.	70.3	65.0	80.0	82.8	69.4
5,000 ft. Pressure	–	–	–	–	
Rel. Hum. %	53	56	47	58	
Soil Temp.	–	–	–	–	
State of Ground	0	1	0	0	

Time of Obs.				
State of Sea and Dir.				
Swell Ht. and Dir.				
Swell Period				
Surf ($L_1L_2K_1P_1D$)				
Barograph Reading	29.040	29.100	29.020	29.103
Attached Thermometer	69.5	71.5	71.0	71.5
Observed Reading	29.138	29.203	29.119	29.204
Total Correction	-.095	-.101	-.099	-.101

Remarks, Notes, and Miscellaneous Phenomena

Types of air masses and frontal passages determined from synoptic maps, severe storms, miscellaneous hydrometeors, floods

G SW B0113

TS W B0225; MOVD OVHD 0231; TS+ B0234; TS B0250

MOVD E DSIPTD 0305

RW- B0231 E0241; RW+ B0241 E0250; RW B0250

E0255; RW- B0255 E0348

A+ B0241 E0250

Month May Day 13 Year 44

16—41616-1 U. S. GOVERNMENT PRINTING OFFICE

Note: Items preceding temperature, dew point, altimeter setting, and remarks may be omitted from this form when it is not used for teletype transmission.

WB Form 1130A

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE
UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

84-6R
Eff. 7-1-45

Security Classification _____

Time entries on this form are 75 th meridian time

To convert to G. C. T. { add / ~~subtract~~ } 5 hours

Height of Barometer 1070 Ft. (MSL)

SURFACE WEATHER OBSERVATIONS

(LAND STATION)

WBAN — 10 A

Station Sample City, Tenn.

Lat. 35° 58' Long. 85° 47'

TYPE (1)	TIME (2)	CLASSIFICATION (3)	CEILING (Hundreds of Feet) (4)	SKY (5)	VISIBILITY (Miles) (6)	WEATHER AND/OR OBSTRUCTIONS TO VISION (7)	SEA-LEVEL PRESSURE (Mbs.) (8)	TEMP. (°F) (9)	DEW PT. (°F) (10)	WIND DIRECTION (11)	WIND VELOCITY (M.P.H.) (12)	WIND CHARACTER AND SHIFTS (13)	ALTIMETER (Inches) (14)	REMARKS AND SUPPLEMENTAL CODED DATA (For Transmission) (15)	PRES. TEND. (16)	NET 3-HR. CHANGE (Inches) (17)	PRECIP. (Inches) (18)	CLOUDS LOW AMT., TYPE, DIRECTION (19)	CLOUDS LOW HEIGHT (Hnds. of Ft.) (20)	CLOUDS MIDDLE AMT., TYPE, DIRECTION (21)	CLOUDS MIDDLE HEIGHT (Hnds. of Ft.) (22)	CLOUDS HIGH AMT., TYPE, DIRECTION (23)	CLOUDS HIGH HEIGHT (Hnds. of Ft.) (24)	STATION PRESSURE (Inches) (25)	DRY BULB (°F) (26)	WET BULB (°F) (27)	WATER TEMP. (°F) (28)	(29)	OBS. INIT. (30)
✓	0100			-Ø/	8					↗	7		/019											29.040					abw.
R	0128			Ø/40Ø	8		213	70	52	↗	10		/019	/LTNG IN CLDS SW/ 50600 3035/2 89	5	035	0.00	3Cb→	E40	0		3Ci↗	E230	29.043	70.3	59.4		4	abw.
SP	0140													PIREPS MDT TURBC 15E NA 65 MSL															abw.
														0135C DC3															abw.
✓	0158		E80	⦶40Ø	8					→↗	6		/018	/FQT LTNG CLD TO GND SW										29.030					abw.
S2	0212		M40	⦶⦶	7						C			/E80⦶ FQT LTNG IN HVY CU S TO WSW															abw.
R	0228		M40	⊕	7	T	224	65	52	→	13		/021	/T W APCHG STN INTSTY INCRG FQT LTNG			0.56							29.060	65.4	57.5		10	abw.
														W CLD TO GND PIREPS HPITS 10 S XM															abw.
														55 MSL 0221C B17															abw.
S3	0235		M40	⊕	5	TRW-				→	24	+		/T OVHD MOVG E LTNG IN CLDS ALL QUADS															abw.
S4	0239									→↘	51	+	/019	/BRMFR										29.040					abw.
S5	0244		P2	X	1/4	T+RW+A+				→↘	44	+		/T OVHD MOVG E FQT LTNG IN CLDS ALL															abw.
														QUADS HLSTO 3/8 INCH															abw.
S6	0252		P3	X	3/4V	TRW				↘	36	+	/027	/T OVHD MOVG E LTNG IN CLDS OVHD AND										29.120					abw.
														E VSBY VRBL 1/2 TO 1 BRMRR LWST															abw.
														PRES 217 AT 0247C															abw.
S7	0258		P8	X	1V	TRW-				↘	20	+	/022	/T DSIPTG VSBY VRBL 1/2 TO 2 BRM										29.070					abw.
														UNSTDY															abw.
S8	0309		M10	⊕	2	RW-				↘	8			/VSBY NE1SE1 1/2 SW2NW2															abw.
R	0328		M12	⊕⦶	3	RW-	224	70	69	↘	6		/021	/E20⊕ BINOVC VSBY ENE 1 1/2			0.04							29.055	69.8	69.3		9+	abw.
														(0336 ABC41 PIREPS CIG 33 MSL)															abw.
S9	0343		M22	⊕12Ø	3	RW-				→↘	4																		abw.
S10	0351		M22	⊕12Ø	7					→↘	3																		abw.
✓	0402		M28	⊕⦶	7					→	2		/022	/E90⊕15Ø										29.070					abw.
R	0428		M30	⊕/⦶	7		230	70	68	→	2		/023	/18Ø/ 206 9039/2	2	035	0.00	2Fc→ 7Cb↘	E18 M30	0		4Ci	E250	29.080	70.2	68.8		10	abw.
S11	0501			-⊕/30Ø	8					→↗	4																		abw.
R	0527			-⦶/	8		227	71	65	→↗	4		/023				0.00							29.080	71.2	67.0		7	abw.
✓	0600			-⦶/	9					→↗	5		/023											29.080					abw.
R	0628			O	15		224	75	64	↗	8		/021				0.00							29.060	75.1	67.6		1-	abw.
✓	0700			O	20					↗	10		/025											29.095					abw.

SUMMARY OF DAY (midnight to midnight)

Time of sunrise 0536 Time of sunset 2001

24-hr. Max. Temp. 86 °F. 24-hr. Min. Temp. 65 °F.

24-hr. Precip. (water equivalent) 0.60 in. 24-hr. Snowfall (unmelted) 0.0 in.

Total hours of fog: Light 0 Moderate 0 Heavy 0

Max. wind (5 min.) 48 (m.p.h., ~~knots~~) Direction NW Time 0240

Extreme wind (fastest single mile) 56 (m. p. h., ~~knots~~) Direction NW Time 0240

Peak gust — (m.p.h., knots) Direction — Time —

Thickness of ice on water — in.

Ground frozen from — in. to — in.

6-HOURLY OBSERVATIONS

Time of Obs.	0105	0707	1308	1906	Midnight
Precip. (in.)	0.00	0.60	0.00	0.00	0.00
Snowfall (in.)	0.0	0.0	0.0	0.0	0.0
Snow Depth (in.)	0.0	0.0	0.0	0.0	0.0
Max. Temp.	83.6	80.6	82.8	86.1	82.8
Min. Temp.	70.3	65.0	80.0	82.8	69.4
5,000 ft. Pressure	—	—	—	—	
Rel. Hum. %	53	56	47	58	
Soil Temp.	—	—	—	—	
State of Ground	0	1	0	0	

Time of Obs.	0105	0707	1308	1906
State of Sea and Dir.				
Swell Ht. and Dir.				
Swell Period				
Surf (L,L,L,K,F,D)				
Barograph Reading	29.040	29.100	29.020	29.105
Attached Thermometer	69.5	71.5	71.0	71.5
Observed Reading	29.138	29.203	29.119	29.204
Total Correction	-.095	-.101	-.099	-.101

Remarks, Notes, and Miscellaneous Phenomena

Types of air masses and frontal passages determined from synoptic maps, severe storms, miscellaneous hydrometeors, floods

G SW B0113

R W B 0225; MOVD OVHD 0231; TS+ B 0234; TS B 0250

MOVD E DSIPTD 0305

RW- B 0231 E 0241; RW+A+ B 0241 E0250; RW B 0250

E0255; RW- B 0255 E 0348

Month July Day 13 Year 45

Note: Slants preceding temperature, dew point, altimeter setting, and remarks may be omitted from this form when it is not used for teletype transmission.

WB Form 1130A

84-7R

Eff. 6-15-46

INSTRUCTIONS FOR AIRWAY METEOROLOGICAL SERVICE
UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

SURFACE WEATHER OBSERVATIONS

(LAND STATION)

WBAN—10A

Time entries on this form are 75 th meridian time

To convert to G. C. T. { add / ~~subtract~~ } 5 hours

Height of Barometer _____ Ft. (MSL)

Security Classification _____

Station Sample City, Tenn.

Lat. 35° 58' Long. 85° 47'

TYPE (1)	TIME (2)	CLASSIFICATION (3)	CEILING (Hundreds of Feet) (4)	SKY (5)	VISIBILITY (Miles) (6)	WEATHER AND/OR OBSTRUCTIONS TO VISION (7)	SEA-LEVEL PRESSURE (Mbs.) (8)	TEMP. (°F) (9)	DEW PT. (°F) (10)	WIND DIRECTION (11)	WIND VELOCITY (M.P.H.) (12)	WIND CHARACTER AND SHIFTS (13)	ALTIMETER (Inches) (14)	REMARKS AND SUPPLEMENTAL CODED DATA (For Transmission) (15)	PRES. TEND. (16)	NET 3-HR. CHANGE (Inches) (17)	PRECIP. (Inches) (18)	CLOUDS LOW AMT., TYPE, DIRECTION (19)	LOW HEIGHT (Hnds. of Ft.) (20)	MIDDLE AMT., TYPE, DIRECTION (21)	MIDDLE HEIGHT (Hnds. of Ft.) (22)	HIGH AMT., TYPE, DIRECTION (23)	HIGH HEIGHT (Hnds. of Ft.) (24)	STATION PRESSURE (Inches) (25)	DRY BULB (°F) (26)	WET BULB (°F) (27)	WATER TEMP. (°F) (28)	Total Cloudiness (29)	OBS. INIT. (30)
✓	0100			-⦶/	8					↗	7		/019											29.040					a40
R	0128			⦶/40⦶	8		213	/70	/52	↗	10		/019	/LTNG IN CLDS SW/ 50600 3035/2 89	5	035	0.00	3Cb→	E40	0		3Ci↗	E230	29.043	70.3	59.4		4	a40
✓	0158		E80	⦶40⦶	8					→↗	6		/018	/FQT LTNG CLD TO GND SW										29.030					a40
▶ S1	0212		M40	⦶⦶	7						C			/E80⦶ FQT LTNG IN HVY CU S TO WSW															a40
▶ RS2	0228		M40	⊕	7	T	224	/65	/52	→	13		/021	/T W APCHG STN INTSTY INCRG FQT LTNG			0.56							29.060	65.4	57.5		10	a40
														W CLD TO GND PIREPS HPITS 10 S XM															a40
														55 MSL 0221C B17															a40
S3	0235		M40	⊕	5	TRW-				→	24	+		/T OVHD MOVG E LTNG IN CLDS ALL QUADS															a40
S4	0239									→↘	51	+	/019	/BRM FLG RPDLY										29.040					a40
S5	0244		P2	X	1/4	T+RW+A+				→↘	44	+		/T OVHD MOVG E FQT LTNG IN CLDS ALL															a40
														QUADS HLSTO 3/8 INCH															a40
S6	0252		P3	X	3/4V	TRW				↘	36	+	/027	/T OVHD MOVG E LTNG IN CLDS OVHD AND										29.120					a40
														E VSBY VRBL 1/2 TO 1 BRMRR LWST															a40
														PRES 217 AT 0247C															a40
S7	0258		P8	X	1V	TRW-				↘	20	+	/022	/T DSIPTG VSBY VRBL 1/2 TO 2 BRM										29.070					a40
														UNSTDY															a40
S8	0309		M10	⊕	2	RW-				↘	8			/VSBY NE1SE11/2SW2NW2															a40
R	0328		M12	⊕⦶	3	RW-	224	/70	/69	↘	6		/021	/E20⊕ BINOVC VSBY ENE 11/2			0.04							29.055	69.8	69.3		9+	a40
														(0336 ABC41 PIREPS CIG 33 MSL)															a40
S9	0343		M22	⊕12⦶	3	RW-				→↘	4																		a40
S10	0351		M22	⊕12⦶	7					→↘	3																		a40
✓	0402		M28	⊕⦶	7					→	2		/022	/E90⊕15⦶										29.090					a40
R	0428		M30	⊕/⦶	7		230	/70	/68	→	2		/023	/18⦶/ 206 9039/2	2	035	0.00	2Fc→ 7Cb↘	E18 M30	0		4Ci	E250	29.080	70.2	68.8		10	a40
▶ S11	0501			-⊕/30⦶	8					→↗	4		/023																a40
R	0527			-⦶/	8		227	/71	/65	→↗	4		/023				0.00							29.080	71.2	67.0		7	a40
✓	0600			-⦶/	9					→↗	5		/023											29.080					a40
R	0628			O	15		224	/75	/64	↗	8		/021				0.00							29.060	75.1	67.6		1-	a40
✓	0700			O	20					↗	10		/025											29.095					a40

SUMMARY OF DAY (midnight to midnight)

Time of sunrise 0536 Time of sunset 2001

24-hr. Max. Temp. 86 °F. 24-hr. Min. Temp. 65 °F.

24-hr. Precip. (water equivalent) 0.60 in. 24-hr. Snowfall (unmelted) 0.0 in.

Total hours of fog: Light 0 Moderate 0 Heavy 0

Max. wind (5 min.) 48 (m.p.h., ~~knots~~) Direction NW Time 0240

Extreme wind (fastest single mile) 56 (m. p. h., ~~knots~~) Direction NW Time 0240

Peak gust — (m.p.h., knots) Direction — Time —

Thickness of ice on water — in.

Ground frozen from — in. to — in.

6-HOURLY OBSERVATIONS

Time of Obs.	0105	0707	1308	1906	Midnight
Precip. (in.)	0.00	0.60	0.00	0.00	0.00
Snowfall (in.)	0.0	0.0	0.0	0.0	0.0
Snow Depth (in.)	0.0	0.0	0.0	0.0	0.0
Max. Temp.	83.6	80.6	82.8	86.1	82.8
Min. Temp.	70.3	65.0	80.0	82.8	69.4
5,000 ft. Pressure	—	—	—	—	
Rel. Hum. %	53	56	47	58	
Boil Temp.	—	—	—	—	
State of Ground	0	1	0	0	

Time of Obs.	0105	0707	1308	1906
State of Sea and Dir.				
Swell Ht. and Dir.				
Swell Period				
Surf (L,L,K,P,D)				
Barograph Reading	29.040	29.100	29.020	29.105
Attached Thermometer	69.5	71.5	71.0	71.5
Observed Reading	29.138	29.203	29.119	29.204
Total Correction	-.095	-.101	-.099	-.101

Remarks, Notes, and Miscellaneous Phenomena

Types of air masses and frontal passages determined from synoptic maps, severe storms, miscellaneous hydrometeors, floods

G SW B0113

TS W B 0225; MOVD OVHD 0231; TS+ B 0234; TS B 0250

MOVD E DSIPTD 0305

RW- B 0231 E 0241; RW+A+ B 0241 E0250; RW B 0250

E0255; RW- B 0255 E 0348

Month July Day 13 Year 45

Note: Slants preceding temperature, dew point, altimeter setting, and remarks may be omitted from this form when it is not used for teletype transmission.

WAR TIME ZONES
U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
PACIFIC WAR TIME
(105TH MERIDIAN TIME)
TO CONVERT TO G.C.T.
ADD 7 HOURS
MOUNTAIN WAR TIME
(90TH MERIDIAN TIME)
TO CONVERT TO G.C.T.
ADD 6 HOURS
CENTRAL WAR TIME
(75TH MERIDIAN TIME)
TO CONVERT TO G.C.T.
ADD 5 HOURS
EASTERN WAR TIME
(60TH MERIDIAN TIME)
TO CONVERT TO G.C.T.
ADD 4 HOURS
NORTH DAKOTA
NEW MEXICO

(*c*) *Weather Bureau first-order or airport stations not having general supervising duties assigned to them.*—Only one copy of WB Form 1130 shall be prepared, and this shall be filed at the station. However, if any general supervising station desires a copy for their files, it will be proper to furnish a carbon copy upon receipt of a request for it.

(*d*) *Weather Bureau airport stations having general supervising duties assigned to them.*—One copy of WB Form 1130 shall be prepared, and this shall be filed at the station. It will be proper to furnish carbon copies to other contiguous general supervising stations upon receipt of a request for them.

(*e*) *Furnishing of extra copies.*—Because of the expense involved, the furnishing of copies from substations, other than those prescribed in the foregoing, is not favored. However, general supervising stations desiring copies from substations under the general supervision of another station should make proper recommendations to the Central Office for consideration, and, if approved, may make arrangements, through the other general supervising stations concerned, to receive them.

CHAPTER III

WB FORM 1135, "PRESSURE-REDUCTION DATA"

2–617. Purpose and Instructions for Use of WB Form 1135.—This is a form designed to facilitate the computation of data required in connection with the reduction of mercurial barometer readings to sea-level, or to the 5,000-foot plane, or both. *Except for those stations which are required to make the computations on WB Form 1083*, WB Form 1135 shall be used at all stations having mercurial barometers for the recording of the data called for thereon at observations taken at 1:30 and 7:30 a. m. and p. m., E. S. T. Stations rendering both WB Form 1135 and WB Form 1146 will prepare WB Form 1135 for both sea-level and 5,000-foot pressure. The use of this form under the conditions prescribed above is mandatory, as it is desired that a complete record of the computations required in these observations be available for use or study, if required. The computations made on this form will be checked by checking stations unless the station using the form is manned by commissioned Weather Bureau personnel. In the latter event, computations on the form will invariably be checked by an employee other than the one taking the observation.

2–618. WB Form 1135 Not To Be Used in Connection With Aneroid or Barograph Readings.—Inasmuch as an aneroid barometer or a barograph is usually used for obtaining station pressure at intermediate observations and computations are thus reduced to a minimum, WB Form 1135 will not be used at those times.

2–619. Entry of Data.—Data will be entered in pencil.

2–620. Filing and Disposition of WB Forms 1135.—At stations manned by commissioned Weather Bureau personnel the forms will be filed in chronological order at the station making the observations. WB Form 1135 from second-order stations manned by Weather Bureau airway observers or Civil Aeronautics Administrtiaon personnel will be mailed from the checking station to the general supervising station for permanent filing. In the event the first-order station is discontinued, the forms will be forwarded to the general supervising station for permanent filing.

CHAPTER IV

FILING OF FORMS

2–621. In connection with the filing of forms, officials in charge at general supervising stations should take action which shall result in the consolidation of the above forms for any district at its general supervising station or at a designated general filing point. In this connection, if any forms are on file for a station in another district, those forms should be forwarded to the general supervising station for that district.

CHAPTER III

WB FORM 1135, "PRESSURE-REDUCTION DATA"

2-617. PURPOSE AND INSTRUCTIONS FOR USE OF WB FORM 1135.—This is a form designed to facilitate the computation of data required in connection with the reduction of mercurial barometer readings to sea-level, or to the 5,000-foot plane, or both. Except for those stations which are required to make the computations on WB Form 1083, WB Form 1135 shall be used at all stations having mercurial barometers for the recording of the data called for thereon at observations taken at 1:30 and 7:30 a. m. and p. m., E. S. T. Stations rendering both WB Form 1135 and WB Form 1146 will prepare WB Form 1135 for both sea-level and 5,000-foot pressure. The use of this form under the conditions prescribed above is mandatory, as it is desired that a complete record of the computations required in these observations be available for use or study, if required. The computations made on this form will be checked by checking stations unless the station using the form is manned by commissioned Weather Bureau personnel. In the latter event, computations on the form will invariably be checked by an employee other than the one taking the observation.

2-618. WB FORM 1135 NOT TO BE USED IN CONNECTION WITH ANEROID OR BAROGRAPH READINGS.—Inasmuch as an aneroid barometer or a barograph is usually used for obtaining station pressure at intermediate observations and computations are thus reduced to a minimum, WB Form 1135 will not be used at those times.

2-619. ENTRY OF DATA.—Data will be entered in pencil.

2-620. FILING AND DISPOSITION OF WB FORMS 1135.—At stations manned by commisioned Weather Bureau personnel the forms will be filed in chronological order at the station making the observations. WB Form 1135 from second-order stations manned by Weather Bureau airway observers or Civil Aeronautics Administration personnel will be mailed from the checking station to the general supervising station for permanent filing. In the event the first-order station is discontinued, the forms will be forwarded to the general supervising station for permanent filing.

CHAPTER IV

FILING OF FORMS

2-621. In connection with the filing of forms, officials in charge at general supervising stations should take action which shall result in the consolidation of the above forms for any region at its general supervising station or at a designated general filing point. In this connection, if any forms are on file for a station in another region, those forms should be forwarded to the general supervising station for that region.

Table for Recording and Reporting Visibility

Fractional Intervals		One-Mile Intervals
0	1	3 to 15
1/16	1 1/4	
1/8	1 1/2	
3/16	1 3/4	
1/4	2	
5/16	2 1/4	
3/8	2 1/2	Five-Mile
1/2		Intervals
5/8		
3/4		More than 15

2-604.070. Weather and/or obstructions to vision (Column (7)).--In this column entries will be made of weather and obstructions to vision, in accordance with tables given below. When more than one entry is made for a given observation, the data will be entered in the following order:

1. Tornado
2. Thunderstorm
3. Liquid precipitation, in the order of intensity
4. Frozen precipitation, in the order of intensity
5. Obstructions to vision, in the order of intensity

Note that an entry is required in this column whenever the visibility is six miles or less.

2-604.071. Weather.--The character of observed hydrometeors and other phenomena will be entered in printed block letter symbols in accordance with the following table:

Table of Symbols for Weather

R	Rain	AP	Small Hail
S	Snow	SP	Snow Pellets
ZR	Freezing Rain	T	Thunderstorm
L	Drizzle	SQ	Snow Squall
ZL	Freezing Drizzle	RQ	Rain Squall
E	Sleet	SW	Snow Showers
A	Hail	RW	Rain Showers

TORNADO (always written out in full)

2-604.072. Obstructions to vision.--The character of obstructions to vision will be entered in printed block letter symbols in accordance with the following table:

Table of Symbols for Obstructions to Vision

F--	Damp Haze
F	Fog
GF	Ground Fog
BS	Blowing Snow
GS	Drifting Snow
BL	Blowing Dust
BN	Blowing Sand
IF	Ice Fog
H	Hazy (Dry Haze)
K	Smoke
D	Dust

2-604.073. Intensity.--A plus or minus sign following the symbols for weather and obstructions to vision will indicate heavy and light degrees of intensity, respectively. The absence of any sign will indicate that the intensity is moderate.

Exceptions: Tornadoes, damp haze, and hazy will be reported without indication of intensity. Thunderstorms will be included in reports without a minus sign; i.e., as either "T" or "T+."

2-604.08. Sea level pressure (Column (8)).--At stations using this form for operational purposes, e.g., teletype transmission, the initial "9" or "10" for "100s" of millibars will be omitted, and the sea level pressure will then be entered as three figures without a decimal point, representing tens, units, and tenths of millibars; e.g., 1013.2 would be entered as 132. At other stations, the full entry will be made.

2-604.09. Temperature (Column (9)).--Enter the dry-bulb temperature to the nearest whole degree Fahrenheit. Temperatures below zero will be preceded by a minus sign.

2-604.10. Dew point (Column (10)).--Enter the dew point temperature to the nearest whole degree Fahrenheit. Dew point temperatures below zero will be preceded by a minus sign.

2-604.11. Wind direction (Column (11)).--This entry will be made to sixteen points of the compass by means of one or two short arrows, as shown below.

↓	North	↑	South
↓↙	North-northeast	↑↗	South-southwest
↙	Northeast	↗	Southwest
←↙	East-northeast	→↗	West-southwest
←	East	→	West
←↖	East-southeast	→↘	West-northwest
↖	Southeast	↘	Northwest
↑↖	South-southeast	↓↘	North-northwest

When the wind is calm, no entry will be made.

2-604.12. Wind velocity (Column (12)).--The wind velocity will be entered in miles per hour or knots as stated at the head of the column. If the wind velocity is estimated, enter the letter "E" immediately following the velocity. "C" will be entered when the wind is calm.

2-604.13. Wind character and shifts (Column (13)).--When gustiness is present, the character will be entered in this column. A minus sign will be used to indicate fresh gusts, and a plus sign to indicate strong gusts. A wind shift will be reported by entering first the direction of the wind before the shift to sixteen points of the compass by use of short arrows. This will be followed by the time of the shift on the 24-hour clock, together with the appropriate letter to denote the local time zone, if the form is used operationally. The intensity of the shift will be indicated after the time zone indicator by use of a plus sign for a heavy shift, a minus sign for a light shift, and no sign for a shift of moderate intensity. When gustiness and a wind shift occur together, the wind shift will be recorded immediately following the intensity of the gustiness, without a space. For example, if a heavy wind shift occurred from southeast to northwest in the central war time zone at 1614, the entry in the column will be "↖1614C+." Since the space provided in Column (13) is not adequate for entry of wind shift data, when a wind shift is reported, all wind data will be distributed evenly among Columns (11), (12), and (13).

2-604.14. Altimeter setting (Column (14)).--At stations having a mercurial barometer that is used daily to establish corrections for the altimeter setting indicator or barograph, this entry will be made and recorded as three figures without a decimal point, representing units, tens, and hundredths of inches. For example: 29.92 would be entered as 992. 8/1/45

2-604.15. Remarks and supplemental coded data (Column (15)).--In this column enter all important weather information that cannot be included in the body of the report. Whenever possible, remarks will be entered in symbols or authorized contractions. If the information is such that symbols and contractions are not applicable, plain English will be used. If necessary, additional lines for Column (15) may be used to report the phenomena. It is not intended that the physical limitations of the form shall limit in any way the information to be reported. Stations instructed to transmit additional data groups with the three-hourly and six-hourly record observations will enter the data after "Remarks." These data will be separated from "Remarks" by a slant and a space. The entries will be made by means of the standard numerical code figures.

2-604.16. Pressure tendency (Column (16)).--Entry in this column is for three- and six-hourly observations. A single code figure will be entered, taken from the code table below (symbol "a" in the 1942 Weather Code) for characteristics of pressure change during the three-hour period preceding the time of observation. Stations equipped with a barograph or a microbarograph will make this entry for three- and six-hourly observations.

Table of Pressure Tendencies

Code Figure	Description	
0	Rising, then falling.	Barometer now higher than, or the same as, 3 hours ago.
1	Rising, then steady; or rising, then rising more slowly.	
2	Rising unsteadily, or unsteady.	
3	Rising steadily, or steady.	
4	Falling or steady, then rising; or rising, then rising more quickly.	
5	Falling, then rising.	Barometer now lower than 3 hours ago.
6	Falling, then steady; or falling, then falling more slowly.	
7	Falling unsteadily, or unsteady.	
8	Falling steadily.	
9	Steady or rising, then falling; or falling, then falling more quickly.	

2-604.17. Net three-hour pressure change (Column (17)).--Entries of a net three-hour change in station pressure will be made in this column at the time of the three- and six-hourly observations to the nearest 0.005 inch or 0.2 millibar, in accordance with the column heading. Stations not entering pressure tendencies in accordance with instructions for Column (16) above will make no entry in this column.

Page 85b, paragraph 2-604.18 - Correct first sentence to read: "Entries of hourly amounts of precipitation will be made in this column only at first-order stations having recording equipment and will represent to the nearest 0.01 inch the accumulated amount of precipitation at the end of each hour. The entries will be made on the line pertaining to the appropriate record observation. For example, the amount of precipitation occurring between 0600 and 0700 will be ascribed to the 0628 observation." 8/1/45

2-604.20. Amount (Columns (19), (21), and (23)).--The amount of each layer of clouds will be entered to the nearest tenth of sky coverage. Few clouds (less than one-tenth) will be entered as 1-; breaks in an overcast or more than nine-tenths will be indicated as 9+. Not more than two cloud types for each of the height categories--low, middle, and high--will be entered for any one observation. Since a series of frequent observations or pilot reports will often indicate the extent or existence of a cloud layer above a layer of broken clouds, the summation of the number of tenths in Columns (19), (21), and (23) may exceed ten-tenths. Entries will be made in Columns (19), (21), and (23) as follows:

2-604.201. When a cloud observation is impossible because of an obstruction to vision, the symbol "X" (obscured) will be entered in the columns unless the obstruction to vision is fog, in which case "10 fog" will be entered in Column (19), and "X" in Columns (21) and (23).

2-604.202. When a cloud observation of middle or high clouds is impossible because of lower clouds, "X" will be entered in Columns (21) or (23) or both.

2-604.203. When no low, middle, or high clouds are present, zeros will be entered in the appropriate columns.

2-604.16. Pressure tendency (Column (16)).--Entry in this column is for three- and six-hourly observations. A single code figure will be entered, taken from the code table below (symbol "a" in the 1942 Weather Code) for characteristics of pressure change during the three-hour period preceding the time of observation. Stations equipped with a barograph or a microbarograph will make this entry for three- and six-hourly observations.

Table of Pressure Tendencies

Code Figure	Description	
0	Rising, then falling.	Barometer now higher than, or the same as, 3 hours ago.
1	Rising, then steady; or rising, then rising more slowly.	
2	Rising unsteadily, or unsteady.	
3	Rising steadily, or steady.	
4	Falling or steady, then rising; or rising, then rising more quickly.	
5	Falling, then rising.	Barometer now lower than 3 hours ago.
6	Falling, then steady; or falling, then falling more slowly.	
7	Falling unsteadily, or unsteady.	
8	Falling steadily.	
9	Steady or rising, then falling; or falling, then falling more quickly.	

2-604.17. Net three-hour pressure change (Column (17)).--Entries of a net three-hour change in station pressure will be made in this column at the time of the three- and six-hourly observations to the nearest 0.005 inch or 0.2 millibar, in accordance with the column heading. Stations not entering pressure tendencies in accordance with instructions for Column (16) above will make no entry in this column.

2-604.18. Precipitation (Column (18)).--Entries of hourly amounts of precipitation will be made in this column only at stations having recording equipment and will represent to the nearest 0.01 inch the accumulated amount of precipitation during the hour ending at time of record observation. These entries will be made after the automatic records have been evaluated. When 0.005 inch or less precipitation has occurred, "T," denoting "trace," will be entered in the column. When no precipitation has occurred, the entry will be 0.00.

2-604.19. Clouds (Columns (19) to (24), Inclusive).--First-order Weather Bureau stations and other stations authorized to take cloud observations will make these entries for three- and six-hourly observations.

2-604.20. Amount (Columns (19), (21), and (23)).--The amount of each layer of clouds will be entered to the nearest tenth of sky coverage. Few clouds (less than one-tenth) will be entered as 1-; breaks in an overcast or more than nine-tenths will be indicated as 9+. Not more than two cloud types for each of the height categories--low, middle, and high--will be entered for any one observation. Since a series of frequent observations or pilot reports will often indicate the extent or existence of a cloud layer above a layer of broken clouds, the summation of the number of tenths in Columns (19), (21), and (23) may exceed ten-tenths. Entries will be made in Columns (19), (21), and (23) as follows:

2-604.201. When a cloud observation is impossible because of an obstruction to vision, the symbol "X" (obscured) will be entered in the columns unless the obstruction to vision is fog, in which case "10 fog" will be entered in Column (19), and "X" in Columns (21) and (23).

2-604.202. When a cloud observation of middle or high clouds is impossible because of lower clouds, "X" will be entered in Columns (21) or (23) or both.

2-604.203. When no low, middle, or high clouds are present, zeros will be entered in the appropriate columns.

2-604.21. Type (Columns (19), (21), and (23)).--The following standard cloud type abbreviations will be used:

Low Clouds (Column (19))
Cu - Cumulus
Fc - Fractocumulus
Cb - Cumulonimbus
Cm - Cumulonimbus mammatus (Mammato cumulus)
St - Stratus
Fs - Fractostratus
Sc - Stratocumulus
Ns - Nimbostratus

Middle Clouds (Column (21))
Ac - Altocumulus
Acc- Altocumulus castellatus
As - Altostratus

High Clouds (Column (23))
Ci - Cirrus
Cs - Cirrostratus
Cc - Cirrocumulus

2-604.22. Direction (Columns (19), (21), and (23)).--Enter the direction from which the cloud type reported is observed to be moving. When the direction is unknown for any reason, omit the entry; otherwise, an arrow denoting the motion to eight points of the compass will be entered immediately following the cloud type abbreviation as follows:

↓ from north	↑ from south
↙ from northeast	↗ from southwest
← from east	→ from west
↖ from southeast	↘ from northwest

When no motion is discernible, enter "C" for calm.

2-604.23. Height (Columns (20), (22), and (24)).--Whenever measured, the height will be entered to the nearest 100 feet above the elevation of the station; e.g., 1450 would be entered as 14. If the height is estimated, it will be entered to the nearest 100 feet from the surface to 5,000 feet; to the nearest 500 feet between 5,000 and 10,000 feet; and to the nearest 1,000 feet above 10,000 feet. Letters indicating the method of determination will be placed before the height entry, as follows:

M = Ceiling light, ceilometer, raob balloon (or rawin)
B = Pilot balloon, ceiling balloon
A = Aircraft report (Pireps)
W = Indefinite as applying to nimbostratus or low, broken clouds when the indefiniteness is not owing to restricted horizontal visibility.
E = Estimated

(Note that this does not include values ascribed to precipitation ceiling.)

2-604.25. Station pressure (Column (25)).--The datum will be secured from the mercurial barometer and entered to the nearest 0.001 inch or 0.05 millibar, in accordance with the column heading. The station pressure for other than six-hourly observations may be taken from the barograph at stations having one and entered to the nearest 0.005 inch or 0.2 millibar, provided a correction applicable to the barograph was established at the time of reading the mercurial barometer for the preceding six-hourly observation. Stations not having a mercurial barometer will omit all entries from this column.

2-604.26. Dry bulb (Column (26)).--Enter the temperature of the dry bulb to the nearest degree and tenth, Fahrenheit.

2-604.27. Wet bulb (Column (27)).--Enter the temperature of the wet bulb to the nearest degree and tenth, Fahrenheit.

2-604.28. Water temperature (Column (28)).--Enter the temperature to whole degrees, Fahrenheit (at designated stations only).

2-604.29. (Total cloudiness)(Column (29)).--Enter the legend "Total Cloudiness" in the space provided above the column number. At each hourly observation only, enter tenths of sky obscured by clouds. Zero will be entered if no clouds are present; 1- if less than one-tenth clouds are present; 9+ if overcast, but with breaks; 10 if the sky is completely overcast or if fog (except ground fog) is present; and "X" if an observation is not possible because of weather or an obstruction to vision. Note that visible sky plus "Total Cloudiness" equals ten-tenths.

2-604.30. Observer's initials (Column (30)).--The observer taking the observation will enter his initials in this column.

2-605.0. Summary of Day (See also par. 2-603.3).--First-order Weather Bureau stations and other stations authorized to make these entries will complete this portion of the form.

2-605.1. Time of sunrise and sunset.--Stations having sunrise and sunset tables will enter these data in accordance with par. 2-603.3.

2-605.2. Maximum and minimum temperatures.--These data will be entered in whole degrees Fahrenheit. Note that the maximum and minimum temperatures must be at least as high and low, respectively, as any temperature recorded through the day.

2-605.3. Twenty-four hour precipitation.--The total amount of precipitation (water equivalent) will be entered to the nearest 0.01 inch. If 0.005 inch or less has been recorded, a "T," denoting "trace," will be entered. If no precipitation has occurred, 0.00 will be entered. The sum of any number of "T" observations will be considered a trace unless recording equipment indicates the total is greater than 0.005 inch (melted).

2-605.4. Twenty-four hour snowfall.--The amount of snowfall (unmelted) will be recorded in inches and tenths. If 0.05 inch or less of snow has fallen, a "T," denoting "trace," will be entered. If no snow has fallen, 0.0 will be entered.

2-605.5. Total hours of fog.--The total hours of light, moderate, and heavy fog (including ground fog) will be determined by summing up the duration of each to the nearest minute (as determined from the time of beginnings and endings of fog in "Notes") and entered to the nearest whole hour. If no fog has occurred, zero will be entered.

2-605.6. Maximum wind.--This datum will be entered to the nearest mile per hour or knot, only at stations having recording equipment. The maximum wind is the highest average velocity for any five consecutive minutes in the twenty-four hours.

2-605.7. Extreme wind.--This datum will be entered only at stations having recording equipment. The extreme wind is the velocity of the mile of wind recorded in the shortest time during the twenty-four hours.

2-605.8. Peak gust.--This datum will be entered only at stations having gust-recording equipment. The peak gust is the highest velocity recorded under gust conditions, as defined elsewhere in this manual.

2-605.9. Thickness of ice on water.--This entry will be made only by designated stations, to the nearest 0.1 inch.

2-605.10. Ground frozen from---------.--This entry will be made only by designated stations, to the nearest whole inch.

2-606.0. Six-Hourly Observation (See also par. 2-603.4).--

Page 85d, paragraph 2-606.01 - Add after the first sentence: "When 0.005 inch or less precipitation has occurred, "T," denoting "trace," will be entered. When no precipitation has occurred, the entry will be 0.00." 8/1/45

0.05 inch or less, "T," denoting "trace," will be entered. When no snow is on the ground, 0.0 will be entered. In the column captioned "Midnight," enter the amount occurring between midnight and the preceding six-hourly observation.

2-606.03. Snow depth.--The depth of snow and ice on the ground at each six-hourly observation will be entered to inches and tenths. When the depth is 0.05 inch or less, "T," denoting "trace," will be entered. When no snow is on the ground, 0.0 will be entered. In the column captioned "Midnight," enter the amount of snow and ice on the ground at midnight.

2-604.27. Wet bulb (Column (27)).--Enter the temperature of the wet bulb to the nearest degree and tenth, Fahrenheit.

2-604.28. Water temperature (Column (28)).--Enter the temperature to whole degrees, Fahrenheit (at designated stations only).

2-604.29. (Total cloudiness)(Column (29)).--Enter the legend "Total Cloudiness" in the space provided above the column number. At each hourly observation only, enter tenths of sky obscured by clouds. Zero will be entered if no clouds are present; 1- if less than one-tenth clouds are present; 9+ if overcast, but with breaks; 10 if the sky is completely overcast or if fog (except ground fog) is present; and "X" if an observation is not possible because of weather or an obstruction to vision. Note that visible sky plus "Total Cloudiness" equals ten-tenths.

2-604.30. Observer's initials (Column (30)).--The observer taking the observation will enter his initials in this column.

2-605.0. Summary of Day (See also par. 2-603.3).--First-order Weather Bureau stations and other stations authorized to make these entries will complete this portion of the form.

2-605.1. Time of sunrise and sunset.--Stations having sunrise and sunset tables will enter these data in accordance with par. 2-603.3.

2-605.2. Maximum and minimum temperatures.--These data will be entered in whole degrees Fahrenheit. Note that the maximum and minimum temperatures must be at least as high and low, respectively, as any temperature recorded through the day.

2-605.3. Twenty-four hour precipitation.--The total amount of precipitation (water equivalent) will be entered to the nearest 0.01 inch. If 0.005 inch or less has been recorded, a "T," denoting "trace," will be entered. If no precipitation has occurred, 0.00 will be entered. The sum of any number of "T" observations will be considered a trace unless recording equipment indicates the total is greater than 0.005 inch (melted).

2-605.4. Twenty-four hour snowfall.--The amount of snowfall (unmelted) will be recorded in inches and tenths. If 0.05 inch or less of snow has fallen, a "T," denoting "trace," will be entered. If no snow has fallen, 0.0 will be entered.

2-605.5. Total hours of fog.--The total hours of light, moderate, and heavy fog (including ground fog) will be determined by summing up the duration of each to the nearest minute (as determined from the time of beginnings and endings of fog in "Notes") and entered to the nearest whole hour. If no fog has occurred, zero will be entered.

2-605.6. Maximum wind.--This datum will be entered to the nearest mile per hour or knot, only at stations having recording equipment. The maximum wind is the highest average velocity for any five consecutive minutes in the twenty-four hours.

2-605.7. Extreme wind.--This datum will be entered only at stations having recording equipment. The extreme wind is the velocity of the mile of wind recorded in the shortest time during the twenty-four hours.

2-605.8. Peak gust.--This datum will be entered only at stations having gust-recording equipment. The peak gust is the highest velocity recorded under gust conditions, as defined elsewhere in this manual.

2-605.9. Thickness of ice on water.--This entry will be made only by designated stations, to the nearest 0.1 inch.

2-605.10. Ground frozen from---------.--This entry will be made only by designated stations, to the nearest whole inch.

2-606.0. Six-Hourly Observation (See also par. 2-603.4).--

2-606.01. Precipitation.--These entries will be in inches and hundredths and will comprise the total precipitation for the preceding six hours. In the column captioned "Midnight," enter the amount measured at midnight for the period between midnight and the preceding six-hourly observation.

2-606.02. Snowfall.--The snowfall (unmelted) during the six hours preceding the observation will be entered to inches and tenths. When the snowfall amounts to 0.05 inch or less, "T," denoting "trace," will be entered. When no snow is on the ground, 0.0 will be entered. In the column captioned "Midnight," enter the amount occurring between midnight and the preceding six-hourly observation.

2-606.03. Snow depth.--The depth of snow and ice on the ground at each six-hourly observation will be entered to inches and tenths. When the depth is 0.05 inch or less, "T," denoting "trace," will be entered. When no snow is on the ground, 0.0 will be entered. In the column captioned "Midnight," enter the amount of snow and ice on the ground at midnight.

2-606.04. Maximum and minimum temperatures.--The maximum and minimum temperatures for the preceding six hours will be entered to degrees and tenths Fahrenheit. These data will not be taken from hourly observations, although they must be at least as high and low, respectively, as any temperature recorded in the preceding six hours. In the column captioned "Midnight," enter the maximum and minimum temperatures for the period between midnight and the preceding six-hourly observation. These data will be taken at midnight from maximum and minimum thermometers if available. If they are not available and a thermograph is, the data may be taken from the thermograph. If neither maximum and minimum thermometers nor a thermograph are available, the entries will be omitted.

2-606.05. 5,000 ft. Pressure.--Stations computing the 5,000 ft. pressure will enter the value in millibars and tenths.

2-606.06. Relative humidity %.--The relative humidity will be entered to the nearest whole per cent.

2-606.07. Soil temperature.--Soil temperature will be entered to degrees and tenths Fahrenheit at designated stations.

2-606.08. State of ground.--Entries for the state of ground will be made in terms of the International Code No. 24, as follows:

Code Figures		Description
0	Ground	dry.
1	"	wet.
2	"	flooded.
3	"	frozen hard and dry.
4	"	partly covered with snow or hail.
5	"	covered with ice or glazed frost.
6	"	covered with thawing snow.
7	"	covered with snow less than 15 cm (6 inches) but ground not frozen.
8	"	covered with snow less than 15 cm (6 inches) and ground frozen.
9	"	covered with snow greater than 15 cm (6 inches) deep.

Note: The following instructions concerning sea conditions will apply to designated stations only.

2-606.09.--Sea, state and direction.--State and direction of the sea refers only to the condition of the sea surface resulting from the action of winds prevailing in the immediate local area. It should be noted that it is possible for a "flat, oily" sea to exist concurrently with a "light," "moderate," or even "heavy" swell.

2-606.091. The state of the sea is recorded as a code figure in accordance with the following table:

Code Figures	Description	Approximate Average Wave Height, Feet
0	Flat, oily	0
1	Calm rippled	0
2	Smooth (wavelets)	1
3	Slight	1 - 3
4	Moderate	3 - 5
5	Rough	5 - 8
6	Very rough	8 - 12
7	High	12 - 20
8	Very high	20 - 40
9	Mountainous	More than 40

2-606.092. The direction of the sea is that direction, to eight points of the compass, from which the sea is coming. It is recorded by an arrow.

Example: A rough sea (waves 5 - 8 feet) from the southwest would be recorded as "5↗."

2-606.10. Swell, height, and direction.--The term "swell" is restricted in usage to that wave motion which underlies the "sea" raised and driven by the local wind. Swell usually has travelled over a considerable distance from the point where it was generated by the wind, and its direction may often differ widely from the direction of the local wind-driven waves ("sea"). It should also be noted that there may be no swell when the sea condition takes any of the values described above.

2-606.101. Height of swell is recorded as that estimated average height of swell in the open sea, measured in whole feet from crest to trough.

2-606.102. Direction of swell is that direction, to eight points of the compass, from which the swell is coming. It is recorded by an arrow.

Example: A three-foot swell from the west would be recorded as "→3."

2-606.11. Swell period.--Swell period is the average time between successive crests, measured to the nearest second. The swell period usually can be observed best by watching the rise and fall in the swell of a patch of foam or other floating object. When the elapsed time, measured by a stop watch, of ten successive rises of such an object has been obtained, a good average period may be recorded by taking one-tenth of this value.

2-606.12. Surf.--A five-figure code comprises the "Primary Data Group" of the combined Surf Code (SURFCO). It will be entered every six hours by those stations (and ships when appropriate) having means of observing surf conditions. The symbolic code form for this group is printed on present supplies of WBAN-10A as $L_bL_sK_sP_sD$. This should be deleted and the following substituted: $H_sH_sM_sP_sD_s$.

2-606.121. Primary surf data group.--A five-figure code group, symbol form $H_sH_sM_sP_sD_s$.

2-606.122. Symbol H_sH_s.--Average height of waves in feet.
99 indicates average height impossible to estimate.
Two figures to be entered for whole feet.
(Example: 01 for 1 foot, 12 for 12 feet, etc.)

2-606.123. Symbol M_s.--Difference between height of maximum waves and average waves in a five-minute interval. Third figure of group to be entered in accordance with the following code table.

Code No.	Difference between height of maximum waves and average waves
0	- 0
1	- 1 foot
2	- 2 feet
3	- 3 feet
4	- 4 feet
5	- 5 feet
6	- 6 feet
7	- 7 feet
8	- 8 feet
9	- Greater than 8 feet except when H_sH_s is reported as 99, in which case this figure means that an estimate is impossible.

2-606.124. Symbol P_s.--Period, i.e., time between passage of successive breakers at a fixed point. Fourth figure of group to be entered in accordance with the following code table.

Code No.	Time between successive breakers
0	No surf
1	Less than 5 seconds
2	5 or 6 seconds
3	7 or 8 seconds
4	9 or 10 seconds
5	11 or 12 seconds
6	13 to 15 seconds
7	16 to 18 seconds
8	Greater than 18 seconds
9	Time impossible to estimate

2-606.125. Symbol D_s.--Angle of breakers with the beach and direction of wave travel (referred to observer on beach facing the sea). Fifth figure of group to be entered in accordance with the following code table.

Code No.	Angle of breakers with the beach
0	Calm
1	0° up to 10° from the left
2	10° up to 20° from the left
3	More than 20° from the left
4	Confused, but predominantly from the left
5	0° up to 10° from the right
6	10° up to 20° from the right
7	More than 20° from the right
8	Confused, but predominantly from the right
9	Not known

2-606.13. Barograph reading.--This entry will be made to the nearest 0.005 inch or 0.2 millibar.

2-606.14. Attached thermometer.--Enter the reading of the attached thermometer of the mercurial barometer to the nearest 0.5 degree Fahrenheit.

2-606.15. Observed reading.--Enter the uncorrected observed reading of the mercurial barometer to the nearest 0.001 inch.

2-606.16. Total correction.--Enter the sum of all corrections required to reduce the observed reading to station pressure. Note that the entry for station pressure, required in Column (25) at six-hourly periods, is the observed reading plus or minus the total correction. Also note that the difference between the "barograph reading" entry and the "station pressure" entry, required in Column (25) at the six-hourly observation, is the correction to be applied to barograph readings until the mercurial barometer is read again and a new correction established.

2-607.0. Remarks, notes, and miscellaneous phenomena.--All first-order Weather Bureau stations and such other stations as are designated will enter all pertinent information, including times of occurrence, beginnings and endings, when appropriate, concerning changes of air masses attending frontal passages determined from synoptic maps, severe storms, miscellaneous hydrometeors, floods, and snow surface temperature data.

2-607.01. Precipitation and thunderstorms.--In addition, enter times of beginnings and endings, to the nearest minute, of thunderstorms, precipitation, changes in type of precipitation, and changes in intensity of thunderstorms and precipitation. Intervals of 15 minutes or less between the time of ending and recommencement need not be recorded unless occurring within one hour previous to the time of a six-hourly observation, when all beginnings and endings will be recorded. This also applies to changes in intensity that do not last more than 15 minutes. The intensity, direction of movement, distance, etc., of thunderstorms and the type and intensity of precipitation may be entered in authorized abbreviations or symbols. If the space is insufficient, continue the notes on the reverse side of the form.

2-607.02. Fog.--Enter times of beginnings and endings of each type and intensity.

2-607.03. Haze, smoke, dust, sand.--Enter times of beginnings and endings.

2-607.04. Hailstorms.--Enter all available information, such as size of hailstones, damage caused, etc.

2-607.05. Tornado.--Enter as complete information as possible on time, path, size of the storm, its appearance, direction of movement, damage, etc.

2-607.06. Lightning.--Enter notes on distance, direction, frequency, etc., of lightning which is observed when a thunderstorm is not in progress at the station; i.e., when no thunder is heard.

2-607.07. Harbor ice.--Enter appropriate data on quantity, thickness, character, breaks, size of floes, persistence, conditions of aircraft landing area, conditions affecting the transfer of passengers from craft of all types, and any other conditions worthy of note.

2-607.08. Miscellaneous.--Phenomena sent in synoptic messages as special phenomena groups, such as frost, glaze, etc., will also be entered.

2-607.09. Since there will always be a time lapse between the occurrence or cessation of phenomena, it will not be necessary to reconcile the differences in time entered under "Remarks, Notes, and Miscellaneous Phenomena" with the time entries pertaining to the observations reporting their occurrence or cessation.

CHAPTER III

WB FORM 1135, "PRESSURE-REDUCTION DATA"

(Cancelled effective July 1, 1945)

CHAPTER IV

FILING OF FORMS

2-621.0.--The Regional Offices will issue instructions concerning filing of WB Forms 1130A, 1130B, and 3024B.

CHAPTER V

WB FORM 1144, STATION RECORD

2–622. This is a form used at the Central Office and general supervising stations for keeping a condensed record of details concerning stations. A new form shall be completed in quadruplicate and rendered as of April 15 of each year. The original and two carbon copies will be forwarded to the general supervising station of the airway district in which the station is located and one copy will be retained for the station files. The general supervising station will examine the entries, initial the form, and forward the original and first carbon copy to the Central Office as promptly as possible. It is essential that the data on this form be kept up to date. In order to assure this, supplemental renditions for any changes occurring at stations will be forwarded, *within 6 days of such changes*, to the Central Office (in duplicate) and to the general supervising station; only the changed data need be entered thereon. In the event that the changed data are so numerous as to make it impractical to correct the complete copies held on file at the general supervising stations and the Central Office, a complete rendition should be made instead of the supplement. The rendition of complete and supplemental copies is to be made by *all* first-order stations. First-order stations having direct supervision over airway and off-airway stations will also render complete and supplemental copies for each substation over which it exercises direct supervision. If a new station is opened, a new form will be rendered. The station records carried at the general supervising stations and the Central Office are to be exact duplicates. Officials making inspections need prepare and submit a supplemental form for stations inspected only when changes have occurred that affect previous entries or require new ones on the form.

CHAPTER VI

WB FORM 1146, "PRESSURE-REDUCTION DATA"

2–623. This form will be prepared for stations reporting 5,000-foot pressure and for that pressure only, and under the supervision and instructions of the Weather Bureau Airport Station, San Francisco, Calif.

PART VII.—6-HOURLY AND 3-HOURLY WEATHER-REPORTING SERVICE

(A) 6-HOURLY SERVICE

CHAPTER I

TYPES OF 6-HOURLY REPORTS

2–700. Need for and Definitions of Various Types of 6-Hourly Reports.—The primary purpose of the 6-hourly system is to provide adequate data for the preparation of weather maps upon which to base airway weather forecasts. Accordingly, the collections must be quite comprehensive. The following major groups of reports are transmitted on all teletype and radio circuits for this purpose:

(*a*) *Teletype map reports* ("MT").—These are complete meteorological reports made at stations located on teletype or radio circuits and enciphered in the authorized numeral weather code. Sequences run on individual teletype and radio circuits are then relayed to all other circuits in the country.

(*b*) *Map reports* ("M").—These are complete meteorological reports made at stations not located on teletype or radio circuits and enciphered in the authorized numeral weather code. Their method of distribution differs from that of teletype map reports in that they are collected by various methods and transmitted in groups from Chicago, Washington, and San Francisco.

(*c*) *Special 6-hourly data added to sequence collection reports.*—Regular hourly airway sequence reports to which certain data are added for use on synoptic maps. Sequences run on individual teletype and radio circuits are then relayed to other circuits.

CHAPTER II

INSTRUCTIONS FOR 6-HOURLY SERVICE

2–701. Complete description of and instructions for 6-hourly service are contained in appendix II to this circular. Instructions for preparation of Form 1083 are contained in part VIII following.

(B) 3-HOURLY SERVICE

CHAPTER III

INSTRUCTIONS FOR MAKING AND TELEGRAPHING 3-HOURLY REPORTS

2–702. Three-hourly reports shall be telegraphed by those stations which have been designated to do so at 4:30 and 10:30 a. m. and p. m., E. S. T., to the general supervising station in whose district they are located, unless otherwise arranged. These reports will consist of a regular coded observation, made in accordance with instructions contained in appendix II to this circular. Such reports shall be recorded on WB Form 1082 and the instructions for preparation of this form are contained in part VIII, following.

PART VII.—6-HOURLY AND 3-HOURLY WEATHER-REPORTING SERVICE

(A) 6-HOURLY SERVICE

CHAPTER I

TYPES OF 6-HOURLY REPORTS

2–700. Need for and Definitions of Various Types of 6-Hourly Reports.—The primary purpose of the 6-hourly system is to provide adequate data for the preparation of weather maps upon which to base airway weather forecasts. Accordingly, the collections must be quite comprehensive. The following major groups of reports are transmitted on all teletype and radio circuits for this purpose:

(*a*) *Teletype map reports* ("MT").—These are complete meteorological reports made at stations located on teletype or radio circuits and enciphered in the authorized numeral weather code. Sequences run on individual teletype and radio circuits are then relayed to all other circuits in the country.

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PART VIII.—INSTRUCTIONS FOR PREPARATION AND DISTRIBUTION OF METEOROLOGICAL FORMS USED FOR 3- AND 6-HOURLY SYNOPTIC REPORTS

CHAPTER I

WB FORM 1082, 3-HOURLY SYNOPTIC REPORTS

2-800. Purpose and Use of Form 1082.—This form is to be used at off-teletype stations, listed in appendix II to this circular, for recording the 3-hourly observations taken at 4:30 and 10:30 a. m. and p. m., E. S. T. Accordingly, it will constitute the original record of 3-hourly synoptic observations.

2-801. Heading and Time Entries.—Station, month, day, year, time, and the meridian time in local use entries will be made as called for on the form. Time entries will be made in local standard time.

2-802. Use of Both Sides of the Form.—One side of the sheet will be used for the observations of one day and the reverse side for the observations of the succeeding day, except that the observations for the last day of one month will not be included on the same sheet with the observations for the first day of the next month.

2-803. Entries on Individual Lines.—Data will be entered in pencil. Instructions for entering data on WB Form 1083 will also govern the entry of *similar* data on WB Form 1082. The following table is given to facilitate the finding of instructions for each line of WB Form 1082 corresponding to the line requiring similar data on Form 1083:

LINE NUMBERS

Form 1082	*Form 1083*	*Form 1082*	*Form 1083*	*Form 1082*	*Form 1083*	*Form 1082*	*Form 1083*
1	2	9	46	17	8	25	18
2	3	10	47	18	9	26	19
3	4	11	48	19	10	27	20
4	5	12	49	20	13	28 [1]	21
5	6	13	50	21	14	29 [1]	22
6	43	14	51	22	15	30	41
7	44	15	52	23	16		
8	45	16	7	24	17		

[1] A dash will be entered if no precipitation or thunderstorm has occurred since the observation taken 3 hours previously.

2-804. Coding.—Data to be enciphered in code, Weather Code (Numeral System) 1939, in the proper blocks at the top of the form, for telegraphing are indicated for each observation by solid underlining: Data to be enciphered in one code group are indicated to the left of the observation columns by heavy black borders to the left and above and below each code group. The last code group ($6R_cR_t$) will not be enciphered or telegraphed unless precipitation or a thunderstorm has occurred since the observation taken 3 hours previously and when telegraphed will be composed of only three figures.

2-805. Binding and Disposition.—The forms for each month will be placed in chronological order and bound by two staples placed at the top corners. Second-order stations will forward these forms at the end of each month in the same manner and to the same station as WB Form 1083. First-order stations using the form will check the observations thoroughly and, unless otherwise instructed by the Central Office or general supervising station, place the forms in the station files.

PART VIII.——INSTRUCTIONS FOR PREPARATION AND DISTRIBUTION OF METEOROLOGICAL FORMS USED FOR 3- AND 6-HOURLY SYNOPTIC REPORTS.

Chapter I

WB FORM 1082, 3-HOURLY SYNOPTIC OBSERVATIONS

2-800. **Purpose and Use of WB Form 1082.**—This form is to be used at stations, listed in appendix II to this circular, for recording the 3-hourly synoptic observations taken at 4:30 and 10:30 a.m. and p.m.; E.S.T. Accordingly, it will constitute the original record of 3-hourly synoptic observations.

2-801. **Heading and Time Entries.**—Station, month, day, year, time, and the meridian time in local use entries will be made as called for on the form. Time entries will be made in local standard time.

2-802. **Use of Both Sides of the Form.**—One side of the sheet will be used for the observations of one day and the reverse side for the observations of the succeeding day, except that the observations for the last day of one month will not be included on the same sheet with the observations for the first day of the next month.

2-803. **Entries on Individual Lines.**—Data will be entered in pencil. Instructions for entering data on WB Form 1083 will also govern the entry of *similar* data on WB Form 1082, and to facilitate reference to instructions, lines requiring similar data on the two forms are given the same number.

2-804. **Coding.**—Data will be coded, in the proper blocks at the bottom of the form, in accordance with instructions in the 1942 Weather Code (Numeral System).

2-805. **Binding and Disposition.**—The forms for each month will be placed in chronological order and bound by two staples placed at the top corners. Second-order stations will forward these forms at the end of each month in the same manner and to the same station as WB Form 1083. First-order stations using the form will check the observations thoroughly and unless otherwise instructed by the Central Office or Regional Office, place the forms in the station files.

Chapter II

WB FORM 1083, 6-HOURLY SYNOPTIC OBSERVATIONS

2-806. **Purpose and Use of WB Form 1083.**—This form is to be used for the recording of 6-hourly observations ("M" and "MT") for synoptic purposes, and shall be used for this purpose at all stations rendering such observations. Accordingly, it will constitute the original record of 6-hourly synoptic observations. Lists of stations rendering such reports are contained in appendix II to this circular. In addition, some stations adding special 6-hourly data to sequence-collection reports will also prepare WB Form 1083 complete, except that in such cases data need not be coded in the blocks at the bottom of the form.

2-807. **Time of Starting Observation.**—The observations will be started at 1:10 and 7:10 a.m. and p.m., E.S.T., except that when it is necessary to measure the ceiling height by means of ceiling balloons, this may be accomplished prior to the 20-minute period allowed for taking of the observation. Also at off-teletype points it may be necessary to start the observations a few minutes earlier in order for the reports to reach teletype collection centers in sufficient time for entry on Schedule "C".

PART VIII.—INSTRUCTIONS FOR PREPARATION AND DISTRIBUTION OF METEOROLOGICAL FORMS USED FOR 3- AND 6-HOURLY SYNOPTIC REPORTS.

CHAPTER I

WB FORM 1082, 3-HOURLY SYNOPTIC OBSERVATIONS

2-800. Purpose and Use of WB Form 1082.--Cancelled effective July 1, 1945, or upon receipt of WB Form 1083, Revised, "Pressure Computation and Coding Form (3- and 6-Hourly Synoptic Observations)." See instructions in Chapter II below.

CHAPTER II

WB FROM 1083, 6-HOURLY SYNOPTIC OBSERVATIONS

2-806. Purpose and Use of WB Form 1083, Revised.--Effective July 1, 1945, or upon receipt, WB Form 1083, Revised, "Pressure Computation and Coding Form (3- and 6-Hourly Synoptic Observations)," is to be used at stations taking 3- and 6-hourly synoptic observations. Stations adding special 3- and 6-hourly data to sequence-collection reports will use WB Form 1083, Revised, for pressure computation.

2-807. Time of Starting Observation.--The observations will be started just sufficiently in advance of the filing time to permit of accurate evaluation of all the elements in the observation. At off-teletype points it will be necessary to start the observations in sufficient time to provide for the reports' reaching teletype collection centers for entry on Schedule "C."

CHAPTER II

WB FORM 1083, 6-HOURLY SYNOPTIC REPORTS

2-806. Purpose and Use of WB Form 1083.—This form is to be used for the recording of 6-hourly observations ("M" and "MT") for synoptic purposes, and shall be used for this purpose at all stations rendering such observations. Accordingly, it will constitute the original record of 6-hourly synoptic observations. Lists of stations rendering such reports are contained in appendix II to this circular. In addition, some stations adding special 6-hourly data to sequence-collection reports will also prepare WB Form 1083 complete, except that in such cases data need not be coded in the blocks at the top of the form.

2-807. Time of Starting Observation.—The observations will be started at 1:10 and 7:10 a. m. and p. m., E. S. T., except that when it is necessary to measure the ceiling height by means of ceiling balloons, this may be accomplished prior to the 20-minute period allowed for taking of the observation.

2-808. Order of Obtaining Elements.—Conditions will be noted and instruments read in the following order: (1) Visual elements (ceiling, sky, visibility, state of weather, etc.); (2) thermometers; (3) precipitation gage; (4) attached thermometer to barometer; (5) barometer; (6) barograph; and (7) wind velocity and direction indicator.

2-809. Weather Bureau Rule for Disposing of Decimals.—In disposing of decimals, if the last figure is greater than 5 (or is 5 with a remainder) the preceding figure will be increased by 1. If the figure is 5 exactly, the preceding figure will be increased by 1 when odd, and when even it will remain unchanged (in this case the result will always be an even number). If the last figure is less than 5, retain the preceding figure unchanged. For example, 70.*51* would be 71; 70.*5* would be 70; 69.*5* would be 70; 29.98*5* would be 29.98; 29.97*5* would be 29.98, etc.

2-810. Method of Making Entries.—Entries will be made in accordance with the printed instructions supplied with the forms, and those instructions should be closely followed.

2-811. Coding.—Data will be coded, in the proper blocks at the top of the form, in accordance with instructions in the Weather Code (Numeral System) 1939, when prepared for "M" or "MT" reports.

2-812. Binding and Disposition.—The forms for each month will be placed in chronological order and bound together with the cover by means of two staples, one near each corner of the top margin. Printed instructions need be bound only with the forms for January of each year, except that when revision to the instructions for preparation is made, a copy of the corrected instructions will be bound with the forms for the first month in which the revision is effective. The form containing the last two observations of one month and the first of the following month will be bound with the forms for the first month. Stations sending the forms to Elkins, W. Va., will mail them unbound, and the binding will be accomplished at that point. Also, for second-order stations not equipped with a punch and staples, the binding will be done at the checking stations. Instructions to second-order stations for mailing date and destination of these forms will be issued by the general supervising station. After pay-roll preparation, checking, etc., has been accomplished, these forms should be sent to the proper section center for permanent filing. At first-order stations, these forms will be *thoroughly* checked and eventually filed locally. Where stations forward the forms to Elkins, permanent filing cannot, of course, be affected until they have been returned from the latter point. In cases where there are two offices serving the same city and the airport station takes the 6-hourly observations, the forms will be filed at the city office unless filing space is not available or other circumstances make it advantageous that they be filed at the airport station.

CHAPTER III

WB FORM 1083-A

2-813. Purpose and Use of WB Form 1083-A.—This form may be used for recording elements taken outdoors when inclement weather makes it inadvisable to carry

2-808. Order of Obtaining Elements.—Conditions will be noted and instruments read in the following order: (1) Visual elements (sky, ceiling, visibility, state of weather, etc.); (2) thermometers; (3) precipitation gage; (4) attached thermometer to barometer; (5) barometer; (6) barograph; and (7) wind velocity and direction indicator.

2-809. Weather Bureau Rule for Disposing of Decimals.—In disposing of decimals, if the last figure is greater than 5 (or is 5 with a remainder) the preceding figure will be increased by 1. If the figure is 5 exactly, the preceding figure will be increased by 1 when odd, and when even it will remain unchanged (in this case the result will always be an even number). If the last figure is less than 5, retain the preceding figure unchanged. For example, 70.51 would be 71; 70.5 would be 70; 69.5 would be 70; 29.985 would be 29.98; 29.975 would be 29.98 etc.

2-810. Method of Making Entries.—Entries will be made in accordance with the printed instructions supplied with the forms, and those instructions should be closely followed.

2-811. Coding.—Data will be coded, in the proper blocks at the bottom of the form, in accordance with instructions in the 1942 Weather Code (Numeral System), when prepared for "M" or "MT" reports.

2-812. Binding and Disposition.—The forms for each month will be placed in chronological order and bound together with the cover by means of two staples, one near each corner of the top margin. Printed instructions need be bound only with the forms for January of each year, except that when revision to the instructions for preparation is made, a copy of the corrected instructions will be bound with the forms for the first month in which the revision is effective. ~~The form containing the last observation of one month and the first three of the following month will be bound with the forms for the first month.~~ Cancelled 7-1-45. Stations sending the forms to Elkins, W. Va., will mail them unbound, and the binding will be accomplished at that point. Also, for second-order stations not equipped with a punch and staples, the binding will be done at the checking stations. Instructions to second-order stations for mailing date and destination of these forms will be issued by the Regional Office. After pay-roll preparation, checking, etc., has been accomplished, these forms should be sent to the proper section center for permanent filing. At first-order stations, these forms will be thoroughly checked and eventually filed locally. Where stations forward the forms to Elkins, permanent filing cannot, of course, be affected until they have been returned from the latter point. In cases where there are two offices serving the same city and the airport station takes the 6-hourly observations, the forms will be filed at the city office unless filing space is not available or other circumstances make it advantageous that they be filed at the airport station.

Chapter III

WB FORM 1083A

2-813. Purpose and Use of WB Form 1083A.—This form may be used for recording elements taken outdoors when inclement weather makes it inadvisable to carry

1130A

WB Form ~~1083~~. This form is not required, but is provided for the convenience of the observer and to facilitate neatness on WB Form ~~1083~~. 1130A

2–814. Entries.—Entries need be made for only the data desired. ~~These will be transferred *immediately* to WB Form 1083 and checked for accuracy in transferring, before proceeding with the observation. If this form is used at the 3-hourly synoptic observations, extreme care should be used in transferring the data to WB Form 1082, as the line numbers on the two forms do not correspond.~~ Cancelled 7-1-45.

2–815. Filing and Disposition.—This form, when used, will be kept on file at the preparing station for 3 months, after which it may be disposed of.

Chapter IV

WB FORM 1009

2–816. This form is prepared at certain designated stations in order to provide a condensed monthly meteorological record. In some instances the form is prepared by the Section Centers or checking stations for substations. In view of the fact that the form is used by a large number of cooperative climatological observers who take only one observation daily, the instructions bound with the form are prepared for use by these cooperative observers. At stations where WB Form 1009 is prepared on a basis of 6-hourly observations, special instructions are issued and the instructions on the cover of the form should *not* be used. Substations are instructed by the General Supervising station as to the proper routing and disposition of the forms.

WB Form 1083. This form is not required, but is provided for the convenience of the observer and to facilitate neatness on WB Form 1083.

2–814. Entries.—Entries need be made for only the data desired. These will be transferred *immediately* to WB Form 1083 and checked for accuracy in transferring, before proceeding with the observation. If this form is used at the 3-hourly synoptic observations, extreme care should be used in transferring the data to WB Form 1082, as the line numbers on the two forms do not correspond.

2–815. Filing and Disposition.—This form, when used, will be kept on file at the preparing station for 3 months, after which it may be disposed of.

CHAPTER IV

WB FORM 1009

2–816. This form is prepared at certain designated stations in order to provide a condensed monthly meteorological record. In some instances the form is prepared by the Section Centers or checking stations for substations. In view of the fact that the form is used by a large number of cooperative climatological observers who take only one observation daily, the instructions bound with the form are prepared for use by these cooperative observers. At stations where WB Form 1009 is prepared on a basis of 6-hourly observations, special instructions are issued and the instructions on the cover of the form should *not* be used. Substations are instructed by the General Supervising station as to the proper routing and disposition of the forms.

PART IX.—CODE USED IN REPORTING PILOT BALLOON OBSERVATIONS

CHAPTER I

GENERAL INFORMATION

2–900. Scope of Pilot Balloon Work.—Pilot-balloon observations of upper air wind directions and velocities are made four times daily at approximately 5 o'clock and 11 o'clock, a. m. and p. m., 75th meridian time (0500, 1100, 1700 and 2300 eastern standard time). Pilot-balloon observations are made at approximately 130 strategic locations in the continental United States by the U. S. Weather Bureau. At a number of additional points similar observations are made by other agencies. The Weather Bureau, and others, also make pilot-balloon observations in Alaska, Canada, Puerto Rico, Swan Island, Canal Zone, Cuba, Mexico, Central America, Hawaii, certain Pacific Islands, and on vessel stations at sea.

2–901. Transmitted Reports.—Reports of pilot-balloon observations, with certain exceptions, are transmitted four times daily over the Civil Aeronautics Administration national teletype circuits in regular designated sequences. The code used in such transmissions, or transmissions made by telegraph, is described in the following chapter.

CHAPTER II

DESCRIPTION OF CODE

2–902. General Composition of Code.—All pilot-balloon observations are reported by means of a numeral code in which the direction and velocity of the winds at specified altitudes are given by individual groups composed of four or five figures each. The figures within a group, and the groups within a message, are always arranged in a specified order which facilitates the coding and decoding of the observed data.

2–903. Order of Data in Report.—Complete reports consist of the following: (*a*) Station designator, (*b*) time of observation, (*c*) surface-wind data, and (*d*) wind data for *standard* levels above sea level, in accordance with instructions.

2–904. Coding Station Designator.—The first group of the pilot-balloon code consists of two (or three) letters and two figures. The letters used are the regular Civil Aeronautics Administration two- (or three-) letter designators or call letters for the station at which the observation was taken. Examples: OA for Oakland, WA for Washington, MB for Binghamton. The code symbol I_1I_1 is used for two-letter designators and the symbol $I_1I_1I_1$ for three-letter designators.

2–905. Coding Time of Observation.—The time the observation was taken is coded by two figures representing the nearest whole hour and are always included in the first group of the report; 75th meridian (eastern standard) time, on a 24-hour-clock basis, is always used in coding the time pilot-balloon observations were taken at land stations, and ship stations will indicate the time using the 24-hour-clock system in Greenwich civil time. The code symbol used for time of observation is G_1G_1. (05= 5 a. m.; 11=11 a. m.; 17=5 p. m.; 23=11 p. m.).

In order that the approximate mean time of the observation may be coded, 20 minutes is added to the time when balloon was actually released, and this new time is used for all coding and transmission purposes. However, if the total length of the observation is less than 20 minutes, only the *actual* number of minutes of the observation will be added to the time of the balloon's release, instead of the 20 minutes otherwise added.

Example: Denver, Colo., balloon released at 2:12 p. m., 105th meridian time; by adding 20 minutes the time used for coding is 2:32 p. m.; the nearest whole hour is 3 p. m., 105th meridian time, or 5 p. m., 75th meridian time. This is 1700 on the 24-hour-clock system. Accordingly, the value reported for G_1G_1 is "17". However, if the balloon were observed only 14 minutes, the new time used would be 2:26 p. m. (4:26 E. S. T.), the nearest whole hour would be 4:00 p. m., E. S. T., and the code figure reported for G_1G_1 would be "16".

2-906. Coding Wind Direction.—Wind direction is always coded by two figures. The code symbol is *DD*. The true wind direction is coded to 36 points, in which 09 is an east wind, 18=south; 27=west; and 36=north. Calm is coded by the figures "00". The actual direction *from which* the wind is blowing, expressed in degrees, is divided by 10 and then coded to the nearest whole number, in accordance with the usual Weather Bureau rule, wherein the nearest even unit number is used when the decimal is exactly five tenths. Examples: 76°=7.6 or 08; 125°=12.5 or 12; 179°=17.9 or 18; 250°=25.0 or 25; 315°=31.5 or 32; and 358°=35.8 or 36. A table covering all wind directions is given below. As explained under paragraph 2-907, the coded value for *DD* is increased by 50 whenever the coded velocity is 100 or more miles per hour.

DIRECTION CODE

Code figure	Direction in degrees	Code figure	Direction in degrees	Code figure	Direction in degrees	Code figure	Direction in degrees
00	Calm	10	95-105	20	195-205	30	295-305
01	6-14	11	106-114	21	206-214	31	306-314
02	15-25	12	115-125	22	215-225	32	315-325
03	26-34	13	126-134	23	226-234	33	326-334
04	35-45	14	135-145	24	235-245	34	335-345
05	46-54	15	146-154	25	246-254	35	346-354
06	55-65	16	155-165	26	255-265	36	355- 5
07	66-74	17	166-174	27	266-274		
08	75-85	18	175-185	28	275-285		
09	86-94	19	186-194	29	286-294		

2-907. Coding Wind Velocity.—Wind velocity is always coded by two figures. The code symbol is *vv* and the values used are always *miles per hour*.

(*a*) For observed wind velocities up to 99 miles the actual velocities are to be coded, using two figures (01, 02, 03, ------99). The code figures "00" are used when there is no velocity (calm), i. e., when the velocity is less than 0.5 meter per second or 1 mile per hour. Whenever the velocity is coded as "00" the direction should always be coded as "00" also.

(*b*) For observed wind velocities of 100 to 199 miles per hour the actual velocity will be reduced by 100 and the remainder will be coded for symbol *vv*. The true velocity will be indicated in the coded report by adding 50 to the number representing true wind direction and coding the sum for symbol *DD*. Example: A wind direction of 260° and velocity of 94 miles per hour at 8000 feet is coded as "82694", but if the velocity is 104 miles per hour it is coded as "87604".

(*c*) For observed wind velocities of 200 miles per hour, or over, the actual velocity will be reduced by 200 and the remainder will be coded for symbol *vv*. The true velocity will be indicated by inserting a slant between the coded figures used for *DD* and *vv*. As in the case for velocities of 100 to 199 miles per hour, 50 is added to the number representing true wind direction and the sum coded for symbol *DD*. Examples: A true wind direction of 280°, with velocity at 214 miles per hour, occurring at 14,000 feet, is coded as 478/14.

2-908. Levels for Which Data are Sent.—Pilot-balloon reports contain observed values for wind directions and velocities *at the surface* and *at all standard levels*. Wind directions and velocities for levels *which are not standard levels* are never sent. *Standard*

levels occur at 1,000-foot intervals from *sea-level* up to and including 15,000 feet. Above 15,000 feet the standard levels occur at 5,000-foot intervals (20,000; 25,000; 30,000; 35,000; 40,000; 45,000, etc.)

When the altitude of a station *is less than 200 feet below* a particular *standard level*, the wind data for that particular *standard level* will be omitted from the coded report, but data for all higher *standard levels* will be included. For example, where the elevation of the theodolite platform is 1,820 feet above sea level, it is *less* than 200 feet from the 2,000-foot *standard* level, and, accordingly, the first standard level above the surface for which wind data is coded in a report is the *3,000-foot level*, and *not* the 2,000-foot level. However, if the elevation of the theodolite platform at a station is exactly 1,800 feet (or below 1,800 feet), the observed wind data for the 2,000-foot *standard* level will be included in the coded report from that station.

2-909. Maximum Altitude Data.—Obviously, a coded pilot-balloon report should not have wind data for *standard* levels which are lower than the elevation of a station, nor data for *standard* levels at elevations higher than the observed ascent of the balloon. However, whenever the maximum observed altitude of a balloon ascent is only a short and specified distance *below a standard level*, the data observed at this maximum altitude, *for coding purposes*, are presumed to exist also at the next highest standard level and are coded as though they actually were observed at the next highest *standard* level. Whenever the maximum observed altitude is 300 feet or less *below* any standard level up to and including 15,000 feet, the data for such maximum altitude will be coded for the next higher *standard* level. Whenever the maximum observed altitude is 1,000 feet or less *below* any standard level *above* 15,000 feet, the data for such maximum altitude will be coded for the next higher *standard* level.

Examples: When the maximum observed altitude of a balloon ascent is 7,750 feet (or 7,700 to 7,799 feet) and the wind direction and velocity are 260° and 15 miles per hour, the data would be coded for the next higher standard level, i. e., "82615".

When the maximum observed altitude is 24,500 feet (or 24,000 to 24,999 feet) and the wind direction and velocity are 310° and 67 miles per hour, the data would be coded for the next higher standard level, "53167".

When the maximum altitude observed is *more than 300 feet below* any *standard* level up to and including 15,000 feet, or is *more than 1,000 feet below* any *standard* level above 15,000 feet, the final group in a message will be the data observed at the *standard level immediately below* the maximum observed altitude, and a separate group for the maximum altitude data *will not be sent.*

2-910. Identifying Levels for Which Data Are Sent.—The presence or absence of specific identifying code figures is used to identify the particular levels for which data are coded. The code symbol for this identifying figure is H_a. The figures for code symbol H_a are *always* used to identify the particular standard levels listed below:

H_a	*Level*
0	Surface; 10,000; 20,000; 30,000; 40,000 feet, etc.
2	2,000; 12,000 feet.
4	4,000; 14,000 feet.
5	25,000; 35,000; 45,000 feet, etc.
6	6,000 feet.
8	8,000 feet.

Identifying code figures are *never* used to identify the following standard levels: 1,000; 3,000; 5,000; 7,000; 9,000; 11,000; 13,000; 15,000 feet.

2-911. Order of Symbols and Groups in Complete Report.—The order of the symbols in a group and of the groups in a complete message is as follows:

$I_1I_1I_1G_1G_1$ (or $I_1I_1G_1G_1$) H_aDDvv $DDvv$ H_aDDvv $DDvv$ . . . . H_aDDvv H_aDDvv H_aDDvv . . . .

NOTE.—The above order is used at stations whose elevations are above sea level, or 2,000, 4,000, 6,000, 8,000 and 10,000 feet *and which also are more than 200 feet below* the standard levels 1,000, 3,000, 5,000, 7,000, 9,000 or 11,000 feet, respectively.

Pilot-balloon stations whose elevations are *above* 1,000 or 3,000, 5,000, 7,000 or 9,000 feet *and which also are more than 200 feet below* the standard levels 2,000, 4,000, 6,000, 8,000 or 10,000 feet, respectively, will use the following order:

$I_1I_1I_1G_1G_1$ (or $I_1I_1G_1G_1$) H_aDDvv H_aDDvv $DDvv$ H_aDDvv $DDvv$ . . . . H_aDDvv H_aDDvv H_aDDvv . . . .

The order of the symbols within a group, and of the groups within a pilot-balloon message from a *ship station*, is as follows:

YQLLL lllGG DDvv DDvv DDvv DDvv . . . . DDvv DDvv DDvv . . . .

2–912. Definition of Code Symbols:

$I_1I_1I_1$ (or I_1I_1) = Station Designator. (Letters are used.)
G_1G_1 = Time on 24-hour-clock system in eastern standard time.
H_a = Altitude of *standard level* for which data in that group applies.
DD = Wind direction (to nearest 10° points on a 360° compass).
vv = Wind velocity (in miles per hour).

Additional code symbols used by **ship stations** reporting pilot balloon observations:

Y = Day of week (G. C. T.).
Q = Octant of the globe.
LLL = Latitude in degrees and tenths. (The tenths being obtained by dividing the number of minutes by 6 and neglecting the remainder.)
lll = Longitude in degrees and tenths. (Tenths obtained as shown above.)
GG = Greenwich civil time of observation. (05 = 5 a. m.; 11 = 11 a. m.; 17 = 5 p. m.; 23 = 11 p. m., etc., GCT.)

NOTE.—A more complete definition of *Y*, *Q*, *LLL*, *lll*, and *GG* is given in W. B. 1046, entitled "International Code for Radio Weather Reports from Ships."

2–913. Examples of Coded Reports.—Some examples of representative reports are given below:

	Coded
A. *Observed data:*	
(*a*) Station—Cheyenne (6133 feet above sea level)	CX
(*b*) Time—3:02 p. m.; 105th meridian	17
(*c*) Surface—163°, 8 miles per hour	01608
7,000 feet—172°, 14 miles per hour	1714
8,000 feet—175°, 16 miles per hour	81816
9,000 feet—185°, 20 miles per hour	1820
10,000 feet—195°, 22 miles per hour	02022
11,000 feet—214°, 20 miles per hour	2120
12,000 feet—235°, 17 miles per hour	22417
12,720 feet—248°, 29 miles per hour	2529

Coded report;

CX17 01608 1714 81816 1820 02022 2120 22417 2529

NOTE.—In the above report the surface elevation is above 6,000 feet and below 6,800 feet and, accordingly, the first standard level above the surface level included in the report is 7,000 feet. Also, the maximum observed altitude is within 300 feet of the 13,000-foot standard level and, accordingly, the data are coded for the 13,000-foot level.

	Coded
B. *Observed data:*	
(*a*) Station—Kylertown (1688 feet above sea level)	KY
(*b*) Time—10:40 a. m. 75th meridian	11
(*c*) Surface—230°, 18 miles per hour	02318
2,000 feet—265°, 25 miles per hour	22625
3,000 feet—272°, 28 miles per hour	2728
4,000 feet—275°, 32 miles per hour	42832
5,000 feet—282°, 44 miles per hour	2844
6,000 feet—285°, 52 miles per hour	62852
7,000 feet—288°, 67 miles per hour	2967
8,000 feet—295°, 78 miles per hour	83078
9,000 feet—304°, 87 miles per hour	3087
10,000 feet—306°, 94 miles per hour	03194
11,000 feet—315°, 102 miles per hour	8202
12,000 feet—322°, 108 miles per hour	28208
13,000 feet—326°, 111 miles per hour	8311
14,000 feet—327°, 114 miles per hour	48314
15,000 feet—329°, 117 miles per hour	8317
20,000 feet—332°, 126 miles per hour	08326
25,000 feet—337°, 129 miles per hour	58429
28,051 feet—340°, 131 miles per hour	-----

Coded report:

KY11 02318 22625 2728 42832 2844 62852 2967 83078
3087 03194 8202 28208 8311 48314 8317 08326 58429

NOTE.—Since the maximum observed altitude (28,051 feet) is more than 1,000 feet below the next standard level, the data observed at the maximum altitude are not included in the message.

2–914. No Observation Reports.—In case an observation is not made or not received at point of transmission prior to the time of filing the report, a "no observation" report is filed, consisting of the following:

(*a*) Station designator.
(*b*) Time, on a 24-hour-clock, eastern-standard-time basis. (Ship stations will use Greenwich civil time.)
(*c*) Reason for no observation, using one of the following words:

PIBA—No balloons	PIIO—Instrument trouble
PICO—Low clouds	PIKO—Smoky
PIDU—Thick dust	PIRA—Raining
PIFI—Not filed	PISE—Unfavorable sea conditions
PIFO—Foggy	PISO—Snowing
PIHE—No gas	PIWI—High or gusty surface wind

Example: "CX05 PICO" would indicate that no pilot-balloon observation was made at Cheyenne at 5:00 a. m., eastern standard time, due to low clouds.

PART X.—CODE FOR DAILY TRANSMISSION OF RADIOSONDE (RAOB) AND AIRPLANE (APOB) WEATHER OBSERVATIONS

2–1000. Use of Code.—The following code supersedes all previous instructions concerning the transmission of the observations referred to above. The code will apply to raob and apob messages transmitted by teletype, telegraph, or radio.

2–1001. Code Form for Raobs from Land Stations.—The data generally to be coded in raob messages from land stations and the order in which they are to be grouped are shown in symbolic form below:

$$II(I)^1(Y_1)G_1G_1$$
$$HHPPT \quad TUUmm$$
$$HHPPT \quad TUUmm$$
etc.

(for surface and successive significant levels, as required).

$$P_aP_aP_bP_b \qquad P_cP_cP_dP_d \qquad P_eP_eP_fP_fP_gP_g$$

(for pressures at designated levels).

$$P_1P_1P_2P_2h_p \qquad N_cCdd$$
$$P_1P_1P_2P_2h_p \qquad N_cCdd$$
etc.

(for cloud types or layers, from none to three layers, as required, except that groups $P_1P_1P_2P_2h_p$ are included in the message only if the conditions of note (*a*), below, are fulfilled).

$$w_3P_3P_3P_4P_4$$
$$w_3P_3P_3P_4P_4$$
etc.

(for special phenomena, as required), see note (*b*), below.

$$\psi_x\psi_x\psi_y\psi_y\psi_z\psi_z$$
$$P_xP_xP_{sx}P_{sx}\theta_x \qquad \theta_xP_yP_yP_{sy}P_{sy} \qquad P_zP_zP_{sz}P_{sz}$$
$$D_1D_1S_1S_1D_2D_2 \qquad S_2S_2D_3D_3S_3S_3$$

(for isentropic data, as required).

$$w_4H_1H_1H_2H_2$$
$$w_4H_1H_1H_2H_2$$

(for icing, as required).

$$MMMM$$

(for termination of observations).
(for explanation of symbols see par. 2-1004.)

NOTES.—(*a*) Groups $P_1P_1P_2P_2h_p$ are included in raobs only for those cases where appropriate values of P_1P_1 are obtained by observational means (for example, ceiling observations by use of a ceiling light projector or ceiling balloon) and/or as provided in par. 2-1008.

(*b*) Whenever any of the phenomena represented by the symbol w_3 occur at the surface and the upper limit is unknown, the data for P_3P_3 will be the surface pressure, and slants will be used for the missing data for P_4P_4. If data for P_3P_3 or P_4P_4, or both, have been obtained from an aircraft pilot flying in the vicinity of the station near the time of the raob, then these data should be reported in accordance with par. 2-1008.

2–1002. Code Form for Raobs from Ships.—The code form for raobs from ships is identical with that for land stations except that the first group $II(I)(Y_1)G_1G_1$ is replaced by the word RAOB and the two numeral groups *YQLLL lllGG* which are taken from the International Ship Code. (See table 15.)

2–1003. Code Form for Apobs.—The code form for apobs is the same as for raobs except that groups $P_1P_1P_2P_2h_p$ are free from the restrictions specified in note (*a*) in paragraph 2–1001, and that groups $w_4H_1H_1H_2H_2$ are inapplicable.

[1] Certain modifications regarding the group II(I) may be required in the case of radio transmission. See remarks concerning that group in par. 2-1004.

* Part X (pp. 96-114c) superseded by the 1945 radiosonde code.

PART X.* CODE FOR DAILY TRANSMISSION OF RADIOSONDE (RAOB) AND AIRPLANE (APOB) WEATHER OBSERVATIONS

2-1000 Use of Code. The 1943 Radiosonde code supersedes all previous instructions concerning the transmission of Upper Air Soundings. The following is a *condensed* form; copies of the *complete* Radiosonde Code are available at the U.S. Weather Bureau, Washington, D. C.

2-1001 General Instructions. The code is composed of figure groups, each group being composed of five figures. Each figure of each group has a data significance which is identified by the position of the group in the message, and by the position of the figure in the group. Under all conditions the order of the symbols in a group, and the order of the groups in a message, will always be maintained.

Occasionally, for various reasons, complete observation data cannot be obtained. This might happen, for example, in the case of unserviceable instruments, extremely low temperatures, etc. In such cases the usual position of the data in the code group will be indicated by a special character (/), or by a particular figure (9), in accordance with instructions. This special character is referred to herein as a "slant". In radio communications "X" is used.

The complete radiosonde observation is encoded into two separate messages, and these two messages ordinarily are to be sent at separate times. Under usual conditions the first part of the message will be transmitted two or three hours earlier than the second part. However, when the complete radiosonde observation is transmitted as a single message instead of as two messages the same groups and coding procedures will be used. In this case all of the groups of the first part will be followed immediately by all of the groups of the second part, in their usual order.

Selected stations will add a date group to their first transmission reports when necessary to insure positive date identification to message recipients.

UNIVERSAL groups are always sent in a regularly transmitted raob message, insofar as the observed data permit. SUPPLEMENTARY groups are sent only in accordance with instructions issued to the individual stations, or in accordance with observed and computed data.

The following groups are classified as UNIVERSAL groups:

In first transmission:

$$IIIGG \quad PPPTT \quad UUH_5H_{10}H_{20} \quad PPTTU$$

In second transmission:

$$IIIG_{50}G_{50} \quad Y_mY_mH_{33}H_{43}H_{53} \quad PPTTU$$

SUPPLEMENTAL groups consist of *(a)* Mixing Ratio Data Groups, *(b)* Isentropic Data Groups, and *(c)* Additional Data Groups. Supplementary groups are always preceded by an "additional data designator" group, which has the symbol form $A_dA_dA_dA_{df}A_{df}$.

An important feature of this code that must be kept in mind to insure accurate encoding and decoding is that at least one level must be included in the coded report for each 100 mb of ascent. Also, complete PPTTU data are always included for the "mandatory" levels of 5,000, 10,000, and 20,000 feet, and for the 400 mb level (in the first transmission), and for the 10, 13, and 16 km levels (in the second transmission); provided, of course, such heights are reached. In addition, "significant data" levels are included in the report in accordance with instructions.

All amendments prior to 9/1/43 have been included.

* Part X superseded by The 1945 Radiosonde code. (by Circular Letter 32-46)

2-1004. Explanation of Symbols.—(Parentheses about a symbol indicate that the corresponding code numeral or letter is included only under certain conditions.)

II(I)=Station call letters, ordinarily two in number, used in transmission by—

1. Teletype.
2. Telegraph.
3. Point-to-point radio communication.

(In the major weather bulletins broadcast from the Naval Radio Stations at Washington, D. C., (NAA/NSS), and San Francisco, Calif., (NPG), the name of the observation station spelled out (omitting the State or Territory) is used in lieu of the call letters.)

(Y_1)=Day of the week on which the observation was made: 1=Sunday, 2=Monday, etc., 7=Saturday. The day will be reckoned according to 75th meridian time; for example, Thursday=5 will signify the period extending from 0001 to 2400 hours, Thursday, 75th meridian time. This code datum (Y_1) is to be included in the message *only* if the message is filed for transmission after the last scheduled period for raobs-apobs in the National Communication Schedule (teletype) of the Civil Aeronautics Administration for the day on which the observation is made.

G_1G_1=Time of launching (or take-off) to the nearest whole hour, 75th meridian time, on the 00–23 hour basis, e. g., 01 designates 1 a. m.; 13 designates 1 p. m.

Y=Day of the week on which observation was made: 1=Sunday, 2=Monday, etc., 7=Saturday. The day will be reckoned according to Greenwich mean time; for example, Thursday=5 will signify the period extending from 0001 to 2400 hours, Thursday, Greenwich mean time. (For use only with ship station raobs, but not with land station raobs.)

Q=Octant of the globe. (See table 15.)

LLL=Latitude in degrees and tenths, the tenths being obtained by dividing the number of minutes by 6 and neglecting the remainder.

lll=Longitude in degrees and tenths, the tenths being obtained as for latitude *LLL*.

GG=Time of launching to the nearest whole hour, Greenwich mean time (00 designating midnight, 12 being noon, and 18 being 6:00 p. m.). (For use only with ship station raobs, but not with land station raobs.)

HH=Height above sea level in hundreds of meters, to the nearest whole hundred, omitting the ten-thousand-place digit wherever involved, e. g., 520 m. is transmitted as 05, 4570 m. is transmitted as 46, and 12,520 m. as 25. Fifties (50's) are disposed of according to the rule of changing to the nearest *even* hundred, e. g., 2,350 m. is transmitted as 24, 2,450 m. is transmitted as 24, and 12,450 m. also as 24.

PP=Barometric pressure, in whole millibars, including only tens and units digits, i. e., with hundreds and thousands digits omitted. For example: 1,020 mb. is transmitted as 20, 1,000 mb. as 00, 982 mb. as 82, 900 mb. as 00, 705 mb. as 05, etc. (Note tables 19 and 20 regarding average relation of pressure to altitude.)

TT=Temperature of the air in whole degrees centigrade. A naught will be used for the tens digit when the temperature is 0° C. to 9° C., inclusive. When the temperature is −1° C. or lower, the minus sign will be disregarded and 50 added for coding. Where the sum of the temperature and 50 in these cases is 100 or more, the hundreds digit will be omitted.

For example:

15° C. is transmitted as 15.
5° C. is transmitted as 05.
0° C. is transmitted as 00.

SUMS (when temperatures are negative).

−1° C. (1+50=51) is transmitted as 51.
−45° C. (45+50=95) is transmitted as 95.
−50° C. (50+50=100) is transmitted as 00.
−55° C. (55+50=105) is transmitted as 05.
−65° C. (65+50=115) is transmitted as 15.

2-1002. Code Form for Raobs (and Apobs) from Land Stations. The first part of the complete observation contains data considered to be essential for immediate use in forecasting. This first transmission will consist of:

(a) the basic pressure, temperature, and relative humidity data for levels up to and including the 400 millibar level.

(b) the mixing ratio data for each of the foregoing levels.

The second part of the complete observation contains the remaining data obtained from the observation. This second transmission will contain the following:

(a) Pressure, temperature and humidity data for levels above the 400 millibar level.

(b) Isentropic data for the selected isentropic surfaces.

(c) Such other data considered worthy of inclusion, in accordance with instructions, such as cloud data, icing data, miscellaneous upper air data, special phenomena, surface data, etc

2-1003. Symbol Form of 1943 Radiosonde Code:

First Transmission:

IIIGG	PPPTT	$UUH_5H_{10}H_{20}$	PPTTU	PPTTU	PPTTU	.....	.....	.....	etc.
$A_dA_dA_dA_{df}A_{df}$	$Lm_rm_rm_rm_r$	$Lm_rm_rm_rm_r$	$Lm_rm_rm_rm_r$	.....	.....	.....	etc.		

Second Transmission:

$IIIG_{50}G_{50}$	$Y_mY_mH_{33}H_{43}H_{53}$	PPTTU	PPTTU	PPTTU	.....	.....	.....	.....etc.

$A_dA_dA_dA_{df}A_{df}$	$L_xP_{px}P_{px}P_{sx}P_{sx}$	$L_xZ_{fx}Z_{fx}d_{wx}d_{wx}$	$L_xd_{ix}d_{ix}S_{ix}S_{ix}$
	$L_yP_{py}P_{py}P_{sy}P_{sy}$	$L_yZ_{fy}Z_{fy}d_{wy}d_{wy}$	$L_yd_{iy}d_{iy}S_{iy}S_{iy}$
	$L_zP_{pz}P_{pz}P_{sz}P_{sz}$	$L_zZ_{fz}Z_{fz}d_{wz}d_{wz}$	$L_zd_{iz}d_{iz}S_{iz}S_{iz}$
	$A_dA_dA_dA_{df}A_{df}$	$A_dA_dA_dA_{df}A_{df}$	$C_LC_MC_HN_LN_M$
	$A_dA_dA_dA_{df}A_{df}$	$0S_pS_pS_pS_p$	$A_dA_dA_dA_{df}A_{df}$	$m_dP_1P_1P_2P_2$
	$A_dA_dA_dA_{df}A_{df}$	$d_dP_1P_1P_2P_2$	$A_dA_dA_dA_{df}A_{df}$	$c_dP_1P_1P_2P_2$
	$A_dA_dA_dA_{df}A_{df}$	$CP_1P_1P_2P_2$	$A_dA_dA_dA_{df}A_{df}$	$M_pP_1P_1P_2P_2$
	$A_dA_dA_dA_{df}A_{df}$	$R_fP_1P_1P_2P_2$	$A_dA_dA_dA_{df}A_{df}$	$t_1P_1P_1P_2P_2$
	$A_dA_dA_dA_{df}A_{df}$	$i_fP_1P_1P_2P_2$	$A_dA_dA_dA_{df}A_{df}$	$i_1P_1P_1P_2P_2$

2-1004. Code Form for Raobs from Ships. The code form for raobs from ships is identical with that for land stations except that the single IIIGG group is omitted and the two groups $YQL_aL_aL_a$ $L_oL_oL_oGG$ are used instead. *(Note: In coding symbols H_5, H_{10}, and H_{20} in raob reports from ship stations group $YQL_aL_aL_a$ is counted as the first group, rather than IIIGG as is the case of raobs from land stations.)*

(In transmission, the *TT* digits are split between the end of the first group and the beginning of the second group for each significant level.)

UU=Relative humidity in whole percent. A naught will be used for the tens digit when the relative humidity is 0 to 9 percent, inclusive. Zero and 1 percent will be coded as 01, 9 percent as 09, 50 percent as 50, 100 percent as 00.

mm=Mixing ratios in grams of water vapor per kilogram of dry air, omitting the tens digit, coding only the units and tenths digits. Examples: 8.7 g./kg. is coded as 87, 10.4 g./kg. as 04.

(Note table 21 giving saturation mixing ratios for various temperatures and pressures. The saturation mixing ratio multiplied by the relative humidity expressed decimally gives a very close approximation to the actual mixing ratio. It is thus possible to ascertain quickly the value of the missing tens figure if not already known.)

P_aP_a=Barometric pressure, in whole millibars, at 1,520 meters (5,000 feet) m. s. l., omitting the hundreds digit, coding only the tens and units digits. The pressure at 1,520 m., m. s. l., will usually lie in the range 810 to 880 mb. Examples: 833 mb. will be coded as 33, 851 mb. as 51, etc.

P_bP_b=Barometric pressure, in whole millibars, at 3,050 meters (10,000 feet) m. s. l., omitting the hundreds digit, coding only the tens and units digits. The pressure at 3,050 m., m. s. l., will usually lie in the range 640 to 730 mb. Examples: 670 mb. will be coded as 70, 695 mb. as 95, 716 mb. as 16.

P_cP_c=Barometric pressure, in whole millibars, at 4,570 meters (15,000 feet) m. s. l., omitting the hundreds digit, coding only the tens and units digits. The pressure at 4,570 m., m. s. l., will usually lie in the range 510 to 610 mb. Examples: 540 mb. will be coded as 40, 585 mb. as 85.

P_dP_d=Barometric pressure, in whole millibars, at 6,100 meters (20,000 feet) m. s. l., omitting the hundreds digit, coding only the tens and units digits. The pressure at 6,100 m., m. s. l., will usually lie in the range 410 to 510 mb. Examples: 464 mb. will be coded as 64, 481 mb. as 81.

P_eP_e=Barometric pressure, in whole millibars, at 10,000 meters (32,810 feet) m. s. l., omitting the hundreds digit, coding only the tens and units digits. The pressure at 10,000 m., m. s. l., will usually lie in the range 210 to 310 mb. Example: 251 mb. will be coded as 51.

P_fP_f=Barometric pressure, in whole millibars, at 13,000 meters (42,650 feet) m. s. l., omitting the hundreds digit, coding only the tens and units digits. The pressure at 13,000 m., m. s. l., will usually lie in the range 115 to 215 mb. Example: 154 mb. will be coded as 54.

P_gP_g=Barometric pressure, in whole millibars, at 16,000 meters (52,490 feet) m. s. l., omitting the hundreds digit (whenever it occurs), coding only the tens and units digits. The pressure at 16,000 m., m. s. l., will usually lie in the range 55 to 155 mb. Example: 103 mb. will be coded as 03.

P_1P_1=Barometric pressure, in tens of millibars, corresponding to the height of the base of the cloud designated by the code figure for *C* in the immediately succeeding group. The thousands digit is to be dropped when the pressure is 1000 mb. or greater. For example, 1020 mb. will be coded as 02, 875 mb. as 88, etc., the units digit being disposed of according to the standard Weather Bureau rule for dropping decimals. When the pressure in question is unknown P_1P_1 will be coded in apobs in accordance with table 9 and as indicated in note (*a*) paragraph 2–1001 with regard to raobs.

P_2P_2=Barometric pressure, in tens of millibars, corresponding to the height of the top of the cloud designated by the code figure for *C* in the immediately succeeding group. The rules for coding observed or estimated data are the same as those for P_1P_1. When the pressure in question is unknown, P_2P_2 will be coded in apobs in accordance with table 9 and as indicated in note (*a*) paragraph 2–1001 with regard to raobs.

h_p=A characteristic numeral, coded according to table 10, to indicate whether the pressures (P_1P_1 and P_2P_2) corresponding to the height of the base and top,

2-1005. Definitions of Letter Symbols.

III - International Index Number of station where observation is taken.

GG - Time of release (or take off) to the nearest whole hour in Greenwich Civil Time (GCT), using the 24-hour clock *(00-23)*.

000 - Barometric pressure in whole millibars at surface level *(in hundreds, tens, and units)*. 1023.4 mb is coded as 023.

TT - Temperature of the air in whole degrees centigrade *(in tens and units)*. 24.3°C is coded as 24. When the temperature is below zero the minus sign is disregarded and 50 added to the temperature for coding symbol TT *(-26.3°C is coded as 76)*. When the sum of the observed temperature *(when lower than -50°)* plus 50 is more than 100 the figure 1 is omitted *(-68.1°C plus 50 is 118.1 -- coded as 18)*. When the temperature record is missing the code figure 99 is used.

UU - Relative humidity in whole percent *(surface level only)*. When the relative humidity is missing the code figure 99 is used.

H_5 - Indicator for the position in the message occupied by the group containing PPTTU data for the 5,000 foot level. A figure representing the relative group position in the coded message occupied by the group containing data for a particular level is used in coding symbols H_5, H_{10}, H_{20}, H_{33}, H_{43}, and H_{53}. The numeral subscript to the symbol letter H represent, approximately, thousands of feet above mean sea level. The position in the message occupied by the group IIIGG will always be considered as the first group in the first transmission, regardless of how many figure or letter groups may be in the message preceding the group IIIGG. Similarly III$G_{50}G_{50}$ will always be considered the first group in the second transmission. When data for one or two of the symbols H_5, H_{10}, or H_{20} is missing, a slant (/) will be inserted; similarly for H_{33}, H_{43}, or H_{53}. *(Example: Symbol H_5 is coded as 6, which means that the 6th group - counting group IIIGG as number one - in the message contains the data for the 5,000 foot level.)*

H_{10} - Indicator for the position in the message occupied by group containing PPTTU data for the 10,000 foot level. *See explanation under H_5.*

H_{20} - Indicator for the position in the message occupied by group containing PPTTU data for the 20,000 foot level. *See explanation under H_5.*

PP - Barometric pressure at coded level in whole millibars *(tens and units)*. 1023 mb is coded as 23; 982 is coded as 82. When the pressure at a reported level is unknown the code figure 99 is used for symbol PP. Coded figure 99 will never be used for observed pressures. Actual pressures from 97.5 to 98.9 mb will be coded as 98: 99.0 to 00.5 as 00.

U - Relative humidity in percent *(Code Table 110)*. When the relative humidity at the selected upper level is missing a slant (/) will be used in place of a code figure for symbol U. When the relative humidity is below the recordable limits of the instrument the figure 1 will be used in coding symbol U.

In radiosonde reception work the phenomenon called "motor-boating" results at temperatures where accurate humidity values cannot be measured. These lowest measurable limits are:

Relative Humidity	Temperature
15%	10°C
20%	-3°C
25%	-16°C
30%	-24°C
35%	-29°C
40%	-33°C
45%	-37°C
50%	-40°C

respectively, of the cloud type designated by the code figure for C in the succeeding group have been ascertained by observation, have been estimated, or are unknown.

N_c=Amount, in tenths, of sky covered by clouds of the type designated by the code figure for C which immediately follows in the group and which represents clouds at a given height. (See immediately preceding group in code.) Ten-tenths will be coded as 0, "few" and one-tenth will be coded as 1, and amounts from two-tenths to nine-tenths will be coded by the figures 2 to 9, respectively.

C=Type of cloud. (See table 11.)

dd=Direction from which the clouds are coming, according to a scale 01–36, i. e., the number of degrees measured from north divided by 10 and rounded off to the nearest whole figure. Calm=00, N=36, E=09, S=18, W=27, etc. (See paragraph 2–1005 for substitution in case direction data are unknown or missing.)

Note.—A pair of groups $P_1P_1P_2P_2h_p$ N_cCdd will be used for each type or layer of cloud to a maximum of three, for which data may be appropriately transmitted in the message (see next sentence), except that groups $P_1P_1P_2P_2h_p$ are omitted when observational data therefor are unavailable in raobs. (See note (*a*) par. 2–1001.) As many as three cloud groups may be included in the message, representing low, intermediate, and high clouds, respectively, in that order. If no cloud form in any of these categories is observed, the corresponding groups $P_1P_1P_2P_2h_p$ N_cCdd are omitted

w_3=A characteristic numeral designating the nature of a phenomenon occurring at the surface or encountered aloft by an airplane flying in the vicinity, coded in accordance with table 12.

P_3P_3=Barometric pressure, in tens of millibars, at the level of entry of an ascending airplane into the phenomenon given by the code figure for w_3. (See note (*b*), paragraph 2–1001.) The rules for coding observed data are the same as those for P_1P_1. When the pressure in question is unknown, P_3P_3 will be coded in accordance with table 14 in apobs and by slants in raobs.

P_4P_4=Barometric pressure, in tens of millibars, at the level of emergence of an ascending airplane from the phenomenon given by the code figure for w_3. The rules for coding observed data are the same as those for P_1P_1. When the pressure in question is unknown or there was no emergence from the phenomenon during the ascent, P_4P_4 will be coded in accordance with table 14 in apobs and by slants in raobs.

Note.—One $w_3P_3P_3P_4P_4$ group will be used to indicate each of the w_3 phenomena observed. The phenomena will be indicated in the message in the order of increasing value of w_3, that is, in the order: rime or frost, hard ice, haze or smoke, etc. (See table 12.) Data for successive layers in which rime or frost formed will be given before data for layers in which hard ice formed, etc., and data for successive turbulent layers will be given after data for a thunderstorm heard at the station.

$\psi_x\psi_x$=The last two digits of the stream function corresponding to the potential temperature specified by $\theta_x\theta_x$. (The unit used for stream function is explained in paragraph 2–1009 where examples are also given.)

$\psi_y\psi_y$=The last two digits of the stream function corresponding to the potential temperature 6° A. higher than the potential temperature specified by $\theta_x\theta_x$.

$\psi_z\psi_z$=The last two digits of the stream function corresponding to the potential temperature 12° A. higher than the potential temperature specified by $\theta_x\theta_x$.

P_xP_x=The actual pressure, in tens of millibars, with the thousands digit omitted, corresponding to the potential temperature indicated by $\theta_x\theta_x$.

$P_{sx}P_{sx}$=The condensation pressure, in tens of millibars, with the thousands digit omitted, corresponding to the potential temperature indicated by $\theta_x\theta_x$.

It is important to note that the use of code figure 1 for symbol U does not always mean that the relative humidity is 0 to 19%. Code figure 1 may be used for relative humidity as high as 50% when the temperature is below -40°C and the humidity value is below the operating limits of the radiosonde equipment.

The use of code figure 99 for symbol $m_r m_r$ will indicate that the condition of motor-boating results. When the humidity is very low, but is nevertheless recorded accurately, a code figure other than 99 will be used in coding mixing ratio. The use of a slant (/) instead of a figure 1 for symbol U indicates that the relative humidity is missing and may, or may not, be below the recordable limits.

L - Designator of levels for which mixing ratio data are sent. A single figure is used to designate the two consecutive coded data levels to which the two mixing ratio values in that group are applicable.

The code figure used corresponds to the lowest of the two selected levels for which mixing ratio data are sent. When there are 10 or more selected levels with mixing ratio data the figure for the "tens" digit is omitted in coding symbol L. *(Example: the eleventh level is coded as 1.)* Ordinarily the mixing ratio level designation will be coded in numerical order: 1, 3, 5, 7, 9, 1, 3, etc. The surface is counted as the first level.

$m_r m_r$ - Mixing ratio in grams of water vapor per kilogram of dry air *(in units and tenths of grams per kilogram)*. 8.7 g/kg is coded as 87: 0.8 g/kg is coded as 08, etc. When the mixing ratio is 10.0 grams or more the figure for the tens unit will be omitted. When the mixing ratio is missing, code figure 99 is used in coding symbol $m_r m_r$. When the mixing ratio is actually 9.9 g/kg or 19.9 g/kg the code figure 98 will be used in coding symbol $m_r m_r$.

$G_{50}G_{50}$ - Time of release (or take off) to the nearest whole hour, plus 50. Greenwich Civil Time (GCT) and the 24-hour clock *(00-23)* are used. The code figure for symbol $G_{50}G_{50}$ is derived by adding 50 to the GCT value. *(Example: An observation taken at 04 GCT is coded as 54.)*

$Y_m Y_m$ - The day of the month as determined in Greenwich Civil Time. *(Example: An observation taken at 2300 EST of the eighth day of the month which is 0400 of the ninth day of the month according to GCT, is coded as 09.)*

H_{33} - Indicator for the position in the message occupied by group containing PPTTU data for the 32,810 foot level *(10 km)*. *See explanation under H_5.*

H_{43} - Indicator for the position in the message occupied by group containing PPTTU data for the 42,650 foot level *(13 km)*. *See explanation under H_5.*

H_{53} - Indicator for the position in the message occupied by group containing PPTTU data for the 52,490 foot level *(16 km)*. *See explanation under H_5.*

$A_d A_d A_d$ - Designator meaning "additional data follow". The code figure 101 is always coded for the symbol $A_d A_d A_d$. This group is used to report certain special, unusual, or significant meteorological conditions, or to report explanatory material regarding missing, doubtful, or late data, or to report required group identification devices, filing procedures, etc. These data are broadly classed as "additional data". As many additional data groups may be used in the coded report as are necessary to describe the conditions. These groups may be used in both the first and second transmissions.

$A_{df} A_{df}$ - Designator meaning "form of additional data reported". *(Code Table 101)* The code table indicates when one or more groups are necessary to complete the encoding of the conditions being described.

$\theta_x\theta_x$=A potential temperature in degrees A., the hundreds digit being omitted, for which stream function and pressure data designated by the symbols $\psi_x\psi_x$, P_xP_x, $P_{sx}P_{sx}$ are transmitted. For example, a potential temperature of 308° A. is coded as 08, 296° A. is coded as 96.

P_yP_y=The actual pressure, in tens of millibars, with the thousands digit omitted, corresponding to the potential temperature which is 6° A. higher than that specified by $\theta_x\theta_x$.

$P_{sy}P_{sy}$=The condensation pressure, in tens of millibars, with the thousands digit omitted, corresponding to the potential temperature which is 6° A. higher than that specified by $\theta_x\theta_x$.

P_zP_z=The actual pressure, in tens of millibars, with the thousands digit omitted, corresponding to the potential temperature which is 12° A. higher than that specified by $\theta_x\theta_x$.

$P_{sz}P_{sz}$=The condensation pressure, in tens of millibars, with the thousands digit omitted, corresponding to the potential temperature which is 12° A. higher than that specified by $\theta_x\theta_x$.

NOTE.—P_xP_x, $P_{sx}P_{sx}$, P_yP_y, $P_{sy}P_{sy}$, P_zP_z, and $P_{sz}P_{sz}$ are coded in the same manner as P_1 P_1. See examples thereunder.

D_1D_1=Direction of the shear-stability ratio vector as measured from the N. through the E., S., and W. at the height of the lowest specified potential temperature surface for which other isentropic data are computed and transmitted, and coded to 36 points in accordance with table 22.

D_2D_2=Direction of the shear-stability ratio vector as measured from the N. through the E., S., and W. at the height of the specified intermediate potential temperature surface for which other isentropic data are computed and transmitted, and coded to 36 points in accordance with table 22.

D_3D_3=Direction of the shear-stability ratio vector as measured from the N. through the E., S., and W. at the height of the highest specified potential temperature surface for which other isentropic data are computed and transmitted, and coded to 36 points in accordance with table 22.

S_1S_1=Magnitude of the shear-stability ratio vector in decameters per second at the height of the lowest specified potential temperature surface for which other isentropic data are computed and transmitted, rounded off to the nearest corresponding number occurring in the "Magnitude in decameters per second" column of table 23.

NOTE.—The magnitude of the shear-stability ratio vector has the dimensions of velocity, and is here expressed in terms of the unit decameters per second. The appropriate code numbers from table 23 are transmitted for S_1S_1, S_2S_2, and S_3S_3, respectively.

S_2S_2=Magnitude of the shear-stability ratio vector in decameters per second at the height of the specified intermediate potential temperature surface for which other isentropic data are computed and transmitted, rounded off to the nearest corresponding number occurring in the "Magnitude in decameters per second" column of table 23.

S_3S_3=Magnitude of the shear-stability ratio vector in decameters per second at the height of the highest specified potential temperature surface for which other isentropic data are computed and transmitted, rounded off to the nearest corresponding number occurring in the "Magnitude in decameters per second" column of table 23.

w_4=A characteristic numeral from 1 to 3, inclusive, designating the nature of the phenomenon being coded in accordance with table 13 for raobs.

H_1H_1=Height of the lower limit of the phenomenon above sea level in hundreds of meters, to the nearest whole hundred, omitting the ten-thousands digit wherever involved.

H_2H_2=Height of the upper limit of the phenomenon above sea level in hundreds of meters, to the nearest whole hundred, omitting the ten-thousands digit wherever involved.

MMMM=A four-letter group to indicate reason for termination of raobs the maximum altitudes of which are not more than 6,000 meters, m. s. l., to be used whenever the *entire* record above that altitude is missing or unusable. (See table 17.)

L_x - Designator for lowest isentropic level for which data are currently sent. The first code figure in an isentropic data group represents symbols L_x or L_y or L_z. This code figure designates the isentropic surface to which the data in that same group are applicable.

The code figure used is derived from the value of the potential temperature of the selected isentropic surface. The digit for the "units" value of the potential temperature is used. *(Example: Code figure 2 indicates the 302 isentropic surface, code figure 0 indicates the 290 isentropic surface , etc.)*

The following designators are used:

0 for 290° and 320°A; 2 for 302°A; 4 for 284° and 314°A; 6 for 296°A; 8 for 278° and 308°A.

The particular three isentropic surfaces for which data are reported each day vary with the seasons and, in some cases, vary with the geographic location of the stations, in accordance with instructions. The standard isentropic surfaces most generally used have potential temperatures of 290, 296, 302, 308, 314, and 320°A. The values of the three standard isentropic surfaces used daily by Weather Bureau stations during each of the months in the year are given below:

MONTHS	POTENTIAL TEMPERATURE L_x	L_y	L_z
January-February	290	296	302
March-April	296	302	308
May-June	302	308	314
July-August	308	314	320
September-October	302	308	314
November-December	296	302	308

$P_{px}P_{px}$ - The actual pressure at the L_x isentropic surface. Symbol $P_{px}P_{px}$ is coded to the nearest "tens" of millibars, there being a figure for "hundreds" and a figure for "tens". The "units" digit is omitted. When the pressure is unknown the code figure 99 is used. When the actual pressure is 990 to 1005 mb code figure 00 is used.

$P_{sx}P_{sx}$ - The condensation pressure at the L_x isentropic surface, coded in the same manner as $P_{px}P_{px}$.

A "pressure-condensation pressure group" $L_xP_{px}P_{px}P_{sx}P_{sx}$ or $L_yP_{py}P_{py}P_{sy}P_{sy}$ or $L_zP_{pz}P_{pz}P_{sz}P_{sz}$ is sent for each selected isentropic surface, and is included in the second transmission. The "pressure-condensation pressure group" for the lowest surface is always preceded by the additional data designator group 10177, which means "Isentropic data follow".

There ordinarily will be three "pressure-condensation pressure" groups in each message containing isentropic data, i.e., one group for each isentropic surface selected. At times, however, in accordance with instructions, isentropic data may be sent for more than, or fewer than, three isentropic surfaces. In such cases there will be included one "pressure-condensation pressure group" for each surface selected. This provision also applies to the "stream function-wind direction group" and the "direction and spacing of isobars group".

$Z_{fx}Z_{fx}$ - Stream function value at the L_x isentropic surface *(in tens and units)*. The last two digits of the stream function value corresponding to the indicated isentropic surface is used in coding $Z_{fx}Z_{fx}$, $Z_{fy}Z_{fy}$, $Z_{fz}Z_{fz}$. When the stream function value is unknown the code figure 99 is used; when the last two digits of the computed stream function value are 99 the code figure 98 is used instead of 99.

2–1005. Missing and Doubtful Data.—Whenever any of the data are missing for groups to be transmitted by teletype, telegraph, or point-to-point radio communication, a slant (/) will be substituted for each missing digit. In the case of radio broadcasts (non-point to point communications) the letter X will be substituted for each missing digit. For exceptions to these rules, see P_1P_1, P_2P_2, P_3P_3, P_4P_4.

In cases where there is doubt concerning accuracy of the entire sounding data, "DATA DBTF" signifying "data doubtful" will be sent immediately following the "call letters—time" group if the message originates at a land station, or immediately following the "longitude—time" group if the message originates at a ship station.

If there is a gap in the record made by the instrumental recorder for radiosonde or airplane observations, such that it appears possible that there may have been significant levels within the altitudes covered by the gap, the group //9// will be sent between the pairs of five-figure groups which give the data for the two significant levels pertaining to the portion of the record immediately preceding and following the gap. In many cases the group //9// in the message may point to the possibility that one or both of the significant levels just referred to might not have been regarded as significant if the missing data of the gap had been available.

Whenever the relative humidity record is not obtained for any reason, e. g., the occurrence of temperature below −40° C., slant marks will be sent in the message in place of the condensation pressure corresponding to the missing humidity.

2–1006. No Raob or No Apob Messages.—A "no raob" or "no apob" message is one containing no radiosonde or airplane observational data and indicating the reason for not transmitting those data at or before the time of filing shown in the message. "No raob" or "no apob" messages will contain two groups:

(1) II(I)$(Y_1)G_1G_1$* where these symbols have meanings similar to those of the corresponding symbols in paragraph 2–1004 except that the time of filing the message with the communications office is substituted for observation or take-off time in respect to (Y_1) and G_1G_1.

(2) A group from table 16, consisting of four letters indicative of the reason for the "no raob" or "no apob" message.

2–1007. Correction Messages.—Messages transmitting corrections to regular raob or apob messages begin with the abbreviation *CQN*.

Correction messages may be of five kinds, as indicated below (*a*—*e*). In the following, n with a subscript designates the number of the numeral group in the original message to which reference is made, counting II(I)$(Y_1)G_1G_1$ or *YQLLL* as 1, and the following group as 2, etc.

(*a*) When it is desired to transmit a complete corrected message, the code form is: *CQN* followed immediately by the corrected message in its entirety.

(*b*) When it is desired to correct specified groups in the original message, the code form is:

CQN II(I)$(Y_1)G_1G_1$ $n_1/n_2/n_3/n_4$ –

where the dashes represent the corrected figures of the groups numbered n_1, n_2, n_3, etc., respectively, in the originally transmitted message. (See paragraph 2–1011 (*e*) for example.) When only one group is to be corrected, the group number in question, n_1, is followed by a slant in the message, e. g., if n is group 8, the code form is:

CQN II(I)$(Y_1)G_1G_1$ 8/ – – – – –.

(*c*) When it is desired to insert one or more new groups between specified groups in the original message, the code form is:

CQN II(I)$(Y_1)G_1G_1$ *insrt* n_1/n_2 – – – – – n_3/n_4 – – – – –, etc., where the abbreviation "*insrt*" included in the correction message designates the word "insert" and where the dashes represent the figures of new groups to be inserted between groups n_1 and n_2, and n_3 and n_4, etc., respectively, of the originally transmitted message. When, for example, one new group is to be inserted between groups 5 and 6 of the original message, and two new groups in given order are to be inserted between groups 13 and 14, the code form is:

*In what follows it will be understood that in messages *from ship stations* RAOB *YQLLL IIIGG* is to be substituted for *II(I)* $(Y_1)G_1G_1$, the latter group being applicable to land stations only.

(f) When the humidity data are doubtful for the lower portion and the temperature data are doubtful for the upper portion of the sounding:

$II(I)(Y_1)G_1G_1$ HMDTY ----- ----- ----- ----- DBTF ----- ----- ----- ----- TMPS ----- ----- ----- ----- ----- ----- DBTF (see note bottom 101-R page).

If there is a gap in the record made by the instrumental recorder for radiosonde or airplane observations, such that it appears possible that there may have been significant levels within the altitudes covered by the gap, the group //9// will be sent between the pairs of five-figure groups which give the data for the two significant levels pertaining to the portion of the record immediately preceding and following the gap. In many cases the group //9// in the message may point to the possibility that one or both of the significant levels just referred to might not have been regarded as significant if the missing data of the gap had been available.

Whenever the relative humidity record is not obtained for any reason, e.g., the occurrence of temperature below -40°C., slant marks will be sent in the message in place of the condensation pressure corresponding to the missing humidity.

2-1006. No Raob or No Apob Messages.—A "no raob" or "no apob" message is one containing no radiosonde or airplane observational data and indicating the reason for not transmitting those data at or before the time of filing shown in the message. "No raob" or "no apob" messages will contain two groups:

(1) $II(I)(Y_1)G_1G_1$* where these symbols have meanings similar to those of the corresponding symbols in paragraph 2-1004 except that the time of filing the message with the communications office is substituted for observation or take-off time in respect to (Y_1) and G_1G_1.

(2) A group from table 16, consisting of four letters indicative of the reason for the "no raob" "no apob" message.

2-1007. Correction Messages.—Messages transmitting corrections to regular raob or apob messages begin with the abbreviation *CQN*.

Correction messages may be of five kinds, as indicated below *(a—e)*. In the following, n with a subscript designates the number of the numeral group in the original message to which reference is made, counting $II(I)(Y_1)G_1G_1$ or *YQLLL* as 1, and the following group as 2, etc.

(a) When it is desired to transmit a complete corrected message, the code form is: *CQN* followed immediately by the corrected message in its entirety.

(b) When it is desired to correct specified groups in the original message, the code form is:

$CQN\ II(I)(Y_1)G_1G_1n_1/n_2/n_3/n_4$ ----- ----- ----- -----

*In what follows it will be understood that in messages from ship stations RAOB YQLLL 11100 is to be substituted for $II(I)(Y_1)G_1G_1$, the latter group being applicable to land stations only.

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where the dashes represent the corrected figures of the groups numbered n_1, n_2, n_3, etc., respectively, in the originally transmitted message. (See paragraph 2-1011 (e) for example.) When only one group is to be corrected, the group number in question, n_1, is followed by a slant in the message, e.g., if n is group 8, the code form is :

CQN II(I)(I_1)G_1G_1 8/ -----.

(c) When it is desired to insert one or more new groups between specified groups in the original message, the code form is:

CQN II(I)(I_1)G_1G_1 insrt n_1/n_2 ----- n_3/n_4 -----, etc.,

where the abbreviation *"insrt"* included in the correction message designates the word "insert" and where the dashes represent the figures of new groups to be inserted between groups n_1 and n_2, and n_3 and n_4, etc., respectively, of the originally transmitted message. When, for example, one new group is to be inserted between groups 5 and 6 of the original message, and two new groups in given order are to be inserted between groups 13 and 14, the code form is:

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2-1005. Missing and Doubtful Data.—Whenever any of the data are missing for groups to be transmitted by teletype, telegraph, or point-to-point radio communication, a slant (/) will be substituted for each missing digit. In the case of radio broadcasts (non-point to point communications) the letter X will be substituted for each missing digit. For exceptions to these rules, see P_1P_1, P_2P_2, P_3P_3, P_4P_4.

In cases where there is doubt concerning the accuracy of the data for *all elements* for the *entire* sounding, the group "DBTF", signifying "doubtful", will be transmitted immediately following the "call letters-time" group if the message originates at a land station, or immediately following the "longitude-time" group if it originates at a ship station. If only one or two elements are doubtful for the entire sounding, an appropriate group or groups such as "TMPS", "PRES" or "HMDTY" should be inserted preceding the above mentioned "DBTF" group.

If there is doubt concerning the accuracy of the data for *all elements* for only a portion of the sounding, the group "DATA" should be inserted immediately before the doubtful portion of the record and the group "DBTF" should immediately follow the doubtful data. However, if only one or two elements are doubtful for a portion of the sounding, an appropriate group such as "TMPS", "PRES" or "HMDTY" should be substituted for the "DATA" group.

The following are examples of messages containing doubtful data:

(a) When data for the three elements, i.e., temperature, pressure and relative humidity are doubtful for the entire sounding:

$II(I)(Y_1)G_1G_1$ DBTF ----- ----- ----- ----- etc.

(b) When only the humidity data are doubtful for the entire sounding:

$II(I)(Y_1)G_1G_1$ HMDTY DBTF ----- ----- ----- ----- etc.

(c) When data for the three elements are doubtful for only the lower portion of the sounding:

$II(I)(Y_1)G_1G_1$ DATA ----- ----- ----- ----- DBTF -----
----- ----- ----- ----- ----- ----- ----- etc.

(d) When only the humidity data are doubtful for an intermediate portion of the sounding:

$II(I)(Y_1)G_1G_1$ ----- ----- ----- ----- HMDTY -----
----- ----- ----- ----- ----- DBTF ----- ----- -----
----- etc.

(e) When the temperature and pressure data are doubtful for the upper portion of the sounding:

$II(I)(Y_1)G_1G_1$ ----- ----- ----- ----- TMPS PRES -----
----- ----- ----- ----- ----- DBTF (see note below).

NOTE: When the upper portion of the sounding is doubtful the group "DBTF" will appear immediately after the data for the last significant level instead of at the end of the message.

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The first two digits of the respective stream function values which are thus omitted may be supplied by the decoder through inspection of the value of the potential temperature at the selected isentropic surface. Consideration should be given to the fact that the first three digits of the stream function will be very nearly equal in numerical value to the three digits of the potential temperature in whole degrees absolute. For example, stream function values at the 296° potential temperature surface are fairly close to 2960 millions of ergs per gram; at 302° - fairly close to 3020 millions of ergs per gram, etc. The stream function-wind direction group is sent for each selected isentropic surface and always follows the pressure-condensation pressure group reported for the same isentropic surface.

When data for the stream function-wind direction group are missing, but the data for direction and spacing of isobars group are not missing, there will be inserted a code group in the place reserved for the stream function-wind direction group. The first figure of this substitute code group will be the appropriate code figure for the isentropic surface concerned and the last four figures will be 9999. *(Example: 29999, 69999, etc.)*

$d_{wx}d_{wx}$ - Wind direction at the Lx isentropic surface (01 to 36 scale). The direction of the wind at the appropriately indicated isentropic surface *(in hundreds and tens of degrees)* is used in coding $d_{wx}d_{wx}$, $d_{wy}d_{wy}$, and $d_{wz}d_{wz}$. For example, a wind blowing from due east is coded as 09 *(for 90°)*; code figure 00 is used for calm, 36 for 360°, 01 for 10°, etc. When the wind direction is unknown code figure 99 is used.

$d_{ix}d_{ix}$ - Direction of the isobars in the Lx isentropic surface - measured in degrees from North - coded to the nearest "tens" of degrees *(expressed in hundreds and tens of degrees)*. The direction is specified as "the direction of a vector which is tangent to the isobars and is directed cyclonically around low pressure and anticyclonically around high pressure in the isentropic surface to which it pertains". The direction of the isobars is expressed in degrees from North (01 to 36 scale).

When both the "direction of isobars" and "angular spacing of isobars" data are not computed the entire group is omitted from the coded message. The direction and spacing of isobars group is sent for each selected isentropic surface. It always follows the stream function-wind direction group reported for the same surface. When all the data for the stream function-wind direction group and all the data for the direction and spacing of isobars group for the selected isentropic surface are missing, it will not be necessary to use substitute groups, and no groups will appear in the message for these data.

$S_{ix}S_{ix}$ - Spacing between isobars differing by 50 mb where the isobars lie in the Lx isentropic surface. Symbol $S_{ix}S_{ix}$ is expressed in terms of "degrees of angle subtended at the earth's center by the perpendicular distance between the isobars". The angle is coded in "units" and "tenths" of degrees. For example, 0.9 degree of arc will be coded as 09; 4.3 degrees as 43; 9.8 degrees and over as 98; unknown as 99. *(Note: The angle in question may be considered equivalent to the degrees of latitude separation between the isobars if they were oriented east-west.)*

The angular spacing will be computed under the assumption that the earth is a sphere and has a radius of 6367 km. To a very close approximation, the equivalent distance (in miles) on the earth's surface can be determined on a Lambert conformal conic projection map of any scale from the distance that corresponds to a change in degrees of latitude equal to the specified angular spacing. *(In ascertaining such an equivalent distance, it is advisable to scale off the given number of degrees of latitude at approximately the latitude of the station to which the data pertain.)*

CQN $II(I)(Y_1)G_1G_1$ *insrt* 5/6 - - - - - 13/14 - - - - - - - - - - -. If one or more new groups are to be added to the end of the message, the figure represented by the n before the last slant in the correction message is the number of the last group of the original message, and no figure immediately follows that slant. (It will be noted that when data are to be inserted, the groups containing the numbers (n's) of the groups which are to be inserted may be distinguished from the groups containing the correct figures by the fact that the n groups only can have one slant not at the beginning with never more than 2 digits preceding the slant, whereas the correct figure group either has no slants or the slants appear as two or more adjacent to each other or a single slant occurs at the beginning, or a single slant occurs at the end, preceded by more than two digits.)

(*d*) When it is desired both to correct specified groups and to insert one or more new groups between specified groups in the original message, the code form is:

CQN $II(I)(Y_1)G_1G_1$ $n_1/n_2/n_3$ - - - - - - - - - - - - - - - - - *insrt* n_4/n_5 - - - - - - - - - - n_6/n_7 - - - - -, etc., where the data between the $II(I)(Y_1)G_1G_1$ group and abbreviation *insrt* refer to original groups to be corrected and the data after *insrt* refer to new groups to be inserted, as in the cases of (*b*) and (*c*), above, respectively.

(*e*) When it is desired to delete a specified group in the original message and not replace it by any other group, this may be done by employing slants (/) (X's in non-point to point radio communications) for the group in the correction message, e. g., *CQN* $II(I)(Y_1)G_1G_1$ $n_1/$ ///// or, if group n_1 is to be corrected and n_2 deleted: *CQN* $II(I)(Y_1)G_1G_1$ n_1/n_2 - - - - - /////

2–1008. Indicated Altimeter Readings at the Level of Phenomena.—The indicated altimeter reading at the level of the phenomenon and the altimeter setting (Kollsman) will be obtained whenever possible from pilots flying in the vicinity near the time of the radiosonde observation. Desired information includes upper and lower limits of clouds, turbulent layers, precipitation, haze, etc. These data should be coded in accordance with instructions for P_3P_3 and P_4P_4. When the airplane encounters one of these limits but not the other limit of such phenomenon, "slants" should be transmitted in the reports from raob stations in place of pressures for the unknown limits. (Apob reports should contain appropriate numbers selected from tables 9 and 14 instead of "slants" for the pressure at the unknown limit.)

To convert these altimeter readings to pressures, standard atmosphere pressure tables are furnished each station. The following example shows how the pressure will be obtained:

(*a*) Altimeter setting	29.78 inches.
(*b*) Standard atmosphere elevation corresponding to 29.78 inches (see pages 11, 12, and 13 of S. A. tables N. A. C. A. Report No. 538, 1938)	131 feet.
(*c*) Indicated altitude at level of phenomenon	800 feet.
(*d*) Sum of (*b*) and (*c*)	931 feet.
(*e*) Standard atmosphere pressure corresponding to 931 feet	28.93 inches.
(*f*) Pressure at level of phenomenon, 28.93 inches	980 millibars.

2–1009. Coding Stream Functions, Actual and Condensation Pressures, and Direction and Magnitude of Shear-Stability Ratio Vectors.—The stream functions, the actual and condensation pressures, and the direction and magnitude of the shear-stability ratio vectors for three specified potential temperatures will be included in the raob or apob messages. The potential temperatures for which the above data are to be computed and the period for which each group of potential temperatures is to be in effect are given in table 18. The data will be sent in six groups, showing the stream functions, the actual and condensation pressures, and the direction and magnitude of the shear-stability ratio vectors pertinent to a given raob or apob.

In the first group the stream functions will be enciphered, the first two figures representing the last two digits of the stream function for the lowest specified potential temperature, the next following two figures representing the last two digits of the stream function for the potential temperature 6° higher, and the last two figures representing the last two digits of the stream function for the highest specified potential temperature. (At raob or apob stations the respective stream functions for three

CQN $II(I)(Y_1)G_1G_1$ *insrt* 5/6 - - - - - 13/14 - - - - - - - - - -. If one or more new groups are to be added to the end of the message, the figure represented by the n before the last slant in the correction message is the number of the last group of the original message, and no figure immediately follows that slant. (It will be noted that when data are to be inserted, the groups containing the numbers (n's) of the groups which are to be inserted may be distinguished from the groups containing the correct figures by the fact that the n groups only can have one slant not at the beginning with never more than 2 digits preceding the slant, whereas the correct figure group either has no slants or the slants appear as two or more adjacent to each other or a single slant occurs at the beginning, or a single slant occurs at the end, preceded by more than two digits.)

(*d*) When it is desired both to correct specified groups and to insert one or more new groups between specified groups in the original message, the code form is:

CQN $II(I)(Y_1)G_1G_1$ $n_1/n_2/n_3$ - *insrt* n_4/n_5 - - - - - - - - - - - - - - n_6/n_7 - - - - -, etc., where the data between the $II(I)(Y_1)G_1G_1$ group and abbreviation *insrt* refer to original groups to be corrected and the data after *insrt* refer to new groups to be inserted, as in the cases of (*b*) and (*c*), above, respectively.

(*e*) When it is desired to delete a specified group in the original message and not replace it by any other group, this may be done by employing slants (/) (X's in non-point to point radio communications) for the group in the correction message, e. g., *CQN* $II(I)(Y_1)G_1G_1$ n_1/ ///// or, if group n_1 is to be corrected and n_2 deleted: *CQN* $II(I)(Y_1)G_1G_1$ n_1/n_2 - - - - - ///// .

2–1008. Indicated Altimeter Readings at the Level of Phenomena.—The indicated altimeter reading at the level of the phenomenon and the altimeter setting (Kollsman) will be obtained whenever possible from pilots flying in the vicinity near the time of the radiosonde observation. Desired information includes upper and lower limits of clouds, turbulent layers, precipitation, haze, etc. These data should be coded in accordance with instructions for P_3P_3 and P_4P_4. When the airplane encounters one of these limits but not the other limit of such phenomenon, "slants" should be transmitted in the reports from raob stations in place of pressures for the unknown limits. (Apob reports should contain appropriate numbers selected from tables 9 and 14 instead of "slants" for the pressure at the unknown limit.)

To convert these altimeter readings to pressures, standard atmosphere pressure tables are furnished each station. The following example shows how the pressure will be obtained:

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(*c*)	Indicated altitude at level of phenomenon	800 feet.
(*d*)	Sum of (*b*) and (*c*)	931 feet.
(*e*)	Standard atmosphere pressure corresponding to 931 feet	28.93 inches.
(*f*)	Pressure at level of phenomenon, 28.93 inches	980 millibars.

2–1009. Coding Stream Functions, Actual and Condensation Pressures, and Direction and Magnitude of Shear-Stability Ratio Vectors.—The stream functions, the actual and condensation pressures, and the direction and magnitude of the shear-stability ratio vectors for three specified potential temperatures will be included in the raob or apob messages. The potential temperatures for which the above data are to be computed and the period for which each group of potential temperatures is to be in effect are given in table 18. The data will be sent in six groups, showing the stream functions, the actual and condensation pressures, and the direction and magnitude of the shear-stability ratio vectors pertinent to a given raob or apob.

In the first group the stream functions will be enciphered, the first two figures representing the last two digits of the stream function for the lowest specified potential temperature, the next following two figures representing the last two digits of the stream function for the potential temperature 6° higher, and the last two figures representing the last two digits of the stream function for the highest specified potential temperature. (At raob or apob stations the respective stream functions for three

L_y - Designator for intermediate isentropic level for which data are sent. *See explanation under L_x.*

$P_{py}P_{py}$ - Actual pressure at the L_y isentropic surface. *See explanation under $P_{px}P_{px}$.*

$P_{sy}P_{sy}$ - Condensation pressure at the L_y isentropic surface. *See explanation under $P_{sx}P_{sx}$.*

$Z_{fy}Z_{fy}$ - Stream function value at the L_y isentropic surface. *See explanation under $Z_{fx}Z_{fx}$.*

$d_{wy}d_{wy}$ - Wind direction at the L_y isentropic surface. *See explanation under $d_{wx}d_{wx}$.*

$d_{iy}d_{iy}$ - Direction of the isobars in the L_y isentropic surface. *See explanation under $d_{ix}d_{ix}$.*

$S_{iy}S_{iy}$ - Spacing between isobars in the L_y isentropic surface. *See explanation under $S_{ix}S_{ix}$.*

L_z - Designator for highest isentropic level for which data are sent. *See explanation under L_x.*

$P_{pz}P_{pz}$ - Actual pressure at the L_z isentropic surface. *See explanation under $P_{px}P_{px}$.*

$P_{sz}P_{sz}$ - Condensation pressure at the L_z isentropic surface. *See explanation under $P_{sx}P_{sx}$.*

$Z_{fz}Z_{fz}$ - Stream function value at the L_z isentropic surface. *See explanation under $Z_{fx}Z_{fx}$.*

$d_{wz}d_{wz}$ - Wind direction at the L_z isentropic surface. *See explanation under $d_{wx}d_{wx}$.*

$d_{iz}d_{iz}$ - Direction of the isobars in the L_z isentropic surface. *See explanation under $d_{ix}d_{ix}$.*

$S_{iz}S_{iz}$ - Spacing between isobars in the L_z isentropic surface. *See explanation under $S_{ix}S_{ix}$.*

$A_dA_dA_d$ - Designator meaning "additional data follow" - always coded as 101.

$A_{df}A_{df}$ - Designator meaning "form of additional data reported" *(Table 101).*

C - Form of predominant cloud, combined classification *(Table 104).* *See explanation under P_2P_2.*

c_d - Form of corrective data *(Table 103).*

C_H - Form of high cloud *(Table 62 - 1942 Weather Code).*

C_L - Form of low cloud *(Table 50 - 1942 Weather Code).*

C_M - Form of middle cloud *(Table 51 - 1942 Weather Code).*

d_d - Form of doubtful data *(Table 103).*

HHH - Height of 500 mb level - to nearest ten feet.

A group for the "height of the 500 mb level" (50HHH) is always added as the final group of the first transmission. Code figure 50 serves as the group designator, symbol HHH represents the actual height expressed in thousands, hundreds, and tens of feet. The figures for ten-thousands and units of feet are omitted. *(For example, 16972 feet is coded as 697; 17538 feet is coded as 754; 17845 as 784, etc.)*

Contrary to the usual procedure of coding supplementary data, group 50HHH will not be preceded by a designator group. Group 50HHH will be identified readily, however, since it will always be the last group in the first transmission. The 500 mb level data in raob reports from stations on teletype circuits will be coded as HHH instead of 50HHH. When the observation does not reach the 500 mb level, group 50HHH will be omitted from the message.

potential temperatures are originally computed from the sounding data and expressed by four digits each; for example, 2,982 millions of ergs/gram for potential temperature 296° Absolute. The first two digits of each computed stream function are, therefore, omitted from the coded message. The first two digist of the respective stream functions which are thus omitted will be supplied by the decoder through inspection of the values of the potential temperatures pertaining to the data, taking into consideration the fact that the first three digits of the stream function will be very nearly equal in numerical value to the three digits of the potential temperature in whole degrees Absolute. For example, from a transmitted first group 823486 and an indication in the message that the lowest potential temperature is 296° Absolute, it may be deduced that the stream function corresponding to that potential temperature is 2,982 millions of ergs/gram, that the stream function corresponding to the potential temperature 6° higher (302° A.) is 3,034 millions of ergs/gram, and that the stream function corresponding to the highest potential temperature (308° A.) is 3,086 millions of ergs/gram.

In the second group the first two figures will encipher the actual pressure in tens of millibars and the next two the condensation pressure in tens of millibars for the lowest of the three potential temperatures in question, while the last figure of the second group will be the tens digit of the lowest potential temperature.

In the third group the first figure will be the units digit of the lowest potential temperature. The next two figures of the third group will be the actual pressure in tens of millibars, and the last two figures will be the condensation pressure in tens of millibars at the potential temperature 6° higher than the specified lowest potential temperature.

In the fourth group the first two figures will be the actual pressure in tens of millibars, and the last two figures will be the condensation pressure in tens of millibars at the potential temperature 12° higher than the lowest specified potential temperature.

In the fifth group the first two figures will represent the direction to 36 points and the next following two figures the magnitude in decameters per second of the shear-stability ratio vector at the height of the lowest specified potential temperature surface. The last two figures in the group will represent the direction of the shear-stability ratio vector at the height of the intermediate specified potential temperature surface.

In the sixth group the first two figures will represent the magnitude of the shear-stability ratio vector at the height of the intermediate specified potential temperature surface. The next following two figures will represent the direction and the last two figures the magnitude of the shear-stability ratio vector at the height of the highest specified potential temperature surface.

The hundreds digit of the lowest potential temperature is thus omitted, and the omitted digit, generally 2 or 3 in the lower levels, can be supplied by the decoder from the given tens and units digits. If part of the data are not available, those missing parts will be indicated by the use of slant marks. If all of the data are missing, the six groups will be omitted entirely, their absence indicating that the observation did not provide these.

An example of the six groups to be included in a typical raob or apob message is here shown:

$\psi_x\psi_x\psi_y\psi_y\psi_z\psi_z$	$P_xP_xP_{sx}P_{sx}\theta_x$	$\theta_xP_yP_yP_{sy}P_{sy}$	$P_zP_zP_{sz}P_{sz}$	$D_1D_1S_1S_1D_2D_2$	$S_2S_2D_3D_3S_3S_3$
8 2 3 4 8 6	7 9 5 6 9	6 7 2 4 8	6 2 4 0	2 2 4 8 3 0	4 2 3 5 2 0

The decoding of these groups is illustrated in example (*a*), paragraph 2–1011.

2–1010. Coding of Raob Icing Data.—The occurrence of icing conditions shown in table 13 will be indicated by the addition of one or more 5-figure groups at the end of the raob message, as explained hereafter. Such conditions will be indicated only when their lower limits occur at a pressure of 400 millibars or greater. However, the upper limits should be given, even though they occur at pressures lower than 400 millibars. In the event that a 4-letter group, taken from the table 17 is included in the message, the $w_4H_1H_1H_2H_2$ group(s) will immediately *precede* that letter-group.

i_f - Form of icing *(Table 108)*.

i_i - Intensity of icing *(Table 109)*.

$L_aL_aL_a$ - Latitude *(in tens, units, and tenths of degrees)*.

$L_oL_oL_o$ - Longitude *(in tens, units, and tenths of degrees)*.

m_d - Missing data *(Table 103)*.

M_p - Miscellaneous phenomena *(Table 105)*.

N_L - Amount of low clouds *(Table 55 - 1942 Weather Code)*.

N_M - Amount of middle clouds *(Table 55 - 1942 Weather Code)*.

P_1P_1 - Pressure at lowest level of occurrence *(in hundreds and tens of millibars, the units digit being omitted)*.

P_2P_2 - Pressure at highest level of occurrence *(in hundreds and tens of millibars, the units digit being omitted)*.

The "cloud form and cloud level group" is used whenever the lower and/or upper limits of clouds are obtained from the raob record itself, or from reports from pilots flying in the vicinity. When either the lower or upper level is unknown code figure 99 is used for symbol P_1P_1 or P_2P_2 as appropriate. When both the lower and upper limits of the clouds present are not known the "cloud level group" is not sent.

Q - Octant of globe *(Table 102)*.

R_f - Form of precipitation *(Table 106)*.

S_pS_p - Special phenomena, "general" description *(Table 72 - 1942 Weather Code)*.

s_ps_p - Special phenomena, "detailed" description *(Table 73 - 1942 Weather Code)*.

t_i - Turbulence intensity *(Table 107)*.

Y - Day of week *(1-Sunday, 2-Monday, 3-Tuesday, 4-Wednesday, 5-Thursday, 6-Friday, 7-Saturday)*.

Nothing in this paragraph should be construed to effect the instructions regarding the coding of w_3.

In the event that more than one stratum is indicated, the data for the lower stratum should be given first, that for the next higher second, etc.

Whenever one of the elevations pertaining to a group cannot be determined with sufficient accuracy, "slants" are to be substituted for the missing data.

Criteria for Determining Limits of Phenomenon.—In many cases it will be difficult to determine the lower and upper limits of icing conditions. Therefore, careful judgment on the part of the observer is important. In this connection the following criteria may be helpful:

(1) The lengths of the contacts on the recorder records normally increase with height and each fifth contact is slightly longer than the adjacent ones.

(2) Icing occurs only when the temperature is 0° C. or lower, the actual relative humidity is at or near 100 percent and clouds are present or precipitation is occurring.

(3) Hair humidity elements become increasingly sluggish at low temperatures, i. e., below −5° to −10° C. Therefore, at such temperatures the observer must take into account the fact that the indicated relative humidity may be only 85 or 90 percent, even though the instrument is rising through a cloud of supercooled water droplets. Discretion in discounting indicated humidity readings is, therefore, necessary.

(4) The relative humidity curve often indicates the upper limit of the icing condition. If the humidity has been at or near 100 percent and then falls rapidly, the point of sudden change can usually be assumed to be the upper limit of the icing condition. It occasionally happens, however, that after passing through a cloud layer at subfreezing temperatures, the indicated relative humidity remains at 100 percent due to the fact that ice has accumulated on the element. This makes it difficult, if not impossible, to determine the upper limit of the cloud and consequently the upper limit of the icing condition.

(5) The upper limit of the icing condition is sometimes indicated by a temperature inversion, the base of the inversion corresponding approximately to the upper limit of the cloud layer.

(6) As the balloon ascends through an icing condition without attendant ascending convective currents, the weight of the accumulated ice gradually increases (as a rule) so that the ascensional rate progressively decreases. When the balloon emerges from the upper limit of the condition, it may not resume its original ascensional rate, i. e., the rate before entering the icing stratum, but retains approximately the ascensional rate it had at the time of emergence.

(7) Cirrus, cirrostratus and thin altostratus (which produce halos) usually are not favorable for icing.

(8) Icing is not to be included in a raob message when the sky is reported as cloudless.

The following examples illustrate the three conditions designated by the symbol w_4:

1. Ceiling observations have shown that there is a cloud base at about 1,620 meters. At that elevation the ascensional rate shows a decrease coincident with the balloon encountering conditions favorable for icing. From 1,620 meters to 2,270 meters, the ascensional rate shows a progressive decrease, but above the latter elevation the ascensional rate retains a more or less steady value. In the layer 1,620 to 2,270 meters, the temperatures are slightly below 0°C., while the relative humidities are near saturation. At 2,270 meters the relative humidity shows a definite drop, coincident with a slight temperature inversion, which apparently indicates the top of the cloud layer. It is reasonable to assume that there was icing between 1,620 and 2,270 meters and the phenomenon will, therefore, be coded as follows:

$w_4 = 1$
$H_1H_1 = 1{,}620$ meters, coded as 16.
$H_2H_2 = 2{,}270$ meters, coded as 23.

The 5-digit group 11623 will, accordingly, be included in the raob message.

REPORTING MISSING DATA

2-1006. Reporting Missing Data. When, for any reason, certain data in the observation report are missing, appropriate coding procedures will be followed to indicate which particular data are missing. Missing data include those data normally included in a message, but which are unknown because of recorder failure, or are unknown for other reasons. Data which have been recorded but which are obviously incorrect, or are most likely in error, are also considered as "missing data".

When data for all the code elements of a UNIVERSAL group are missing, an appropriate substitute group will be inserted in the position reserved in the code form for that UNIVERSAL group except where otherwise indicated in the instructions given below.

When data for all the code elements of a SUPPLEMENTAL group are missing that code group will be omitted from the message, and a substitute group will NOT be inserted in the position reserved in the code form for that SUPPLEMENTAL group, except where otherwise indicated in the instructions given below.

When all the code elements of a PPTTU group for a required level are missing the code group 9999/ will be used in the place normally occupied by that PPTTU group.

When data for a two-digit symbol in a coded group are missing, the code figure 99 will be used in place of the usual two-digit code figure. When data for a one-digit symbol in a coded group are missing a single slant (/) will be used in place of the usual single digit code figure, except as indicated in the instructions below, or as provided for in the code tables.

Code figure 99 will be used for missing data for symbols UU, PP, TT, $m_r m_r$, $P_{px}P_{px}$, $P_{sx}P_{sx}$, $Z_{fx}Z_{fx}$, $d_{wx}d_{wx}$, $d_{ix}d_{ix}$, $S_{ix}S_{ix}$, $P_{py}P_{py}$, $P_{sy}P_{sy}$, $Z_{fy}Z_{fy}$, $d_{wy}d_{wy}$, $d_{iy}d_{iy}$, $S_{iy}S_{iy}$, $P_{pz}P_{pz}$, $P_{sz}P_{sz}$, $Z_{fz}Z_{fz}$, $d_{wz}d_{wz}$, $d_{iz}d_{iz}$, $S_{iz}S_{iz}$, P_1P_1 and P_2P_2. *(Note: In order that the decoder may not be confused between which are observed values of 99, and which are missing data reported by code figure 99, a rule has been set up in this code whereby observed values of 99 are coded either as 98 or 00, and are never coded as 99.)*

When data are missing because of an interruption (break) in the continuous record, appropriate "additional data groups" are added at the end of the message to designate the span of the interrupted portion of the record, and to designate the form of data which are missing. These "additional data groups" have the symbol form $A_dA_dA_dA_{df}A_{df}$ $m_dP_1P_1P_2P_2$.

Besides using these two groups at the end of the message to describe the interrupted record, the encoder will insert a code group 9999/ in the places normally occupied by the PPTTU group in each span of 100 millibars of ascent, provided that ALL of the data elements in the PPTTU groups for this portion of the record are missing. This 9999/ coding device is necessary in these cases to insure to the decoder the proper assignment of the "hundreds" digit in the following PPTTU groups, since pressure is given to "tens" and "units" of mb only. An interruption of 100 mb or less would require one 9999/ group, an interruption of from 101 to 200 mb would require two 9999/ groups, etc.

2. Ceiling observations have shown that there are cumulonimbus clouds with a base at approximately 1,850 meters. At that elevation, the ascensional rate shows an *increase* coinciding with the balloon encountering conditions favorable for icing. From 1,850 meters to 3,340 meters the ascensional rate continues higher than previously but above the latter elevation the rate drops off suddenly and then remains nearly constant thereafter. In the layer from 1,850 to 3,340 meters the temperature is subfreezing, while the relative humidities are near saturation. At 3,340 meters the relative humidity shows a slight drop indicating the top of the cloud layer. It is reasonable to assume that the radiosonde passed through a cumulonimbus cloud in which both icing and ascending convective currents occurred, the latter, however, more than compensating for the retardation in ascensional rate which would have resulted from icing alone. This phenomenon will be coded as follows:

$w_4=2.$
$H_1H_1=1{,}850$ meters, coded as 18.
$H_2H_2=3{,}340$ meters, coded as 33.

The 5-figure group 21833 will, accordingly, be included in the raob message. (It is also possible for a ballon to pass through a cumulonimbus cloud with conditions favorable for icing but with a *decrease* in ascensional rate. In this case the weight of the accumulated ice would be great enough to overcome any ascending currents. Under these circumstances $w_4=1$.)

3. Ceiling observations show a low cloud layer with a base at 300 meters, which the raob shows is unfavorable for icing, owing to above-freezing temperatures. At 600 meters (the top of the lower cloud) the relative humidity began to fall rapidly until it reached 65 percent at 800 meters. At 1,680 meters the ascensional rate shows a decrease persisting for two or more contacts. The temperature at that level is slightly below freezing while the relative humidity, which had been increasing from 800 meters up to that point, then becomes stationary at 85 percent and continues at that value throughout the remainder of the flight. Because of the low clouds and the fact that the relative humidity did not go above 85 percent, it is impossible for the observer to determine whether or not there is an upper cloud layer coinciding with the decrease in ascensional rate. There is also no evidence whereby it is possible to determine with any degree of accuracy, the upper limit of this phenomenon. It is impossible, therefore, for the observer to say whether or not there was icing. This phenomenon will be coded as follows:

$w_4=3$
$H_1H_1=1{,}680$ meters, coded as 17.
$H_2H_2=$unknown, coded as //.

The 5-digit group 317// will, accordingly, be included in the raob message.

290297°--41——8

For example, in consecutive groups coded 49052 9999/ 83011 (where the pressure of the lower recorded level is 949 mb) the presence of one 9999/ group automatically indicates that the pressure of the upper recorded level can NOT be less than 849 mb. It follows that code figure 83 for symbol PP in the upper recorded level must be decoded as 883 mb, and not as 783 or 683. Similarly, 49052 9999/ 9999/ 83011 would mean that the pressure of the upper recorded level must be 783 mb since it cannot be less than 749 mb nor more than 849mb.

The additional data designator group 10178, plus the group $m_dP_1P_1P_2P_2$, are used to designate the forms and levels of missing data. For example, if the temperature data are missing between levels 732 mb and 514 mb the groups 10178 47351 are added at the end of the message to report this information. (101 for "additional data follows"; 78 for "forms and levels of missing data"; 4 for "temperature data only are missing"; 73 for "lower level of 730 mb"; 51 for "upper level of 510 mb".) In this particular case it would not be necessary to insert additional 9999/ groups in the message since all of the PPTTU data elements are not missing.

It will not be necessary to report that mixing ratio are missing, since it may be presumed that the same reasons that prevent the reporting of relative humidity also prevent the reporting of mixing ratio data for the same levels. The use of code figure 99 for symbol m_rm_r in the appropriately designated mixing ratio data groups, will specify automatically the particular levels for which mixing ratio data are missing. The use of a slant (/) for symbol U specifies that the relative humidity data are missing.

It will not be necessary to report that isentropic data are missing. When all isentropic data groups are missing for one or more selected surfaces the isentropic groups are simply omitted from the message and no designator groups are necessary to report the omission. When isentropic data for less than the usual number of selected surfaces are reported the figures used for the isentropic surface designators L_x or L_y or L_z will specify to which particular surface the data apply. When less than six isentropic data elements are reported for one selected surface the use of code figure 99 will specify the elements which are missing.

2-1007. Reporting Doubtful Data. At times it may be necessary to report that the data included in the report are doubtful. Groups to indicate which data are doubtful may be sent at the end of either the first or second transmissions, or may be reported as a separate message when discovered too late for inclusion in the original message.

When data recorded for any selected level are "doubtful" they may be considered as EITHER "missing data", OR as "correct data".

When data are believed to be "extremely doubtful" they will be considered as "missing data" and will be so coded.

2-1011. Examples of Decoding.—Examples showing methods of decoding follow:

(*a*) Message received by teletype:

BU01	02940	19539	05660	93325	10100
82418	18190	41912	32800	10805	58906
80601	91089	3////	27780	9////	44360
9////	54160	6////	4903	8073	7170//
1135	823486	79569	67248	6240	224830
423520					

Coded

Code Figures		Code Symbols	
BU01		IIG_1G_1	
02940	19539	*HHPPT*	*TUUmm*
05660	93325	*HHPPT*	*TUUmm*
10100	82418	*HHPPT*	*TUUmm*
18190	41912	*HHPPT*	*TUUmm*
32800	10805	*HHPPT*	*TUUmm*
58906	80601	*HHPPT*	*TUUmm*
91089	3////	*HHPPT*	*TUUmm*
27780	9////	*HHPPT*	*TUUmm*
44360	9////	*HHPPT*	*TUUmm*
54160	6////	*HHPPT*	*TUUmm*
4903	8073	$P_aP_aP_bP_b$	$P_cP_cP_dP_d$
7170//		$P_eP_eP_fP_fP_gP_g$	
1135		N_cCdd	
823486		$\psi_x\psi_x\psi_y\psi_y\psi_z\psi_z$	
79569	67248	$P_xP_xP_{sx}P_{sx}\theta_x$	$\theta_xP_yP_yP_{sy}P_{sy}$
6240		$P_zP_zP_{sz}P_{sz}$	
224830	423520	$D_1D_1S_1S_1D_2D_2$	$S_2S_2D_3D_3S_3S_3$

Decoded

Burbank, Calif., raob ascent made at 1 a. m., 75th meridian time

Data for levels

Level No.	Elevations m. (m. s. l.)	Barometric pressure (mb.)	Temperature (°C.)	Relative humidity (percent)	Mixing ratio (g./kg.)
Surface	[1] 200	994	1	95	3.9
1	500	966	9	33	2.5
2	1,000	910	8	24	1.8
3	1,800	819	4	19	1.2
4	3,200	680	1	8	.5
5	5,800	490	−18	6	.1
6	9,100	308	−43	(2)	(2)
7	12,700	178	−59	(2)	(2)
8	14,400	136	−59	(2)	(2)
9	15,400	116	−56	(2)	(2)

[1] Actually 220.

[2] Unknown. Readings of hair hygrometer unreliable at low temperatures.

Barometric pressure: 849 mb. at 1,520 m.; 703 mb. at 3,050 m.; 580 mb. at 4,570 m.; 473 mb. at 6,100 m.

Barometric pressure: 271 mb. at 10,000 m.; 170 mb. at 13,000 m.; Observation yields no pressure datum at 16,000 m.

Few or 1 Ci direction 350°.

Stream function 2,982 millions of ergs/gram for $\theta=296°$ A.

Stream function 3,034 millions of ergs/gram for $\theta=302°$ A.

Stream function 3,086 millions of ergs/gram for $\theta=308°$ A.

Actual pressure for $\theta=296°$ A., 790 mb.

Condensation pressure for $\theta=296°$ A., 560 mb.

Lowest potential temperature surface $\theta=296°$ A.

Actual pressure for $\theta=302°$ A., 720 mb.

Condensation pressure for $\theta=302°$ A., 480 mb.

Actual pressure for $\theta=308°$ A., 620 mb.

Condensation pressure for $\theta=308°$ A., 400 mb.

Direction of shear-stability ratio vector for $\theta=296°$ A., 220°.

Magnitude of shear-stability ratio vector for $\theta=296°$ A., 48 decameters/second.

Direction of shear-stability ratio vector for $\theta=302°$ A., 300°.

Magnitude of shear-stability ratio vector for $\theta=302°$ A., 42 decameters/second.

Direction of shear-stability ratio vector for $\theta=308°$ A., 350°.

Magnitude of shear-stability ratio vector for $\theta=308°$ A., 20 decameters/second.

When data are believed to be "somewhat doubtful" but are nevertheless probable, and are certainly possible, they will be considered, for coding purposes, as "correct data" and will be coded in the usual way. However, in these cases, there will be added two or more "additional data groups" at the end of the message to report the form of data, and their levels of occurrence, which are considered as "doubtful".

For example, if it is believed that the temperature values are doubtful between the 631 mb and 512 mb levels, the TT symbols in the PPTTU groups for these levels would be coded as though the data were correct, and the code groups 10179 46351 would be placed at the end of the first transmission message.

These groups are translated as follows:

101 for symbol $A_dA_dA_d$ means "additional data follow".
79 for symbol $A_{df}A_{df}$ means "form and levels of doubtful data follow".
4 for symbol d_d means "form of doubtful data is temperature".
63 for symbol P_1P_1 means that the pressure at the lower level of doubtful data is 630 millibars.
51 for symbol P_2P_2 means that the pressure at the upper level of doubtful data is 510 millibars.

When it is desired to report "doubtful data" for two or more spans of record, which are separated by spans of record which are not doubtful, it will be necessary to use two or more $d_dP_1P_1P_2P_2$ groups after the single designator group $A_dA_dA_dA_{df}A_{df}$.

When only one level is doubtful the coded figures for symbols P_1P_1 and P_2P_2 are identical, or represent levels only 10 mb apart.

2-1008. Reporting Corrective Data. At times it may be necessary to send corrections to raob messages which were originally reported with incorrect data, or which had too many or too few groups. The provisions included herein provide for the sending of corrections for ALL elements of only one specific group, or for several groups, or for all groups in the incorrect message, as required. Corrections can also be sent for specific elements of data in one group, or in all groups, of the original message.

For example, it may be necessary to report that one of the PPTTU groups was omitted, or that only the temperature or relative humidity were reported incorrectly for several levels, or that only the mixing ratio data, or isentropic data were reported incorrectly.

The reporting of corrective data requires two or more groups ("additional data groups") depending on the amount and type of data being corrected. The first of these groups has the symbol form $A_dA_dA_dA_{df}A_{df}$. The code figure for symbol $A_dA_dA_d$ is always 101; the code figure for symbol $A_{df}A_{df}$, when used to report corrective data, is always taken from the 80 to 89 list in Code Table 101.

In many cases, where incorrect data have been sent in the original message, it will be more satisfactory to send an entirely new corrected message, than it would be to send corrections to several different portions of the original message.

For example, when the additional data designator group is coded as 10181 it means "corrected report for the entire first part follows". Group 10181 is placed as the first group in the complete message, as corrected, and immediately precedes group 111GG. The corrected message is then transmitted as an additional observation, or as a regular message, as usual.

(*b*) Message received by teletype:

EO04	12841	04842	21930	48555	36595
69033	41115	99129	48586	37318	52376
66213	4298	75//	79611	0614	08060
05//	16661	68879	98861	9341//	80779
66563	////	//////	//////		

Coded — *Decoded*

Code Figures		Code Symbols	
EO04		IIG_1G_1	
12841	04842	*HHPPT*	*TUUmm*
21930	48555	*HHPPT*	*TUUmm*
36595	69033	*HHPPT*	*TUUmm*
41115	99129	*HHPPT*	*TUUmm*
48586	37318	*HHPPT*	*TUUmm*
52376	66213	*HHPPT*	*TUUmm*
4298	75//	$P_aP_aP_bP_b$	$P_cP_cP_dP_d$
79611	0614	$P_1P_1P_2P_2h_p$	N_cCdd
08060	05//	$P_1P_1P_2P_2h_p$	N_cCdd
16661		$w_3P_3P_3P_4P_4$	
68879		$w_3P_3P_3P_4P_4$	
98861		$w_3P_3P_3P_4P_4$	
9341//		$\psi_x\psi_x\psi_y\psi_y\psi_z\psi_z$	
80779	66563	$P_xP_xP_{sx}P_{sx}\theta_x$	$\theta_xP_yP_yP_{sy}P_{sy}$
////		$P_zP_zP_{sz}P_{sz}$	
//////	//////	$D_1D_1S_1S_1D_2D_2$	$S_2S_2D_3D_3S_3S_3$

El Paso, Tex., hour of apob take-off 4 a. m., 75th meridian time

Data for levels

Level No.	Elevations m. (m. s. l.)	Barometric pressure (mb.)	Temperature (°C.)	Relative humidity (percent)	Mixing ratio (g./kg.)
Surface	[1] 1200	884	10	48	4.2
1	2100	793	4	85	5.5
2	3600	659	−6	90	3.3
3	4100	611	−9	91	2.9
4	4800	558	−13	73	1.8
5	5200	537	−16	62	1.3

[1] Actually 1193

Barometric pressure: 842 mb. at 1,520 m.; 698 mb. at 3,050 m.; 575 mb. at 4,570 m.; No data for 6,100 m.

Base observed at 790 mb. pressure.
Top observed at 610 mb. pressure.
10 Sc direction 140°.

Base and top above maximum elevation of ascent.
10 As direction unknown.

Hard ice formed on airplane between levels at 660 and 610 mb. pressure.

Rain encountered between levels at 880 and 790 mb. pressure.

Turbulence encountered between levels at 880 and 610 mb. pressure.

Stream function 2,993 millions of ergs/gram for $\theta=296°$ A.
Stream function 3,041 millions of ergs/gram for $\theta=302°$ A.
Observation yields no stream function data for $\theta=308°$ A.

Actual pressure for $\theta=296°$ A., 800 mb.
Condensation pressure for $\theta=296°$ A., 770 mb.
Lowest potential temperature surface, $\theta=296°$ A.
Actual pressure for $\theta=302°$ A., 650 mb.
Condensation pressure for $\theta=302°$ A., 630 mb.

Observation yields neither acutal nor condensation pressure for $\theta=308°$ A.

Observation yields no shear-stability ratio vector data because of insufficient upper air wind data due to low clouds.

Similarly, 10182 means "corrected report for the entire second part follows". In the above two cases, of course, the first part is understood to mean "up to 400 mb level", and the second part means "above 400 mb level".

When incorrect data have been sent, or a group has been omitted, in the first few groups of a message the additional data designator group 10183 may be used. Group 10183 means "corrected report for first several consecutive groups". For example group 10183 might be used to correct data originally sent for one or several of the symbols III, GG, PPP, TT, UU, H_5, H_{10}, and H_{20}, or for symbols PP, TT, or U of the first few selected levels above the ground.

In corrective messages of this type (i.e. with group 10183) all groups are sent in the usual order. The corrected message, when preceded by group 10183, may be broken off after the first or second PPTTU group which was reported correctly in the original report. When this has been done the decoder can determine the continuity of records between data of the original message and data of the corrected message.

When all the mixing ratio data groups are sent in a corrective message they are sent in the usual order, and are preceded by the designator group 10186 which means "corrected mixing ratio data groups follow".

When all the isentropic data groups are sent in a corrective message they are sent in the usual order, and are preceded by the designator group 10187, which means "isentropic data groups follow".

When "additional data groups" are sent in a corrective message they are sent in the usual order, and are preceded by the designator group 10188 which means "additional data groups follow".

The above instructions are followed only for corrections to: *(a)* the entire "first part" of a complete observation, or *(b)* the entire "second part", or *(c)* the first several consecutive groups of a message, or *(d)* all the mixing ratio groups, or *(e)* all the isentropic groups. Different procedures are used *(described below)* when corrections are sent for single groups, or for several random groups, or for specific elements of the various groups.

Three additional data groups, plus the appropriate number of corrected data groups, are used when corrective messages are sent involving only certain specific groups of the original message, or involving only specific data in one or more groups. The first of these three groups used in these cases has the symbol form $A_dA_dA_dA_{df}A_{df}$, and is always coded as 10180, which means "form and levels of corrective data follow". This designator group is followed by the "additional data group" having the symbol form $c_dP_1P_1P_2P_2$, where symbol c_d is "form of corrective data being reported", symbol P_1P_1 is lower level of corrective data reported, and symbol P_2P_2 is highest level of corrective data reported.

Immediately after the above two groups there will be placed a group that means "corrected PPTTU groups follow", or "corrected mixing ratio groups follow", etc., as appropriate. This latter group (which will be either 10184, 10185, 10186, or 10187) will, in turn, be followed by all the corrected data groups for the points between the levels specified by the $c_dP_1P_1P_2P_2$ group.

(*c*) Message received by teletype:

NA311	02905	28628	07265	89322	//9//
21736	99310	22586	79313	35407	69107
37247	68805	53958	97102	3378	44//
93771	0627	74665	6432	08474	79974

Coded — *Decoded*

Code Figures		Code Symbols		Decoded
NA311		$IIY_1G_1G_1$		Nashville, Tenn., apob flight made *Tuesday*, take-off at 11 a. m., 75th meridian time

Data for levels

				Level No.	Elevations m. (m. s. l.)	Barometric pressure (mb.)	Temperature (° C.)	Relative humidity (percent)	Mixing ratio (g./kg.)
02905	28628	*HHPPT*	*TUUmm*	Surface	[1] 200	990	−2	86	2. 8
07265	89322	*HHPPT*	*TUUmm*	1	700	926	−8	93	2. 2
//9//		//9//		Data between 700 and 2,100 m. are missing, and it is uncertain whether there are significant levels between those heights.					
21736	99310	*HHPPT*	*TUUmm*	2	2100	773	−19	93	1. 0
22586	79313	*HHPPT*	*TUUmm*	3	2200	758	−17	93	1. 3
35407	69107	*HHPPT*	*TUUmm*	4	3500	640	−26	91	. 7
37247	68805	*HHPPT*	*TUUmm*	5	3700	624	−26	88	. 5
53958	97102	*HHPPT*	*TUUmm*	6	5300	495	−39	71	. 2

[1] Actually 180.

3378	44//	$P_aP_aP_bP_b$	$P_cP_cP_dP_d$	Barometric pressure: 833 mb. at 1,520 m.; 678 mb. at 3,050 m.; 544 mb. at 4,570 m.; No data for 6,100 m.
93771	0627	$P_1P_1P_2P_2h_p$	N_cCdd	Base observed at 930 mb. pressure. Top observed at 770 mb. pressure. 10 Sc direction 270°.
74665	6432	$P_1P_1P_2P_2h_p$	N_cCdd	Base estimated at 740 mb. pressure. Top estimated at 660 mb. pressure. 6 Ac direction 320°.
08474		$w_3P_3P_3P_4P_4$		Rime formed on airplane between levels at 840 and 740 mb. pressure.
79974		$w_3P_3P_3P_4P_4$		Snow encountered between levels at 990 and 740 mb. pressure.

(Figures for stream functions and related pressures and shear-stability ratio vector data are omitted since the potential temperatures specified occur above the maximum altitude of the flight.)

NOTE.—Due to the lack of data for the stratum from 700 meters to 2,100 meters, some uncertainty exists regarding the accuracy of the elevations above 700 meters and the pressures at fixed levels.

(*d*) Message received by teletype:

XW07 APWE

Coded	*Decoded*
XW07	Maxwell Field, Montgomery, Ala., apob flight, message filed at 7 a. m., 75th meridian time.
APWE	Flight not made by 7 a. m., 75th meridian time, on account of unfavorable weather conditions.

For example, suppose the temperatures reported in the first message for only the 671 mb, 603 mb, and 532 mb levels were incorrect, and it is desired to send a corrective report. The coded figures for the corrected temperatures, and for the relative humidities, for these three levels are 59, 64, 71 and 6, 5, and 4, respectively. The corrective message would contain the following groups:

10180 46753 10184 71596 03645 32714, where

101 = symbol $A_dA_dA_d$ = "additional data follows"
80 = symbol $A_{df}A_{df}$ = "form and levels of corrective data follow"
4 = symbol c_d = "form of corrective data being reported in following groups of this message is temperature"
67 = symbol P_1P_1 = lower level of record for which following groups apply is 670 mb.
53 = symbol P_2P_2 = upper level of record for which following groups apply is 530 mb.
101 = symbol $A_dA_dA_d$ = "additional data follows"
84 = symbol $A_{df}A_{df}$ = "corrected PPTTU groups of first part follow"
71 = symbol PP = 71 mb (i.e., 671 mb)
59 = symbol TT = -9°C
6 = symbol U = 60 to 69%
03 = symbol PP = 03 mb (i.e., 603 mb)
64 = symbol TT = -14°C
5 = symbol U = 50 to 59%
32 = symbol PP = 32 mb (i.e., 532 mb)
71 = symbol TT = -21°C
4 = symbol U = 40 to 49%

The above groups, of course, would be preceded by the "station-time" group 11168 when actually transmitted.

When a correction to one or several, but not ALL, mixing ratio groups is to be reported three "additional data groups" plus the corrected mixing ratio groups, are sent.

For example, 10180 for symbol $A_dA_dA_dA_{df}A_{df}$ means "form and levels of corrected data follow"; 76354 for symbol $c_dP_1P_1P_2P_2$ means "form of corrective data being reported is mixing ratio (7); 630 mb and 540 mb are the pressures at the lower and upper levels of the corrected mixing ratio data; 10186 for symbol $A_dA_dA_dA_{df}A_{df}$ means "corrected mixing ratio groups follow"; after group 10186 would be sent the necessary number of $Lm_rm_rm_rm_r$ groups required for each PPTTU group between the levels indicated by group $c_dP_1P_1P_2P_2$.

In many instances it will be more satisfactory to send a corrected message for all the mixing ratio groups rather than for two or three random mixing ratio groups which are not in consecutive order.

When a correction to one or several, but not ALL, isentropic groups is to be reported three additional data groups, plus the corrected isentropic data groups, are sent.

(*e*) Message received by teletype:

CQN CD04 10/11/16/17 26342 15880 49460
47131

Coded	*Decoded*
CQN	Correction message.
CD04	Scott Field, Belleville, Ill., ascent at 4 a. m., 75th meridian time.
10/11/16/17	Groups Nos. 10, 11, 16, and 17 of the original message to be replaced by the four following groups, respectively.
26342	Group to replace group 10 of original message.
15880	Group to replace group 11 of original message.
49460	Group to replace group 16 of original message.
47131	Group to replace group 17 of original message.

TABLE 9.—*Code for* P_1P_1 *and* P_2P_2 *when unknown in apobs*

When the height and pressure at the base of the cloud layer are unknown: Code P_1P_1 as—	When the height and pressure at the top of the cloud layer are unknown: Code P_2P_2 as—
05—If uncertain whether base below or above maximum (i. e. maximum elevation reached by airplane).	05—If uncertain whether top below or above maximum.
06—If certain base *below* maximum, plane being *out of clouds* at maximum.	06—If certain top *above* maximum, plane being *out of clouds* at maximum.
07—If certain base *below* maximum, plane being *in clouds* at maximum.	07—If certain top *above* maximum, plane being *in clouds* at maximum.
08—If certain base *above* maximum.	08—If certain top *below* maximum.

TABLE 10.—*Symbol* h_p—*Basis for information regarding cloud limits*

Code figure	Significance	Code figure	Significance
0	Base of clouds above maximum, top above maximum.[1] (P_1P_1=08, P_2P_2=06).	4	Base estimated, top observed.
1	Base observed, top observed.	5	Base estimated, top estimated.
2	Base observed, top estimated.	6	Base estimated, top unknown.[1]
3	Base observed, top unknown.[1]	7	Base unknown, top observed.[1]
		8	Base unknown, top estimated.[1]
		9	Base unknown, top unknown.[1]

[1] See table 9.

TABLE 11.—*Symbol* C—*Type of cloud*

Code figure	Type of cloud	Abbreviations
1	Cirrus	Ci
2	Cirrostratus	Cs
3	Cirrocumulus	Cc
4	Altocumulus	Ac
5	Altostratus	As
6	Stratocumulus	Sc
7	Nimbostratus	Ns
8	Cumulus or Fractocumulus	Cu or Fc
9	Cumulonimbus	Cb
0	Stratus or Fractostratus	St or Fs

For example, group 10180 means "forms and levels of corrected data follow"; then comes the $c_dP_1P_1P_2P_2$ group, in which c_d is coded as 8 for "isentropic data"; then comes 10187 for "corrected isentropic data groups follow"; then comes the corrected isentropic groups for one or more surfaces.

From the above it can be seen that it usually will be more satisfactory to send all the isentropic groups, preceded by the single designator group 10187, which means "corrected isentropic groups follow".

It should be noted from the above examples that *(a)* when corrections for <u>all</u> the groups are sent only one "additional data group" is necessary (besides the corrected groups), and that *(b)* when corrections for only one or several groups are sent three "additional data groups" are necessary.

2-1009. Reporting "Reason for No Raob" Data. A brief message will be sent in place of the regular message when, for any reason, the regular raob is not made, or is not finished in time for the regular transmission, or does not provide satisfactory data, or does not provide data for levels which are higher than 500 meters above the ground.

This brief message will usually consist of only two groups, and will be known as the "reason for no raob" report. The first group will have the symbol form 111GG and the second group will have the symbol form $A_dA_dA_dA_{df}A_{df}$. The code figures for symbol $A_{df}A_{df}$ will come from the 33-52 group of figures in Table 101.

For example, if the 0400 GCT observation from Washington (405) could not be made because of unfavorable weather conditions the "reason for no raob" report would be coded 40504 10135.

When required two (or more) groups with symbol $A_{df}A_{df}$ may be used to furnish the reasons for no report. *(Example: 10135 for "weather conditions unfavorable" and 10137 for "observation delayed".)*

TABLE 12.—*Symbol* w_3—*Special phenomena*

Code figure	Phenomena	Code figure	Phenomena
0	Rime or frost.	6	Rain.
1	Hard ice.	7	Snow or sleet, i. e., ice pellets.
2	Haze or smoke.	8	Hail.
3	Dust or blowing snow (or both).	9	Thunderstorm [1] heard at station, or turbulence.
4	Fog.		
5	Drizzle (international definition).		

[1] See table 14, last 2 sentences.

TABLE 13—*Symbol* w_4—*Icing*

Code figure	Phenomena
1	When there is a decrease, either sudden or gradual, in the ascensional rate which extends over 2 or more adjacent contacts, provided, that the decrease occurs in a layer wherein the meterological conditions are favorable for icing. (See par. 2–1010.)
2	When meteorological conditions are favorable for icing (see par. 2–1010), but the record shows either no decrease in ascensional rate, or an increase in ascensional rate of the balloon. (In this case icing and turbulence might be occurring simultaneously, such as is possible in the upper portion of a high cumulonimbus cloud. Here the ascending currents would be sufficiently strong to overcome or compensate retardation in the ascensional rate which would have resulted if icing only had occurred.)
3	When there is a decrease, either sudden or gradual, in the ascensional rate of the balloon with temperature 0° C. or lower (allowing for possible instrumental error) but the observer is unable to determine whether or not the instrument was in a cloud or in precipitation in liquid form and, therefore, whether icing occurred. (The decrease in ascensional rate in this case might be due to ice accretion in a cloud or precipitation aloft not visible to the observer. It is also possible to have a decrease in ascensional rate with conditions unfavorable for icing due to a descending turbulent current, precipitation or to some mechanical defect.)

TABLE 14.—*Code for* P_3P_3 *and* P_4P_4 *when unknown or there was no emergence from phenomenon during ascent in apobs*

In those cases where, *during the ascent*, the airplane encountered one of the phenomena designated by the code element w_3, and the pressure at the level of entry (P_3P_3) into the phenomenon is unknown, or the pressure at the level of emergence (P_4P_4) from the phenomenon is unknown or there was no emergence during the ascent, the code element P_3P_3 or P_4P_4, whichever is in question, will be coded as follows:

05—If uncertain whether the specified phenomenon was being encountered at the maximum elevation reached by the airplane;

06—If the specified phenomenon was encountered below the maximum elevation reached by the airplane, but not at that elevation;

07—If the specified phenomenon was being encountered at the maximum elevation reached by the airplane.

When w_3 represents "thunderstorm heard at station" (code figure 9), the elements $P_3P_3P_4P_4$ are enciphered as 0000 in apobs and also in raobs. When w_3 represents "turbulence" (code figure 9), the regular code for P_3P_3 and P_4P_4 will be used as for code figures 0 to 8 pertaining to w_3.

2-1010. Examples of Decoding. Examples showing methods of decoding follow:

(a) First Transmission - sent at 0200 E.W.T. (0600 G.C.T.)

Coded Message: 49304 99401 95681 66093 10082 49052 78031 93011 59511
68601 73691 0081/ 13925 31814 51006 70503 90199

Group no.	Code symbols	Code figures	Decoded data
1	IIIGG	49304	Station = Oakland, Cal.; time of observation = 0400 GCT.
2	PPPTT	99401	Surface pressure = 994 mb.; surface temperature = 1°C.
3	$UUH_5H_{10}H_{20}$	95681	Surface humidity = 95%; sixth group (6) in message contains 5000-foot data; eighth group (8) contains 10,000-foot data; eleventh group (1) contains 20,000-foot data.
4	PPTTU	66093	Pressure = 966 mb.; Temperature = 9°C; Humidity = 30 to 39%.
5	PPTTU	10082	Pressure = 910 mb.; Temperature = 8°C; Humidity = 20 to 29%.
6	PPTTU	49052	Pressure = 849 mb.; Temperature = 5°C; Humidity = 20 to 29%.
7	PPTTU	78031	Pressure = 778 mb.; Temperature = 3°C; Humidity = 0 to 19%.
8	PPTTU	93011	Pressure = 693 mb.; Temperature = 1°C; Humidity = 0 to 19%.
9	PPTTU	59511	Pressure = 659 mb.; Temperature = -1°C; Humidity = 0 to 19%.
10	PPTTU	68601	Pressure = 568 mb.; Temperature = -10°C; Humidity = 0 to 25%.
11	PPTTU	73691	Pressure = 473 mb.; Temperature = -19°C; Humidity = 0 to 30%.
12	PPTTU	0081/	Pressure = 400 mb.; Temperature = -31°C; Humidity = Unknown.
13	$Lm_rm_rm_rm_r$	13925	Mixing ratios: Surface level = 3.9 g/kg; 2nd level = 2.5 g/kg.
14	$Lm_rm_rm_rm_r$	31814	Mixing ratios: 3rd level = 1.8 g/kg; 4th level = 1.4 g/kg.
15	$Lm_rm_rm_rm_r$	51006	Mixing ratios: 5th level = 1.0 g/kg; 6th level = 0.6 g/kg.
16	$Lm_rm_rm_rm_r$	70503	Mixing ratios: 7th level = 0.5 g/kg; 8th level = 0.3 g/kg.
17	$Lm_rm_rm_rm_r$	90199	Mixing ratios: 9th level = 0.1 g/kg; 10th level = Unknown.

Note: Humidity is actually below measurable limits in groups numbered 10 and 11; in group 12 the relative humidity data are missing (unknown).

TABLE 15.—*Symbol Q—Octant of the globe*

Longitude	Code figures
North latitude:	
0° W. to 90° W.	0
90° W. to 180° W.	1
180° E. to 90° E.	2
90° E. to 0° E.	3
South latitude:	
0° W. to 90° W.	5
90° W. to 180° W.	6
180° E. to 90° E.	7
90° E. to 0° E.	8

TABLE 16.—*Second group of "no raob" and "no apob" messages*

Group		Reason for no report
RA=Radiosonde	AP=Airplane	
RAWE	APWE	Unfavorable weather conditions.
RARF		Recorder failure.
RAIF		Radiosonde instrument failure.
RADI		Radiosonde instrument disabled in launching.
RARA		No radiosondes on hand.
RABT		No batteries on hand.
RABA		No ballons on hand.
RAHE		No gas on hand.
RALO	APLO	Maximum altitude less than 500 m. above ground.
RADL	APDL	Observation delayed; to be transmitted later.
RAFI	APFI	No raob or apob message received for filing.
	APAF	Aerometeorograph failure.
	APPL	No airplane available.
	APPI	No pilot available.
	APFD	Field unsafe, or closed.
RAXX	APXX	Any reason not included above.

TABLE 17.—*Reasons for the termination of raobs the maximum altitudes of which are not more than 6,000 meters, m. s. l.*

Code group	Reason	Code group	Reason
GEFA	Ground equipment failure.	FADE	Fading, reason unknown.[1]
RAFA	Radiosonde transmitter failure.	WSUN	Weak signal, reason unknown.[1]
BAFA	Radiosonde battery failure.	SHDR	Excessive shifting or drifting of the record.
POFA	Power failure at ground.	ICNG	Balloon forced down by icing conditions.
AINT	Atmospheric interference.	RAIN	Balloon forced down by heavy rain.
LINT	Local interference.	SNOW	Balloon forced down by heavy snow.
FAWI	Fading caused by high winds aloft.[1]	HAIL	Balloon forced down by hail.
WSAN	Fading signal, antenna shielded by obstruction.[1]	LKBL	Leaking balloon.
WSGE	Fading signal, geographical conditions.[1]	REXX	Any reason not included above.

[1] Fading signals differ from weak signals in that the former are first received satisfactorily, then become increasingly weaker, and finally become too weak for reception, while the latter are weak from the beginning.

(b) Second Transmission - sent at 0443 E.W.T. (0843 G.C.T.)

Coded Message: 49354 1846/ 08931 71971 82081 70091 36091 16061 10177
67956 68231 62218 27248 23432 23016 86240 88633 83506

Group no.	Code symbols	Code figures	Decoded data
1	$111G_{50}G_{50}$	49354	Station = Oakland, Cal.; time of observation = 0400 GCT. *(Time of observation is increased by 50 to indicate that this is the SECOND transmission.)*
2	$Y_mY_mH_{33}H_{43}H_{53}$	1846/	Day of month = 18th *(in Greenwich)*; 4th group in message contains 32,810-foot data *(10 km)*; 6th group contains data for 42,650-foot level *(13 km)*; 52,490-foot data not sent.
3	PPTTU	08931	Pressure = 308 mb.; Temperature = -43°C; Humidity = 0 to 50%.
4	PPTTU	71971	Pressure = 271 mb.; Temperature = -47°C; Humidity = 0 to 50%.
5	PPTTU	82081	Pressure = 182 mb.; Temperature = -58°C; Humidity = 0 to 50%.
6	PPTTU	70091	Pressure = 170 mb.; Temperature = -59°C; Humidity = 0 to 50%.
7	PPTTU	36091	Pressure = 136 mb.; Temperature = -59°C; Humidity = 0 to 50%.
8	PPTTU	16061	Pressure = 116 mb.; Temperature = -56°C; Humidity = 0 to 50%.
9	$A_dA_dA_dA_{df}A_{df}$	10177	Additional data groups follow (101); additional data furnished are isentropic data (77).
10	$L_xP_{px}P_{px}P_{sx}P_{sx}$	67956	At 296° level: actual pressure = 790 mb.; condensation pressure = 560 mb.
11	$L_xZ_{fx}Z_{fx}d_{wx}d_{wx}$	68231	At 296° level: stream function = 2,982 millions of ergs/gram; wind direction = 310°.
12	$L_xd_{ix}d_{ix}S_{ix}S_{ix}$	62218	At 296° level: direction of isobars = 220°; angular spacing of isobars = 1.8°.
13	$L_yP_{py}P_{py}P_{sy}P_{sy}$	27248	At 302° level: actual pressure = 720 mb.; condensation pressure = 480 mb.
14	$L_yZ_{fy}Z_{fy}d_{wy}d_{wy}$	23432	At 302° level: stream function = 3,034 millions of ergs/gram; wind direction 320°.
15	$L_yd_{iy}d_{iy}S_{iy}S_{iy}$	23016	At 302° level: direction of isobars = 300°; angular spacing of isobars = 1.6°.
16	$L_zP_{pz}P_{pz}P_{sz}P_{sz}$	86240	At 308° level: actual pressure = 620 mb.; condensation pressure = 400 mb.
17	$L_zZ_{fz}Z_{fz}d_{wz}d_{wz}$	88633	At 308° level: stream function = 3,086 millions of ergs/gram; wind direction = 330°.
18	$L_zd_{iz}d_{iz}S_{iz}S_{iz}$	83506	At 308° level: direction of isobars = 350°; angular spacing of isobars = 0.6°.

Note: Humidity is actually below measurable limits in groups 3 to 8 inclusive.

TABLE 18.—*Potential temperatures for which stream functions and actual and condensation pressures are to be computed and dates on which each group of potential temperatures becomes effective*

Date effective	Potential temperatures			Date effective	Potential temperatures		
	Lowest θ_x	Intermediate θ_y	Highest θ_z		Lowest θ_x	Intermediate θ_y	Highest θ_z
Jan. 1	290	296	302	Sept. 1	302	308	314
Mar. 1	296	302	308	Nov. 1	296	302	308
May 1	302	308	314	Jan. 1	290	296	302
July 1	308	314	320				

TABLE 19.—*Pressure, in mb., at various geometric heights above sea level, in hundreds of meters, according to the United States standard atmosphere*

Geometric height hundreds of meters above sea level	0	1	2	3	4	5	6	7	8	9
	mb.	*mb.*	*mb.*	*mb.*	*mb.*	*mb.*	*mb.*	*mb.*	*mb.*	*mb.*
−0	1,013	1,025	1,038	1,050						
+0	1,013	1,001	989	978	966	955	943	932	921	910
10	899	888	877	866	856	846	835	825	815	805
20	795	785	775	766	756	747	737	728	719	710
30	701	692	683	675	666	658	649	641	633	624
40	616	608	600	593	585	577	570	562	555	547
50	540	533	526	519	512	505	498	491	485	478
60	472	465	459	453	446	440	434	428	422	416
70	410	405	399	393	388	382	377	372	366	361
80	356	351	346	341	336	331	326	321	317	312
90	307	303	298	294	289	285	281	277	272	268
100	264	260	256	252	248	245	241	237	233	230
110	226	223	219	216	212	209	206	203	200	196
120	193	190	187	185	182	179	176	173	171	168
130	165	163	160	158	155	153	151	148	146	144
140	141	139	137	135	133	131	129	127	125	123
150	121	119	117	115	113	112	110	108	107	105
160	103	102	100	99	97	96	94	93	91	90
170	88	87	86	84	83	82	80	79	78	77
180	76	74	73	72	71	70	69	68	67	66
190	65	64	63	62	61	60	59	58	57	56
200	55.2									
210	47.2									
220	40.4									
230	34.5									
240	29.5									
250	25.2									
260	21.6									
270	18.4									
280	15.8									
290	13.5									
300	11.5									

2-1011. Code Tables.

TABLE 101

Symbol $A_{df}A_{df}$ = Additional Data Form Reported

Note: "Reason for No Raob" given by Code Figures 33 to 52, inclusive.
"Reason for Termination of Record" given by Figures 50 to 54, inclusive.
Code Figures 65 to 99 require additional groups beside the $A_dA_dA_dA_dA_{df}A_{df}$ group.

00	Reserved
01	First day of month (G.C.T.)
02	Second day of month (G.C.T.)
03	Third day of month (G.C.T.)
04	Fourth day of month (G.C.T.)
05	Fifth day of month (G.C.T.)
06	Sixth day of month (G.C.T.)
07	Seventh day of month (G.C.T.)
08	Eighth day of month (G.C.T.)
09	Ninth day of month (G.C.T.)
10	Tenth day of month (G.C.T.)
11	Eleventh day of month (G.C.T.)
12	Twelfth day of month (G.C.T.)
13	Thirteenth day of month (G.C.T.)
14	Fourteenth day of month (G.C.T.)
15	Fifteenth day of month (G.C.T.)
16	Sixteenth day of month (G.C.T.)
17	Seventeenth day of month (G.C.T.)
18	Eighteenth day of month (G.C.T.)
19	Nineteenth day of month (G.C.T.)
20	Twentieth day of month (G.C.T.)
21	Twenty first day of month (G.C.T.)
22	Twenty second day of month (G.C.T.)
23	Twenty third day of month (G.C.T.)
24	Twenty fourth day of month (G.C.T.)
25	Twenty fifth day of month (G.C.T.)
26	Twenty sixth day of month (G.C.T.)
27	Twenty seventh day of month (G.C.T.)
28	Twenty eighth day of month (G.C.T.)
29	Twenty ninth day of month (G.C.T.)
30	Thirtieth day of month (G.C.T.)
31	Thirty first day of month (G.C.T.)
32	
33	Radiosonde disabled at launching
34	Power failure at ground
35	Unfavorable weather conditions
36	Low maximum altitude (less than 500 meters above ground)
37	Observation delayed
38	Raobs temporarily discontinued at request of supervising office
39	Raobs permanently discontinued at request of supervising office

TABLE 20.—*Heights above sea level, in hundreds of meters, at various pressures, in mb., according to the United States standard atmosphere*

Pressure (mb.)	0	10	20	30	40	50	60	70	80	90
	100's m.	*100's m.*	*100's m.*	*100's m.*	*100's m.*	*100's m.*	*100's m.*	*100's m.*	*100's m.*	*100's m.*
1,000	1. 1	0. 3	−0. 6	−1. 4	−2. 2	−3. 0				
900	9. 9	9. 0	8. 1	7. 2	6. 3	5. 4	4. 5	3. 7	2. 8	2. 0
800	19. 5	18. 5	17. 5	16. 5	15. 5	14. 6	13. 6	12. 7	11. 7	10. 8
700	30. 1	29. 0	27. 9	26. 8	25. 7	24. 6	23. 6	22. 5	21. 5	20. 5
600	42. 0	40. 8	39. 5	38. 3	37. 1	35. 9	34. 7	33. 5	32. 4	31. 2
500	55. 7	54. 3	52. 8	51. 4	50. 0	48. 6	47. 3	45. 9	44. 6	43. 3
400	71. 8	70. 1	68. 4	66. 7	65. 0	63. 4	61. 8	60. 3	58. 7	57. 2
300	91. 6	89. 4	87. 3	85. 2	83. 1	81. 1	79. 2	77. 3	75. 4	73. 6
200	117. 9	114. 7	111. 8	108. 9	106. 2	103. 6	101. 0	98. 6	96. 2	93. 9
100	162. 1	156. 0	150. 4	145. 3	140. 6	136. 2	132. 1	128. 2	124. 6	121. 1
0		309. 0	264. 8	238. 9	220. 6	206. 3	194. 7	184. 9	176. 3	168. 8

TABLE 21.—*Saturation mixing ratios (g./kg.) for various temperatures (t°C.) and pressures (P mb.)*

t°C. \ P mb.	1,050	1,000	950	900	850	800	750	700	650	600	550	500	450	400
40	47. 14	49. 68	52. 52	55. 70	59. 29	63. 37	68. 06	73. 49	79. 87	87. 46	96. 64			
35	35. 30	37. 17	39. 25	41. 57	44. 19	47. 16	50. 56	54. 49	59. 08	64. 51	71. 04	79. 05	89. 09	
30	26. 27	27. 64	29. 16	30. 86	32. 77	34. 94	37. 41	40. 25	43. 56	47. 47	52. 15	57. 84	64. 94	74. 02
25	19. 39	20. 40	21. 51	22. 74	24. 13	25. 70	27. 49	29. 55	31. 94	34. 75	38. 10	42. 17	47. 21	53. 62
20	14. 20	14. 93	15. 73	16. 63	17. 64	18. 77	20. 06	21. 55	23. 27	25. 28	27. 68	30. 59	34. 17	38. 71
15	10. 29	10. 81	11. 39	12. 04	12. 76	13. 57	14. 50	15. 56	16. 79	18. 23	19. 94	22. 01	24. 55	27. 75
10	7. 37	7. 75	8. 16	8. 62	9. 13	9. 71	10. 37	11. 24	12. 00	13. 02	14. 23	15. 69	17. 48	19. 73
5	5. 22	5. 48	5. 77	6. 10	6. 46	6. 87	7. 33	7. 86	8. 47	9. 19	10. 04	10. 58	12. 31	13. 88
0	3. 64	3. 82	4. 03	4. 25	4. 50	4. 79	5. 11	5. 48	5. 90	6. 40	6. 99	7. 69	8. 56	9. 65
−5	2. 51	2. 64	2. 78	2. 93	3. 11	3. 30	3. 53	3. 78	4. 07	4. 41	4. 82	5. 30	5. 90	6. 64
−10	1. 71	1. 79	1. 89	1. 99	2. 11	2. 24	2. 39	2. 56	2. 76	2. 99	3. 27	3. 60	4. 00	4. 50
−15	1. 14	1. 20	1. 26	1. 33	1. 41	1. 50	1. 60	1. 71	1. 85	2. 00	2. 18	2. 40	2. 67	3. 00
−20	.748	.786	.827	.873	.925	.983	1. 05	1. 12	1. 21	1. 31	1. 43	1. 57	1. 75	1. 97
−25	.480	.504	.531	.561	.594	.631	.673	.721	.776	.841	.918	1. 01	1. 12	1. 26
−30	.303	.318	.335	.353	.374	.397	.424	.454	.489	.530	.578	.636	.707	.795
−35	.186	.196	.206	.217	.230	.245	.261	.280	.301	.326	.356	.391	.435	.489
−40	.112	.118	.124	.131	.139	.147	.157	.168	.181	.196	.214	.236	.262	.295
−45	.066	.069	.073	.077	.081	.086	.092	.099	.106	.115	.126	.138	.154	.173

NOTE.—Saturation with respect to liquid water assumed at temperatures below 0° C.

TABLE 22.—*Symbols* D_1D_1, D_2D_2, D_3D_3—*Direction of the shear-stability ratio vector*

Code figure	Direction in degrees from N. through E., S., W.	Code figure	Direction in degrees from N. through E., S., W.	Code figure	Direction in degrees from N. through E., S., W.	Code figure	Direction in degrees from N. through E., S., W.
00	Calm	10	95–105	20	195–205	30	295–305
01	6–14	11	106–114	21	206–214	31	306–314
02	15–25	12	115–125	22	215–225	32	315–325
03	26–34	13	126–134	23	226–234	33	326–334
04	35–45	14	135–145	24	235–245	34	335–345
05	46–54	15	146–154	25	246–254	35	346–354
06	55–65	16	155–165	26	255–265	36	355–5
07	66–74	17	166–174	27	266–274		
08	75–85	18	175–185	28	275–285		
09	86–94	19	186–194	29	286–294		

TABLE 101 *(continued)*

40	Raobs not filed
41	Aerometeorograph failure
42	No airplane available
43	No pilot
44	Field closed, or unsafe
45	No radiosondes on hand
46	No batteries on hand
47	No balloons on hand
48	No gas on hand
49	Any reason not listed herein
50	Radiosonde transmitter failure
51	Radiosonde battery failure
52	Ground equipment failure
53	Atmospheric interference
54	Local interference
# 55	Fading signal, caused by high winds aloft
# 56	Fading signal, antenna shielded by obstruction
# 57	Fading signal, geographical conditions
# 58	Fading signal, reason unknown
# 59	Weak signal, reason unknown
60	Excessive shifting or drifting of record
61	Balloon forced down by icing condition
62	Balloon forced down by precipitation
63	Leaking balloon
64	Any reason not included above
65	
66	Airplane sounding report follows
67	Ship raob report follows
68	First part of raob report follows (i.e., up to 400 mb.)
69	Second part of raob report follows (i.e., above 400 mb.)
70	
71	Mixing ratio data groups follow ($Lm_rm_rm_rm_r$ ..... etc.)
72	
73	Special station identification group follows
74	Cloud form and cloud amount data group follows ($C_LC_MC_HN_LN_M$)
75	Special phenomena data group follows ($0S_pS_ps_ps_p$)
76	
77	Isentropic data groups follow ($L_xP_{px}P_{px}P_{sx}P_{sx}$ ..... etc.)
78	Forms and levels of missing data follow ($m_dP_1P_1P_2P_2$)
79	Forms and levels of doubtful data follow ($d_dP_1P_1P_2P_2$)

Fading signals differ from weak signals in that fading signals are first received satisfactorily, then become increasingly weaker, and finally become too weak for reception, while weak signals are weak from the beginning.

TABLE 23.—*Symbols* S_1S_1, S_2S_2, S_3S_3—*Magnitude of the shear-stability ratio vector*

Code figure	Magnitude in decameters per second	Code figure	Magnitude in decameters per second	Code figure	Magnitude in decameters per second	Code figure	Magnitude in decameters per second
00	0	15	15	40	40	80	80
01	1	16	16	42	42	84	84
02	2	17	17	44	44	89	89
03	3	18	18	46	46	90	100
04	4	19	19	48	48	91	110
05	5	20	20	50	50	92	120
06	6	22	22	52	52	93	130
07	7	24	24	54	54	94	140
08	8	26	26	56	56	95	150
09	9	28	28	58	58	96	160
10	10	30	30	60	60	98	180
11	11	32	32	64	64	99	200 or over
12	12	34	34	68	68		
13	13	36	36	72	72		
14	14	38	38	76	76		

TABLE 101 *(continued)*

80	Forms and levels of corrective data follow ($c_dP_1P_1P_2P_2$)
81	Corrected report for entire first part follows (i.e., first transmission)
82	Corrected report for entire second part follows (i.e., second transmission)
83	Corrected report for first several consecutive groups (of either part) follows
84	Corrected PPTTU groups from first part follow (PPTTU, PPTTU, ... etc.)
85	Corrected PPTTU groups from second part follow (PPTTU, PPTTU, ... etc.)
86	Corrected mixing ratio data groups follow ($Lm_rm_rm_rm_r$ ..... etc.)
87	Corrected isentropic data groups follow ($L_xP_{px}P_{px}P_{sx}P_{sx}$ ..... etc.)
88	Corrected additional data groups follow ($A_dA_dA_dA_{df}A_{df}$ ..... etc.)
89	
90	
91	Cloud form and level data group follows ($CP_1P_1P_2P_2$)
92	Miscellaneous phenomena form and level data group follows ($M_pP_1P_1P_2P_2$ .....)
93	Precipitation form and level data group follows ($R_fP_1P_1P_2P_2$)
94	Turbulence intensity and level data group follows ($t_iP_1P_1P_2P_2$ ..... etc.)
95	Icing form and level data group follows ($i_fP_1P_1P_2P_2$)
96	Icing intensity and level data group follows ($i_iP_1P_1P_2P_2$ ..... etc.)
97	
98	
99	Reserved

TABLE 102

Symbol Q = Octant of Globe

Code figure	Longitude	
0	0°W to 90°W	North latitude
1	90°W to 180°W	North latitude
2	180°E to 90°E	North latitude
3	90°E to 0°E	North latitude
4	Reserved	
5	0°W to 90°W	South latitude
6	90°W to 180°W	South latitude
7	180°E to 90°E	South latitude
8	90°E to 0°E	South latitude
9	Reserved	

TABLE 103

Symbol c_d = Form of corrective data being reported in the following groups of this message.

Symbol d_d = Form of doubtful data which were sent in previous groups of this message or of earlier message.

Symbol m_d = Form of missing data in previous groups of this message.

Code figure	Description
0	Pressure, temperature and relative humidity (PPTTU)
1	Pressure and temperature (PP and TT)
2	Pressure and relative humidity (PP and U)
3	Pressure only (PP)
4	Temperature only (TT)
5	Relative humidity only (U)
6	Temperature and relative humidity (TT and U)
7	Mixing ratio ($m_r m_r$)
8	Isentropic
9	Additional data

TABLE 104

Symbol C = Form of predominating cloud

Code figure	Description
1	Cirrus
2	Cirrostratus
3	Cirrocumulus
4	Altocumulus
5	Altostratus
6	Stratocumulus
7	Nimbostratus
8	Cumulus or Fractocumulus
9	Cumulonimbus
0	Stratus or Fractostratus

TABLE 105

Symbol M_p = Miscellaneous phenomena

Code figure	Description
0	
1	
2	Dust
3	Smoke
4	Haze
5	Damp haze
6	Blowing snow
7	Fog
8	Lightning
9	Thunder

TABLE 106

Symbol R_f = Form of precipitation

Code figure	Description
0	
1	
2	Sleet
3	Rain and snow mixed
4	Ice crystals
5	Drizzle
6	Rain
7	Snow
8	Hail, or small hail
9	Precipitation present, but form is unknown

TABLE 107

Symbol t_i = Intensity of turbulence

Code figure	Description
0	
1	
2	Data suggests turbulence
3	
4	
5	Pilot reports turbulence
6	Pilot reports light turbulence
7	Pilot reports moderate turbulence
8	Pilot reports heavy turbulence
9	Turbulence present, but intensity is unknown

TABLE 108

Symbol I_f = Form of icing

Code figure	Description
0	
1	
2	Data suggests icing
3	Frost
4	Rime
5	Mixture of rime and ice
6	Milky ice
7	Clear ice
8	
9	Icing present, but form is unknown

TABLE 109

Symbol i_i = Intensity of icing

Code figure	Description
0	
1	
2	Data suggests icing
3	
4	
5	Pilot reports ice
6	Pilot reports light ice
7	Pilot reports moderate ice
8	Pilot reports heavy ice
9	Icing present, but intensity is unknown

TABLE 110

Symbol U = Relative humidity

Code figure	Description
0	95 to 100%
# 1	0 to 19%
2	20 to 29%
3	30 to 39%
4	40 to 49%
5	50 to 59%
6	60 to 69%
7	70 to 79%
8	80 to 89%
9	90 to 94%

See instructions for coding relative humidity *(Paragraph 2-1005)* wherein it is shown that although code figure "1" usually means that relative humidity is from 0 to 19%, nevertheless, under specified conditions, code figure "1" may be used to represent humidities up to 50%.

TABLE 111

Pressure, *(in millibars)* at various geometric heights above sea level *(in hundreds of meters)*. *(According to U. S. Standard Atmosphere)*

Hundreds of meters	0	1	2	3	4	5	6	7	8	9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
-0	1,013	1,025	1,038	1,050						
+0	1,013	1,001	989	978	966	955	943	932	921	910
10	899	888	877	866	856	846	835	825	815	805
20	795	785	775	766	756	747	737	728	719	710
30	701	692	683	675	666	658	649	641	633	624
40	616	608	600	593	585	577	570	562	555	547
50	540	533	526	519	512	505	498	491	485	478
60	472	465	459	453	446	440	434	428	422	416
70	410	405	399	393	388	382	377	372	366	361
80	356	351	346	341	336	331	326	321	317	312
90	307	303	298	294	289	285	281	277	272	268
100	264	260	256	252	248	245	241	237	233	230
110	226	223	219	216	212	209	206	203	200	196
120	193	190	187	185	182	179	176	173	171	168
130	165	163	160	158	155	153	151	148	146	144
140	141	139	137	135	133	131	129	127	125	123
150	121	119	117	115	113	112	110	108	107	105
160	103	102	100	99	97	96	94	93	91	90
170	88	87	86	84	83	82	80	79	78	77
180	76	74	73	72	71	70	69	68	67	66
190	65	64	63	62	61	60	59	58	57	56
200	55.2	--	--	--	--	--	--	--	--	--

Pressures at geometric heights above 20,000 meters are as follows:
21,000 = 47.2 mb.; 22,000 = 40.4 mb.; 23,000 = 34.5 mb.; 24,000 = 29.5 mb.;
25,000 = 25.2 mb.; 26,000 = 21.6 mb.; 27,000 = 18.4 mb.; 28,000 = 15.8 mb.;
29,000 = 13.5 mb.; 30,000 = 11.5 mb.

TABLE 112

Heights above sea level *(in hundreds of meters)* at various pressures *(in millibars)*. *(According to U. S. Standard Atmosphere)*

Pressure mb.	0	10	20	30	40	50	60	70	80	90
	100's meters	100's meters	100's meters	100's meters	100's meters	100's meters	100's meters	100's meters	100's meters	100's meters
1,000	1.1	0.3	-0.6	-1.4	-2.2	-3.0	----	----	----	----
900	9.9	9.0	8.1	7.2	6.3	5.4	4.5	3.7	2.8	2.0
800	19.5	18.5	17.5	16.5	15.5	14.6	13.6	12.7	11.7	10.8
700	30.1	29.0	27.9	26.8	25.7	24.6	23.6	22.5	21.5	20.5
600	42.0	40.8	39.5	38.3	37.1	35.9	34.7	33.5	32.4	31.2
500	55.7	54.3	52.8	51.4	50.0	48.6	47.3	45.9	44.6	43.3
400	71.8	70.1	68.4	66.7	65.0	63.4	61.8	60.3	58.7	57.2
300	91.6	89.4	87.3	85.2	83.1	81.1	79.2	77.3	75.4	73.6
200	117.9	114.7	111.8	108.9	106.2	103.6	101.0	98.6	96.2	93.9
100	162.1	156.0	150.4	145.3	140.6	136.2	132.1	128.2	124.6	121.1
0	-----	309.0	264.8	238.9	220.6	206.3	194.7	184.9	176.3	168.8

TABLE 113

Saturation mixing ratios *(g./kg.)* for various temperatures *(°C)* and pressures *(mb.)*.

	1,050 mb.	1,000 mb.	950 mb.	900 mb.	850 mb.	800 mb.	750 mb.	700 mb.
40°C	47.14	49.68	52.52	55.70	59.29	63.37	68.06	73.49
35	35.30	37.17	39.25	41.57	44.19	47.16	50.56	54.49
30	26.27	27.64	29.16	30.86	32.77	34.94	37.41	40.25
25	19.39	20.40	21.51	22.74	24.13	25.70	27.49	29.55
20	14.20	14.93	15.73	16.63	17.64	18.77	20.06	21.55
15	10.29	10.81	11.39	12.04	12.76	13.57	14.50	15.56
10	7.37	7.75	8.16	8.62	9.13	9.71	10.37	11.24
5	5.22	5.48	5.77	6.10	6.46	6.87	7.33	7.86
0	3.64	3.82	4.03	4.25	4.50	4.79	5.11	5.48
-5	2.51	2.64	2.78	2.93	3.11	3.30	3.53	3.78
-10	1.71	1.79	1.89	1.99	2.11	2.24	2.39	2.56
-15	1.14	1.20	1.26	1.33	1.41	1.50	1.60	1.71
-20	.748	.786	.827	.873	.925	.983	1.05	1.12
-25	.480	.504	.531	.561	.594	.631	.673	.721
-30	.303	.318	.335	.353	.374	.397	.424	.454
-35	.186	.196	.206	.217	.230	.245	.261	.280
-40	.112	.118	.124	.131	.139	.147	.157	.168
-45	.066	.069	.073	.077	.081	.086	.092	.099

TABLE 113 *(continued)*

	700 mb.	650 mb.	600 mb.	550 mb.	500 mb.	450 mb.	400 mb.
40°C	73.49	79.87	87.46	96.64			
35	54.49	59.08	64.51	71.04	79.05	89.09	
30	40.25	43.56	47.47	52.15	57.84	64.94	74.02
25	29.55	31.94	34.75	38.10	42.17	47.21	53.62
20	21.55	23.27	25.28	27.68	30.59	34.17	38.71
15	15.56	16.79	18.23	19.94	22.01	24.55	27.75
10	11.24	12.00	13.02	14.23	15.69	17.48	19.73
5	7.86	8.47	9.19	10.04	10.58	12.31	13.88
0	5.48	5.90	6.40	6.99	7.69	8.56	9.65
-5	3.78	4.07	4.41	4.82	5.30	5.90	6.64
-10	2.56	2.76	2.99	3.27	3.60	4.00	4.50
-15	1.71	1.85	2.00	2.18	2.40	2.67	3.00
-20	1.12	1.21	1.31	1.43	1.57	1.75	1.97
-25	.721	.776	.841	.918	1.01	1.12	1.26
-30	.454	.489	.530	.578	.636	.707	.795
-35	.280	.301	.326	.356	.391	.435	.489
-40	.168	.181	.196	.214	.236	.262	.295
-45	.099	.106	.115	.126	.138	.154	.173

Section III

FORECASTS AND ANALYSES

PART I.—AIRWAY FORECASTS

CHAPTER I

GENERAL DESCRIPTION OF FORECASTS

3–100. Purpose and Places Issued From.—In order that pilots, transport operators, and other aviation interests concerned, may have information at all times concerning weather conditions which may be expected to be encountered in flights along civil airways and in landing or departing from airway terminals, the Weather Bureau airway forecast centers at Boston, Mass., New York, N. Y., Arlington (Washington National Airport), Va., Atlanta, Ga., Cleveland, Ohio, Chicago, Ill., Kansas City, Mo., New Orleans, La., Fort Worth, Tex., Albuquerque, N. Mex., Billings, Mont., Salt Lake City, Utah, Los Angeles, Calif., San Francisco, Calif., and Seattle, Wash., issue short-period forecasts covering the airways and terminals in their respective districts, in accordance with specific instructions issued to stations concerned by the Central Office of the Weather Bureau.

3–101. Types of and Periods Covered by Airway Forecasts.—There are two types of airway forecasts issued for general use, namely, (1) regional or route, and (2) terminal forecasts. These forecasts are issued for periods of 8 hours in advance, beginning at 5:30 and 11:30 a. m. and p. m., Eastern Standard Time. The regional or route forecasts include statements concerning expected wind and weather conditions, with emphasis being placed on forecasts of upper air winds when velocities in excess of 60 miles per hour are expected. The regional forecasts are for areas including several airways, while route or trip forecasts give similar information for a specified individual route. The terminal forecasts are statements of weather conditions expected to prevail at particular terminals and landing points during the period covered by the forecasts.

3–102. Terms and Abbreviations Used.—The terms used in all of these forecasts are generally similar to and have the same limits and meanings as those prescribed elsewhere in this circular for use in airway observations. To conserve time on the teletype circuits, authorized and special abbreviations are used for many of the more frequently used words and phrases. (The term "CAVU," for example, as used in airway forecast terminology is defined as "ceiling and visibility unlimited"; unlimited in this case means a ceiling of 10,000 feet or more and a visibility of 10 miles or more.) Lists of such abbreviations and phrase contractions are available in publications of the Civil Aeronautics Administration. (See Manual of Operations, chapter B—Communications Section, part 4, section 1, "Abbreviations and Phrase Contractions"; part 4, section 2, "List of Teletype Call Letters and Designators", and part 4, section 3, "Q" Signal Abbreviations, which may be obtained from the Civil Aeronautics Administration.)

3–103. Headings Used for Identifying Forecasts.—Forecasts are identified for teletype and radio transmissions by a heading made up as follows: (1) The period covered by the forecast on the basis of the 24-hour-clock and local time at the place of issuance; (2) the abbreviation "AWY FCST," and (3) the month and day, using figures. A single airway or route covered by a forecast is then designated by combining the call letters of the two terminal stations and entering these as the first part of the body of the forecast. For example:

0530 1330M AWY FCST 10/16 SLCX - - - - - - - - - -

which translated reads "5:30 a. m. to 1:30 p. m., mountain standard time, airway forecast, October 16, for Salt Lake City to Cheyenne airway." Where more than one

airway is included, the terminal designators for all such airways are entered as the first part of the body of the forecasts. For example:

0530 1330C AWY FCSTS 11/5 CGCX CGWG OHRK OHDV MPDM MPHR MPYX MPDH - - - - - - - - -

Terminal forecasts are identified by the call letters for the station and the abbreviation "TRML" entered as the first part of the body of the forecast. For example:

AG TRML - - - - - -

If more than one terminal is covered by a single forecast, designators are entered for each terminal so included. For example:

VD CI SU CF CS SH JX TJ TRMLS - - - - -

3–104. Practice When Large Number of Forecasts are Transmitted.—In actual practice, where a large number of forecasts are transmitted at one time, the "Time—AWY FCST—Date" group constitutes a general heading for the whole group and individual forecasts in the transmission are identified by the side heading, as described above, entered as the first part of the body of the forecast.

CHAPTER II

EXAMPLES OF FORECASTS

3–105. The following examples are intended to illustrate the proper usage of terms and methods of rendition of forecasts:

(*a*) *Regional, or route forecasts.*—Examples of regional forecasts follow:

0230 1030P AWY FCSTS 10/24
SAMX PDBE POSM PDYASM. COLD FRONT OF DECRSG INTSTY ALG CASCDS IN WASH AND N OREG WILL CONT EWD MOVMT RCHG SPOKANE BAKER LINE BY 1030P. WRM FRONT WENATCHEE TO GRANGEVILLE WILL MOV SLWLY NEWD APCHG SMMX AWY BY 1030P. CONTD BRKN TO OVC WITH LGT RAINS XCP OCNLY MDT OVR AND W OF CASCDS. CIGS 3 TO 6 THSD LWRG W OF CASCDS TO ABT 2 THSD DURG MDT PCPN. CIG AND VSBY ZERO OVR HIR MTNS. VSBY UNL XCP LCLY 3 TO 6 IN PCPN. LGT ICG IN CLDS ABV 8 THSD MSL. WNDS ALF OVR AND W OF CASCDS ETD 240 DEGREES 50 MPH 8 TO 13 THSD MSL.

The above forecast would be translated as follows: "2:30 a. m. to 10:30 a. m., Pacific standard time, airway forecast for October 24, Seattle-Missoula, Portland-Boise, Pendleton-Spokane, Portland-Yakima-Spokane Airways. Cold front of decreasing intensity along Cascades in Washington and northern Oregon will continue eastward movement reaching Spokane-Baker line by 10:30 p. m., P. S. T. Warm front Wenatchee to Grangeville will move slowly northeastward approaching Spokane-Missoula airway by 10:30 p. m., P. S. T. Continued broken to overcast with light rains, except occasionally moderate, over and west of Cascades. Ceilings 3,000 to 6,000 lowering west of Cascades to about 2,000 during moderate precipitation. Ceiling and visibility zero over higher mountains. Visibility unlimited, except locally 3 to 6 miles in precipitation. Light icing in clouds above 8,000 feet mean sea level. Winds aloft over and west of Cascades estimated 240°, 50 miles per hour between 8,000 and 13,000 mean sea level.

0830 1630P AWY FCSTS 11/7
VRMF. OCLDD FRONT XTG FROM BELLINGHAM TO HOOD RIVER WILL MOV EWD TO EPHRATA BAKER LINE BY 1630P ACYPD BY LGT TO MDT RAIN SQALS LOW LVLS AND SNW INTMD LVLS. BRKS W OF CASCDS. CIGS 2 TO 4 THSD VSBY UNL XCP 3 IN SQALS. CASCDS AND

OLYMPICS OBSCD ABOVE 3 THSD MSL. LGT TO OCNLY MDT ICG ABV 4 THSD MSL. STG SWLY SFC WINDS WRN WASH LCLY OF GALE FORCE PUGET SOUND AREA. WNDS ALF 55 TO 65 MPH FROM 250 ALL FLYING LVLS. MDT TURBC OVR CASCDS AND LCL STATIC IN SNW INTMD LVLS.

The above forecast would be translated as follows: "8:30 a. m. to 4:30 p. m., Pacific standard time, airway forecasts, November 7. Vancouver (B. C.) to Medford. Occluded front now extending from Bellingham to Hood River will move eastward to Ephrata-Baker line by 4:30 p. m., P. S. T., accompanied by light to moderate rain squalls at low levels and snow at intermediate levels. Overcast will be broken west of Cascade Range. Ceilings will be 2,000 to 4,000 feet. Visibility will be over 10 miles, except 3 miles in squalls. Cascade and Olympic mountains will be obscured above an elevation of 3,000 feet. Light to occasionally moderate icing will occur above 4,000 feet (mean sea level). Strong southwesterly surface winds will be experienced over western Washington occasionally of gale force Puget Sound area. Winds aloft will be 55 to 65 miles per hour from the west-southwest at all flying levels. Moderate turbulence will be experienced over Cascade Range and local static will occur in snow at intermediate levels."

1030 1830C AWY FCSTS 6/28

NOGW NOPS JACS CSMM JXNA DBTM TMMM JXNO AGTM PSTJ. SFC COLD FRONT ASOCTD WITH DEEP LOW OVR NRN MICH AND XTNDG THRU ILL CNTRL MO AND SWWD INTO THE PNHDL RGN AT 0630C WILL APCH NWRN MISS BY 1830C. AN UPPER COLD FRONT XTNDG THRU WRN OHIO AND SWWD INTO NWRN TENN AT 0630C WILL ADVN TO NEAR BIRMINGHAM AND MONROE BY 1830C AND WILL BE ATNDED BY TSTM ACTVTY PARTICULARLY DURG LTTR PART OF AFTN. BRKN HI AND LWR CLDNS WILL PVL GNRLY WITH CIG 2 TO 4 THSD AND VSBY OVR 6 MILES WHILE AFTN LCL AMS TSHWRS WILL DVLP OVR MISS ALA AND NRN GA AND SOME LGT RAIN SHWRS WILL OCCUR DURG AFTN OVR SRN FLA. VSBY WILL BE RESTRICTED TO 1 TO 4 MILES IN PCPN AREAS.

The above forecast would be translated as follows: "10:30 a. m. to 6:30 p. m., central standard time, airway forecasts, June 28, New Orleans to Greensboro, New Orleans to Memphis, Jackson to Charleston, Charleston to Miami, Jacksonville to Nashville, Daytona Beach to Tampa, Tampa to Miami, Jacksonville to New Orleans, Atlanta to Tampa, Memphis to Tallahassee. Surface cold front associated with a deep Low over northern Michigan and extending through Illinois, central Missouri, and southwestward into the Panhandle region at 6:30 a. m., will approach northwestern Mississippi by 6:30 p. m., C. S. T. An upper cold front extending through western Ohio and southwestward into northwestern Tennessee at 6:30 a. m. will advance to near Birmingham and Monroe by 6:30 p. m., C. S. T., and will be attended by thunderstorm activity, particularly during the latter part of the afternoon. Broken high and lower cloudiness will prevail generally with ceiling 2,000 to 4,000 and visibility over 6 miles, while local air mass thunderstorms will develop over Mississippi, Alabama, and northern Georgia and some light rain showers will occur during the afternoon over southern Florida. Visibility will be restricted to 1 to 4 miles in precipitation areas."

1630 0030C AWY FCSTS 11/6

CGCX CGWG MPYX MPHR MPDH MPDM OHDV OHRK. LOW CNTRD NW OF DIST WITH TROUGH XTNDG SWD OVR DAKOTAS WILL MOV SLWLY EWD WITH WK WRM FRONT PIERRE MINOT LINE AT 1230C ADVNG TO WRN BDR OF MINN BY MIDN. OVRNG IN ADVN OF WRM FRONT WILL CAUSE BRKN TO OVC HI CLDNS AND LWR BRKN NEAR 6 THSD XCP LWR OVC NEAR 2 THSD ERN DAKOTAS AND XTRM WRN MINN WHICH WILL DSIPT RPDLY IN DAKOTAS WITH PASG OF WRM FRONT. OCNL VERY LGT SNW UNTIL 1830C NWRN MINN AND

SRN MANT AND AFT 2000C CNTRL MINN. SCTD OR BRKN HI CLDNS THRUT NEBR IA WIS NRN ILL WRN DAKOTAS AND SRN MINN. VSBY OVR 6 XCP LCLY 1 TO 2 IN SNW NRN MINN AND 2 TO 4 WITH SMOKE NERN ILL AND SERN NEB BCMG 1 TO 2 AFT 1730C NERN ILL.

The above forecast would be translated as follows: "4:30 p. m. to 12:30 a. m., central standard time, airway forecasts, November 6, Chicago to Cheyenne, Chicago to Winnipeg, Minneapolis to Sioux City, Minneapolis to Huron, Minneapolis to Duluth, Minneapolis to Des Moines, Omaha to Denver, Omaha to Bismarck. Low centered northwest of district with trough extending southward over Dakotas will move slowly eastward with weak warm front Pierre-Minot line at 12:30 p. m. advancing to western border of Minnesota by midnight. Overrunning in advance of warm front will cause broken to overcast high cloudiness and lower broken near 6,000, except lower overcast near 2,000 eastern Dakotas and extreme western Minnesota, which will dissipate rapidly in Dakotas with passing of warm front. Occasional very light snow until 6:30 p. m., C. S. T., northwestern Minnesota and southern Manitoba and after 8:00 p. m. central Minnesota. Scattered or broken high cloudiness throughout Nebraska, Iowa, Wisconsin, northern Illinois, western Dakotas, and southern Minnesota. Visibility over 6 except locally 1 to 2 in snow northern Minnesota and 2 to 4 with smoke northeastern Illinois and southeastern Nebraska becoming 1 to 2 after 5:30 p. m. northeastern Illinois."

1530 2330M AWY FCSTS 11/7

SLLQ SLBE SLBT. COLD OCCLUSION NOW XTNDG SWWD THRU IDA AND CNTRL NEV WILL CONT EWD MVMT BUT DVLP WAVE FORMATION OVR SRN NEV WITH CSDRBL RETARDATION OF FRONT S OF THE IDA LINE WITH RPD MVMT EWD ACROSS NRN IDA AND WITH SOME SLWG OF FRONT ACRS SRN IDA. FRONT XPCD TO PASS BUTTE BURLEY LINE BY 2330M. AHD OF FRONT OVC WITH LGT RAINS CIGS 2 TO 4 THSD AND VSBY 4 TO 8 UPR SNAKE RVR VLY AND BRKN TO OVC 5 TO 7 THSD RMNDR IDA WITH CIGS 6 TO 8 THSD OR HIR THENCE SWD. VSBY UNL XCPT 4 TO 8 IN SMOKE SALT LAKE VLY.

The above forecast would be translated as follows: "3:30 p. m. to 11:30 p. m., mountain standard time, airway forecasts, November 7. Salt Lake City to Las Vegas, Salt Lake City to Boise, Salt Lake City to Butte. Cold occlusion now extending southwestward through Idaho and Central Nevada will continue eastward movement but will develop a wave formation over southern Nevada with considerable retardation of the front south of the Idaho line, with rapid movement eastward across northern Idaho and some slowing of front across southern Idaho. Front is expected to pass Butte-Burley line by 11:30 p. m., M. S. T. Ahead of front overcast with light rains, ceilings 2,000 to 4,000, and visibility 4 to 8 miles in the upper Snake River Valley and broken to overcast 5,000 to 7,000 the remainder of Idaho with ceilings 6,000 to 8,000 or higher thence southward. Visibility unlimited except 4 to 8 miles in smoke Salt Lake Valley."

330 0730E AWY FCSTS 11/14

MKBJ CGNK IDPG NABJ CGDT CGLV MRBO IDCC DYGR DTWA DTWK DYDT CGGR BOEA PTER COER. WRM FRONT RUNNING FROM NERN NC NEWD TO S OF NANTUCKET AT 1930E AND SLWLY MOVG NWD WITH UPRUNNING OF WRM MOIST AIR FROM OFF THE ATLC OVR PA WRN NY OHIO AND MD RESULTING IN OVC FROM THE CST TO WRN OHIO AND STEADY LGT RAIN ERN PA AND WRN MD AND LGT SNW WRN PA WRN NY AND ERN OHIO WITH THE WRN EDGE OF PCPN AREA RMNG ABT STATIONARY. CIG 4 TO 8 HND VSBY 2 TO 4 CSTL PLAIN. THRU MTNS WRN PA AND MD CIG ZERO TO 4 HND AND VSBY 1 1/2 DOWNWARD AND ZERO HIR RDGS. THRU XTRM WRN PA AND ERN OHIO CIG 7 TO 15 HND AND VSBY MSTLY 2 TO 5. THRU WRN OHIO CIG 25 HND TO 5 THSD VSBY 5 OR BTR. OVC TO

BRKN CLDS MICH IND AND WRN KY WITH CIG 3 TO 6 THSD VSBY 4 OR BTR XCP CIG 1 THSD OR LESS AND VSBY 1 OR LESS IN LCL SNW SRN TIP LAKE MICH AND VSBY 1 OR LESS UNTIL 0130E IN LCL GNDFG BLC NRN IND. ICG ALL CLDS ALGHNY MTNS WWD WITH ICG LVL SLOPING UPWARD THENCE EWD TO 5 OR 6 THSD OVR CSTL PLAIN.

The above forecast would be translated as follows: "11:30 p. m. to 7:30 a. m. eastern standard time, airway forecasts, November 14–15. Milwaukee to Buffalo, Chicago to Newark, Indianapolis to Philadelphia, Nashville to Buffalo, Chicago to Detroit-Wayne County, Chicago to Louisville, Martinsburg to Baltimore, Indianapolis to Cincinnati, Vandalia to Grand Rapids, Detroit-Wayne County to Washington, Detroit-Wayne County to Woodward, Vandalia to Detroit-Wayne County, Chicago to Grand Rapids, Baltimore to Elmira, Pittsburgh to Erie, Columbus to Erie. Warm front running from northeastern North Carolina northeastward to south of Nantucket at 7:30 p. m., E. S. T., and slowly moving northward with uprunning of warm, moist air from off the Atlantic over Pennsylvania, western New York, Ohio, and Maryland, resulting in overcast from the coast to western Ohio and steady light rain eastern Pennsylvania and western Maryland and light snow western Pennsylvania, western New York, and eastern Ohio with the western edge of precipitation area remaining about stationary. Ceiling 400 to 800 visibility 2 to 4 coastal plain. Through mountains western Pennsylvania and Maryland ceiling zero to 400 and visibility 1½ downward and zero higher ridges. Through extreme western Pennsylvania and eastern Ohio ceiling 7 to 15 hundred and visibility mostly 2 to 5. Through western Ohio ceiling 2,500 to 5,000 visibility 5 or better. Overcast to broken clouds Michigan, Indiana, and western Kentucky with ceiling 3,000 to 6,000 visibility 4 or better except ceiling 1,000 or less and visibility 1 or less in local snow southern tip Lake Michigan and visibility 1 or less until 1:30 a. m., E. S. T., in local ground fog balance northern Indiana. Icing all clouds Allegheny Mountains westward with icing level sloping upward, thence eastward to 5,000 or 6,000 over Coastal Plain."

2130 0530M AWY FCSTS 11/10

PUWD AWY. COLD FRONT NEAR WD WY LINE AT 2130M MOVG WELL BYD AWY BY 2330M. CLR OR HI CLDS COLO SXN OVC OR BRKN AT 5 HND TO 1 THSD IN KAN WITH LGT SNWS BUT CIGS WILL RISE AND PCPN CEASE BY 0400M. VSBY 1 TO 3 IN SNW OTRW GNRLY OVR 6.

AB–PHB–EO AWY. COLD FRONT NEAR AMARILLO TUCUMCARI LINE MOVG SWD TO NEAR ROSWELL LUBBOCK LINE 0530M. BRKN OR OVC TO REAR OF FRONT IN ERN NM CIGS GNRLY 1 TO 2 THSD OCNL SNW FLRYS. OTRW GNRLY CLR. VSBY UNL XCP 2 TO 4 MILES IN SNW FLRYS.

The above forecasts would be translated as follows: "9:30 p. m. to 5:30 a. m., mountain standard time, airway forecasts, November 10. Pueblo to Wichita Airway. A cold front near the Wichita-Waynoka line at 9:30 p. m., M. S. T., moving well beyond the airway by 11:30 p. m., E. S. T. Clear or high clouds Colorado section, overcast or broken at 500 to 1,000 in Kansas with light snows but ceilings will rise and precipitation cease by 4:00 a. m., M. S. T. Visibility 1 to 3 in snow, otherwise generally over 6.

"Albuquerque to El Paso Airway via Hobbs. Cold front near Amarillo-Tucumcari line, moving southwestward to near Roswell-Lubbock line by 5:30 a. m., M. S. T. Broken or overcast to rear of front in eastern New Mexico with ceilings generally 1,000 to 2,000 and occasional snow flurries, otherwise generally clear. Visibility unlimited except 2 to 4 miles in snow flurries."

2230 0630C AWY FCSTS 11/10

KCAQ KCID KCCG CGPS LSOL OHTS KCDM WDOL. COLD FRONT TARKIO AMARILLO LINE 1830C WILL MOV TO LINE IOWA CITY COLUMBIA FORT SMITH BY 0630C. MDT TO SVR WND SHFT WILL OCCUR WITH FRONT PSG AND WND WILL BE STG GSTY FROM NW. E OF FRONT LOW CLDNS WITH OCNL RAIN OR DRZL AND CSDRBL FOG CIGS GNRLY UNDER 5 HND VSBYS VRBL FROM NEAR ZERO TO 1 MILE XCP NARROW

STRIP JUST E OF FRONT ABT 50 TO 100 MILES WIDE WHERE CNDS WILL IPV WITH CIGS BCMG TEMPORARILY 2 THSD OR HIR AND VSBYS OVER 3. FLWG FRONT PSG CIGS BCMG 4 HND TO 1 THSD WITH SOME SHWRS AND LGT SNWS WITH VSBYS GNRLY OVR 6 XCP VRBL TO NEAR 1 IN SNWS. NO ICG BELOW 7 THSD E OF FRONT BUT ICG LVL LWRG RPDLY AFTR FRONT PSG TO BASE LWR CLDS ABT 50 MILES TO W OF FRONT.

The above forecast would be translated as follows: "10:30 p. m. to 6:30 a. m., central standard time, airway forecasts, November 10. Kansas City-Amarillo, Kansas City-Indianapolis, Kansas City-Chicago, Chicago-Memphis, St. Louis-Oklahoma City, Omaha-Tulsa, Kansas City-Des Moines, Wichita-Oklahoma City. Cold front Tarkio-Amarillo line 6:30 p. m. will move to line Iowa City-Columbia-Fort Smith by 6:30 a. m., C. S. T. Moderate to severe wind shift will occur with front passage and wind will be strong and gusty from the northwest. East of front low cloudiness with occasional rain or drizzle and considerable fog with ceilings generally under 500 feet and visibilities variable from near zero to 1 mile except a narrow strip about 50 to 100 miles wide just east of front where conditions will improve, becoming temporarily 2,000 feet or higher and visibilities over 3 miles. Following frontal passage ceilings will become 400 to 1,000 feet with some showers and light snows and with visibilities generally more than 6 miles except variable to near 1 mile in snow. No icing below 7,000 feet east of front but with icing level lowering rapidly after frontal passage to base of lower clouds about 50 miles to west of front."

1430 2230P AWY FCSTS 10/25

BUSQ BUZR BULQ BUNJ BUYH BUZB PKLLQ SQPYU. COLD FRONT XTDG SWWD FROM SILVER LAKE TO NEAR SAN DIEGO WILL MOV EWD ABT 10 MPH ACPYD BY LGT RAIN ALG CST AND CSTL HILLS AND LGT SHWRS OVR MOJAVE DESERT. OVC CSTL RGN WITH CIG NEAR 1 THSD ALG CST AND NEAR ZERO CSTL HILLS XCPT BRKN CLDS WITH CIG 2 TO 4 THSD WILL PVL ALG CST BTWN SANTA BARBARA AND SANTA MONICA WITH CLDS BCMG BRKN ALG ALL OF CSTL RGN AND CIG 2 TO 4 THSD BY 2230P. BRKN TO OVC WITH CIG 5 THSD OR ABV WILL PVL E OF CSTL HILLS. CONTG OVC ALG S SLOPE OF TEHACHAPI MTNS WITH CIG SLWLY RSG FROM 1 TO 2 THSD.

The above forecast would be translated as follows: "2:30 p. m. to 10:30 p. m., Pacific standard time, airway forecasts, October 25. Burbank-San Diego, Burbank-Santa Barbara, Burbank-Las Vegas, Burbank-Needles, Burbank-Blythe, Burbank-Sandberg, Kernville-Las Vegas, San Diego-Yuma. Cold front extending southwestward from Silver Lake to near San Diego will move eastward about 10 miles per hour accompanied by light rain along coast and coastal hills and light showers over Mojave Desert. Overcast coastal region with ceiling near 1,000 feet along coast and near zero coastal hills except broken clouds with ceiling 2,000 to 4,000 feet will prevail along coast between Santa Barbara and Santa Monica with clouds becoming broken along all of coastal region and ceiling 2,000 to 4,000 feet by 10:30 p. m., P. S. T. Broken to overcast with ceiling 5,000 feet or above will prevail east of coastal hills. Continued overcast along south slope of Tehachapi Mountains with ceiling slowly rising from one to two thousand feet."

0430 1230C AWY FCSTS 10/13

OLFV. CAVU THRUT.

AQFV. CAVU N TEX FLWD BY SCTD TO BRKN CU 3 TO 6 THSD DVLPG IN PNHDL MID FORNN.

EOFV. CAVU CNTRL TEX AND BRKN TO OVC 3 TO 6 THSD W TEX WITH TSTMS AND LGT TO MDT RAIN SHWRS ACPYD BY SCTD TO BRKN LWR CLDS 1 TO 2 THSD XCP TPG MTNS. VSBYS OVER 6 MILES XCP LWRG 3 TO 6 MILES IN PCPN.

290297°—41——9

FVJI FVGS FVPS FVJA CRNO. CLR OR SCTD CLDS N AND XTRM E TEX ARK AND LA. BRKN TO OVC LWR CLDS 5 TO 10 HND INTR S-CNTRL TEX SCTD TO BRKN 15 HND TO 3 THSD LWR TEX CST AND SCTD TO CLR UPPER CST. LWR CLDS CNTRL TEX LFTG AFT DABRK 1 TO 2 THSD BY 0900C SCTD TO BRKN CLDS 3 TO 5 THSD BCMG GNRL ALL SXNS S TEX BY MID FORNN WITH SCTD LGT SHWRS DVLPG ALG CST. VSBYS 4 TO 8 MILES ACCT LGT SMOKE ARK NE TEX AND LA LCLY LESS THAN 1 MILE ACCT MDT TO DNS GNDFG LA AND UPPER CST AND OVR 6 MILES RMNDER TEX XCP LCLY 3 TO 6 MILES ACCT LGT FOG AND LGT SMOKE MXD S-CNTRL TEX IPVG ALL SXNS TO OVR 6 MILES BY 0900C.

The above forecasts would be translated as follows: "4:30 a. m. to 12:30 p. m., central standard time, airway forecast for October 13, Oklahoma City to Fort Worth. Ceiling and visibility unlimited throughout.

"Amarillo to Fort Worth. Ceiling and visibility unlimited north Texas followed by scattered to broken cumulus 3,000 to 6,000 feet developing in Panhandle middle forenoon.

"El Paso to Fort Worth. Ceiling and visibility unlimited central Texas and broken to overcast 3,000 to 6,000 feet west Texas with thunderstorms and light to moderate rain showers accompanied by scattered to broken lower clouds 1,000 to 2,000 feet except topping mountains. Visibility over 6 miles except lowering 3 to 6 miles in precipitation.

"Fort Worth to Brownsville, Fort Worth to Galveston, Fort Worth to Memphis, Fort Worth to Jackson, Corpus Christi to New Orleans. Clear or scattered clouds north and extreme east Texas, Arkansas, and Louisiana. Broken to overcast lower clouds 5 to 10 hundred feet interior south-central Texas; scattered to broken 1,500 to 3,000 feet lower Texas coast, and scattered to clear upper coast. Lower clouds central Texas lifting after daybreak to 1,000 to 2,000 feet by 9 a. m., C. S. T., with scattered to broken clouds 3,000 to 5,000 feet becoming general all sections of south Texas by middle forenoon with scattered light showers developing along coast. Visibility 4 to 8 miles account of light smoke Arkansas, northeast Texas and Louisiana but locally less than 1 mile account of moderate to dense ground fog Louisiana and upper coast regions and over 6 miles remainder Texas except locally 3 to 6 miles account of light fog and light smoke mixed south-central Texas improving all sections to over 6 miles by 9 a. m., C. S. T."

0530 1330E AWY FCSTS 11/11

WACC WACS WAPS WAGW WANW NWKX EVED PTHI. STEEP GRADIENT WWD FROM CNTRL PA WITH RPDLY FLG PRES TO DPENG LOW CNTRL OVR XTRM ERN KAN WITH SVR COLD FRONT THRU CNTR OF LOW SWD TO NEAR PALESTINE. LOW WILL MOV NNEWD AND FRONT WILL MOV EWD TO XTRM WRN TENN AND KY BY 1330E PECDED BY TSTMS WHICH WILL ADVN INTO SRN IND AND CNTRL KY AND TENN BY THAT TIME. OVC SKIES WILL PVL WITH LGT TO MDT RAINS W OF MTNS AND OCNL SCTD RAINS E OF MTNS. CIGS 3 TO 8 HND W OF MTNS AND IN MTNS WHILE E OF MTNS CIGS WILL LWR FROM 3 TO 7 THSD BY 0350E TO 7 TO 15 HND BY 1330E XCP THERE WILL BE SOME LOW ST IN CNTRL NC WITH CIGS ARND 5 HND. VSBY MSTLY 3 TO 7 WITH SMOKE AND PCPN LMTG XCP 1/2 TO 2 IN ERN NC AND NERN SC UNTIL 0830E WITH GNDFG LMTG AND NEAR 1 IN SWRN PA ACCT SMOKE AND FOG MXD.

The above forecast would be translated as follows: "5:30 a. m. to 1:30 p. m., eastern standard time, airway forecasts, November 11. Washington-Cincinnati; Washington-Charleston; Washington-Memphis; Washington-Greensboro; Washington-Norfolk; Norfolk-Knoxville; Evansville-Muscle Shoals; Pittsburgh-Huntington. Steep gradient westward from central Pennsylvania with rapidly falling pressure to deepening low central over extreme eastern Kansas with severe cold front through center of low southward to near Palestine. Low will move north-northeastward and front will

move eastward into the extreme western Kentucky and Tennessee by 1:30 p. m., E. S. T., preceded by thunderstorms which will advance into southern Indiana and central Kentucky and Tennessee by that time. Overcast skies will prevail with light to moderate rains west of mountains and occasional scattered rains east of mountains. Ceilings 300 to 800 west of mountains and in mountains, while east of mountains ceilings will lower from 3,000 to 7,000 by 5:30 a. m., E. S. T., to 700 to 1,500 by 1:30 p. m., E. S. T., except there will be some low stratus in central North Carolina with ceilings around 500. Visibility mostly 3 to 7 with smoke and precipitation limiting except ½ to 2 in eastern North Carolina and northeastern South Carolina until 8:30 a. m., E. S. T., with ground fog limiting and near 1 in southwestern Pennsylvania account smoke and fog mixed."

(*b*) *Terminal Forecasts.*—Examples of terminal forecasts follow:

PD EU TRMLS. BRKN TO OVC 3 TO 5 THSD LWRG OCNLY TO ABT 2 THSD. CONTUS LGT TO MDT RAIN VSBY 3 TO 6 DUE PCPN IPVG OCNLY TO 7 OR MORE. LGT ICG IN CLDS ABV 8 THSD MSL.

The above terminal forecast would be translated as follows:

"Portland-Eugene Terminals. Broken to overcast with ceilings 3,000 to 5,000 lowering occasionally to 2,000. Continuous light to moderate rain. Visibility 3 to 6 due precipitation improving occasionally to 7 or more. Light icing in clouds above 8,000 feet mean sea level."

SM TRML. OVC 4 TO 2 THSD LGT RAIN VSBY 4 TO 8 PCDG OCLDD FRONT PSG 1700P. PCPN BCMG SHWRY THRFTR AND CEASG NEAR 2130P WITH CLDNS BCMG BRKN TO OCNLY SCTD 6 TO 8 THSD AND VSBY IPVG TO ABV 10 BY 2230P.

The above terminal forecast would be translated as follows:

"Spokane Terminal. Overcast with ceilings 4,000 to 2,000. Light rain with visibility 4 to 8 preceding occluded front passage 5:00 p. m., Pacific time. Precipitation becoming showery thereafter and ceasing near 9:30 p. m., P. S. T., with cloudiness becoming broken to occasionally scattered 6,000 to 8,000 and visibility improving to above 10 by 10:30 p. m., P. S. T."

JA NO MS UM BH UG AG CB TRMLS. MSTLY BRKN HI AND LWR CLDNS WITH CIG 2 TO 4 THSD AND VSBY OVR 6 BUT WITH OCNL RAIN SHWRS OR LCL TSHWRS VCNTY AFT NOON IN WHICH CIG WILL LWR TO 8 TO 12 HND AND VSBY TO 1 TO 3 TEMPORARILY.

The above terminal forecasts would be translated as follows:

"Jackson, New Orleans, Mobile, Meridian, Birmingham, Montgomery, Atlanta, Chattanooga Terminals. Mostly broken high and lower cloudiness with ceiling 2,000 to 4,000 and visibility over 6 miles, but with occasional rain showers or local thundershowers in the vicinity after noon in which ceiling will lower to 800 to 1,200 and visibility to 1 to 3 temporarily."

BH TRML. OVC AT 2 TO 4 HND WITH VSBY 2 TO 4 IN SMOKE AND SOME FOG UNTIL 0900C THEN BCMG BRKN AT 8 TO 12 HND WITH VSBY OVR 6 AND CIG LFTG TO 2 TO 4 THSD BY 1030C.

The above terminal forecast would be translated as follows:

"Birmingham Terminal. Overcast at 200 to 400 with visibility 2 to 4 miles in smoke and some fog until 9:00 a. m., C. S. T., then becoming broken at 800 to 1,200 with visibility over 6 miles and ceiling lifting to 2,000 to 4,000 by 10:30 a. m., C. S. T."

CG TRML. OVC AT 1 TO 2 THSD WITH LWR SCTD TO BRKN AT 5 HND AND RAIN SHWRS UNTIL NOON. LWR CLDS DCRSG THRFTR BUT BCMG OVC AT 5 HND WITH MDT SHWRS DUE TO COLD FRONT PSG ABT 1500C WITH LGT SHWRS CONTG. VSBY 6 OR BTR XCP BRIEFLY 2 TO 4 IN SHWRS NEAR NOON AND 1500C.

The above terminal forecast would be translated as follows:

"Chicago Terminal. Overcast at 1,000 to 2,000 with lower scattered to broken clouds at 500 and rain showers until noon. Lower clouds decreasing thereafter but becoming overcast at 500 with moderate showers due to cold front passing about 3 p. m., C. S. T., with light showers continuing. Visibility 6 or better except briefly 2 to 4 in showers near noon and 3:00 p. m."

MP TRML. OVC AT ZERO TO 4 HND LFTG TO 5 HND TO 1 THSD BY 0900C WITH LGT INTMT SNW AND BLWG SNW PRSTG. VSBY ZERO TO ½ INCRG TO NEAR 1 BY 0900C.

The above terminal forecast would be translated as follows:

"Minneapolis Terminal. Overcast at zero to 400 lifting to 500 to 1,000 by 9 a. m., C. S. T., with light intermittent snow and blowing snow persisting. Visibility zero to ½ increasing to near 1 by 9 a. m."

JI CR TRMLS. VRBL CLDNS BROKEN TO OVC OCNL LGT DRZL AND RAIN. CIG 1 TO 2 THSD VSBY 4 TO 8 MILES CIG LWRG OCNLY BELOW 1 THSD NEAR 2100C.

The above terminal forecast would be translated as follows:

"Brownsville, Corpus Christi Terminals. Variable cloudiness broken to overcast, occasional light drizzle and rain. Ceiling 1,000 to 2,000 feet, visibility 4 to 8 miles, ceiling lowering occasionally below 1,000 feet near 9 p. m., C. S. T."

BT TRML. BRKN TO OVC NEAR 8 THSD WITH LWR SCTD TO BRKN NEAR 5 THSD INCRG TO OVC IN SHWRS DVLPG VCNTY TRML LATE FORNN LWRG CIG AND VSBY TO 3 THSD AND 4 MILES. LGT ICG IN CLDS BCMG MDT OVR RNGS.

The above terminal forecast would be translated as follows:

"Butte Terminal. Broken to overcast clouds near 8,000 with lower scattered to broken clouds near 5,000, increasing to overcast in showers developing in the vicinity of the terminal in the late forenoon, lowering ceiling and visibility to 3,000 and 4 miles. Light icing in clouds, becoming moderate over ranges."

GT TRML. HI BRKN TO OVC WITH LWR SCTD CLDS FRMG NEAR 5 THSD FORNN INCRG TO OVC BY 1530M. LWR SCTD TO BRKN FRMG AFT 1330M NEAR 1 THSD INCRG TO OVC WITH LGT SNW BY 1430M LWRG VSBY TO 2. VSBY OTRW OVR 9.

The above terminal forecast would be translated as follows:

"Great Falls Terminal. High broken to overcast clouds, with lower scattered clouds forming near 5,000 feet during the forenoon, increasing to overcast by 3:30 p. m., M. S. T. Lower scattered to broken clouds forming after 1:30 p. m., M. S. T., near 1,000, increasing to overcast, with light snow by 2:30 p. m., M. S. T., lowering visibility to 2 miles. Visibility otherwise over 9 miles."

CX TRML. SCTD TO BRKN HI CLDS WITH LWR SCTD OCNLY BRKN 7 THSD VSBY UNL.

The above terminal forecast would be translated as follows:

"Cheyenne Terminal. Scattered to broken high clouds with lower scattered clouds occasionally broken at 7,000. Visibility unlimited."

BE TRML. OVC LOW ST 1 THSD TO 7 HND VSBY 1 UNTIL ABT 1030M BCMG 2 TO 4 THSD AND 2 TO 4 MILES WITH OCNL LGT RAINS AND FOG THNG BY 1130M AND PRSTG.

The above terminal forecast would be translated as follows:

Boise Terminal. Overcast low Stratus at 1,000 to 700 feet visibility 1 mile until about 10:30 a. m., M. S. T., ceiling becoming 2,000 to 4,000 and visibility 2 to 4 miles with occasional light rains and fog thinning by 11:30 a. m., M. S. T., and persisting.

RT TRML. HI BRKN WITH LWR SCTD TO BRKN CLDS AT 5 THSD APPRG BY 1730M. LGT RAINS AFT 1730M. AND CLDNS BCMG OVC IN PCPN. VSBY UNL XCP 4 IN RAINS.

The above terminal forecast would be translated as follows:

"Rock Springs Terminal. High broken with lower scattered to broken clouds at 5,000 appearing by 5:30 p. m., M. S. T. Light rains after 5:30 p. m., M. S. T., and cloudiness becoming overcast in precipitation. Visibility unlimited except 4 miles in rains."

BJ TRML. OVC WITH OCNL LGT SNW CIG 4 TO 2 THSD VSBY UNRSTD UNTIL 0330E. STEADY SNOW THRFTR CIG 25 TO 15 HND VSBY 7 TO 4 ICG CLDS.

The above terminal forecast would be translated as follows:

"Buffalo Terminal. Overcast with occasional light snow ceiling 4,000 to 2,000 visibility unrestricted until 3:30 a. m., E. S. T. Steady snow thereafter ceiling 2,500 to 1,500 visibility 7 to 4. Icing in clouds."

GR SN ID FW TRMLS. BRKN TO OVC WITH RAIN SHWRS CHGNG TO SNW SHWRS ABT 1800C. CIG GNRLY 1 TO 2 THSD BUT OCNLY 4 TO 8 HND IN SNW. VSBY 1 TO 3 IN SNW AND 6 OR MORE OTRW. ICG CNDS. STG GSTY SFC WNDS.

The above terminal forecast would be translated as follows:

"Grand Rapids, South Bend, Indianapolis, Fort Wayne Terminals. Broken to overcast with rain showers changing to snow showers about 6:00 p. m., C. S. T. Ceiling generally 1,000 to 2,000 but occasionally 400 to 800 in snow. Visibility 1 to 3 in snow and 6 or more otherwise. Icing conditions. Strong gusty surface winds."

LH GK TRMLS. OVC OR BRKN CLDS AT 4 TO 8 HND WITH LGT SNW VSBY 1 TO 2 MILES UNTIL 1230C IPVG TO BRKN OR SCTD AT 2 TO 4 THSD. VSBY UNL THRFTR.

The above terminal forecast would be translated as follows:

"La Junta, Goodland Terminals. Overcast or broken clouds at 400 to 800 with light snow, visibility 1 to 2 miles until 12:30 p. m., C. S. T., improving to broken or scattered clouds at 2,000 to 4,000, visibility unlimited thereafter."

EH PHB PCD TRMLS. CLR BCMG SCTD OR BRKN AT 1 TO 2 THSD WITH APCH COLD FRONT ABT 1300M. VSBY UNL.

The above terminal forecast would be translated as follows:

"Roswell, Hobbs, Carlsbad Terminals. Clear becoming scattered or broken at 1,000 to 2,000 with approaching cold front about 1:00 p. m., M. S. T. Visibility unlimited."

KC TRML. OVC. CIGS 2 TO 3 THSD UNTIL ABOUT 2300C. MDT TO SVR WND SHFT NEAR MIDN WITH CIG LWRG TO 4 TO 8 HND. SHWRS CHGNG TO LGT SNW AFTR 0400C. VSBY OVR 6 UNTIL WND SHFT PSG THEN 3 TO 6 IN SHWRS AND OCNLY LWRG TO NEAR 1 IN SNW.

The above terminal forecast would be translated as follows:

"Kansas City Terminal. Overcast with ceilings 2,000 to 3,000 until about 11:00 p. m., C. S. T. Moderate to severe wind shift near midnight with ceiling lowering to 400 to 800 feet. Showers changing to light snow after 4 a. m., C. S. T. Visibility more than 6 until front passage, then 3 to 6 in showers and occasionally lowering to near 1 mile in snow."

BU TRML. OVC WITH OCNL LGT RAIN UNTIL NEAR 1630P WITH CLDS BCMG BRKN AND CIG IPVG TO 2 TO 4 THSD THRFTR. VSBY 3 TO 6 IPVG TO UNRST BY 2030P.

The above terminal forecast would be translated as follows:

"Burbank Terminal. Overcast with occasional light rain until near 4:30 p. m., Pacific standard time with clouds becoming broken and ceiling improving to 2,000 to 4,000 thereafter. Visibility 3 to 6 miles improving to unrestricted by 8:30 p. m., P. S. T."

HU TRML. CLR OR SCTD CLDS FLWD BY SCTD TO BRKN CLDS 15 HND TO 3 THSD DVLPG BY 0900C LFTG TO 4 OR 5 THSD BY NOON WITH LGT SHWRS DVLPG. VSBY LESS THAN 1 MILE ACCT MDT TO DNS GNDFG IPVG AFT DABRK 3 TO 6 MILES BY 0800C AND UNRSTD AFT 0900C.

The above terminal forecast would be translated as follows:

"Houston Terminal. Clear or scattered clouds followed by scattered to broken clouds 1,500 to 3,000 feet developing by 9 a. m., C. S. T., lifting to 4,000 or 5,000 by noon with light showers developing. Visibility less than 1 mile account moderate to dense ground fog improving after daybreak 3 to 6 miles by 8 a. m., C. S. T., and unrestricted after 9 a. m., C. S. T."

RA GW TRML. HI AND LOW BRKN TO OVC WITH CIGS 3 TO 6 THSD WITH SOME SCTD TO BRKN ST 3 TO 6 HND UNTIL 0930E. MSTLY OVC WITH OCNL LGT RAIN WITH CIGS 1 TO 3 THSD AFT 0930E. VSBY 1 TO 3 IPVG TO 3 TO 6 AFT 0900E WITH PCPN AND FOG LMTG.

The above terminal forecast would be translated as follows:

"Raleigh-Greensboro Terminal. High and low broken to overcast with ceilings 3,000 to 6,000 with some scattered to broken Stratus 300 to 600 until 9:30 a. m., E. S. T. Mostly overcast with occasional light rain with ceilings 1,000 to 3,000 after 9:30 a. m., E. S. T. Visibility 1 to 3 improving to 3 to 6 after 9:00 a. m., E. S. T., with precipitation and fog limiting."

WA RW NW TRMLS. OVC OR BRKN SVRL LYRS. CIG 3 TO 1 THSD WITH LGT INTMT RAIN BGNG DURG AFTN. LWR BRKN CLD DECK 10 TO 5 HND AFT 1700E. VSBY 10 TO 5 UNTIL 1700E THEN LWRG TO 3 TO 1 IN LGT FOG.

The above terminal forecast would be translated as follows:

"Washington-Richmond-Norfolk Terminals. Overcast or broken several layers. Ceiling 3,000 to 1,000 with light intermittent rain beginning during afternoon. Lower broken cloud deck 1,000 to 500 after 5:00 p. m., E. S. T. Visibility 10 to 5 until 5:00 p. m., E. S. T., then lowering to 3 to 1 in light fog."

PART II.—TRANSMISSION OF AIR-MASS AND FRONTAL ANALYSES BY TELETYPE AND RADIO

3–200. Origin of Analyses.—The central office of the Weather Bureau places the results of the air-mass and frontal analysis of the 7:30 a. m., eastern standard time, map on the teletype circuits at Washington daily at 11:55 a. m., eastern standard time, to be relayed to all airway communications circuits. This includes an analysis of the Northeast Pacific prepared at San Francisco, Calif., and transmitted to Washington for incorporation in the Washington analysis.

3–201. General Composition of AMAFA and Symbols Used Therein.—The transmissions by teletype and radio are made as follows:

(*a*) *Headings.*—The heading of the transmissions consists of the Washington designator; the symbol "AMAFA," meaning "air-mass and frontal analysis;" the date and time of map analyzed, using figures. For example: "WA AMAFA 2407 . . ." would be translated as "Washington air-mass and frontal analysis of the 7:30 a. m., E. S. T., map, for the 24th day of the month.

(*b*) *Body of* AMAFA *report.*—Following the heading is one space and then a type-of-front symbol group to indicate the type of front to follow in the message. The locations of fronts are designated according to latitude and longitude of various points along the fronts.

(*c*) *Symbols for types of air masses.*—Each symbol will be composed of two figures, the first known as the mass and the second as the thermodynamic property, as follows:

Mass:

1. Continental or dry Arctic	cA
2. Continental or dry Polar	cP
3. Superior	S
4. Maritime or moist Arctic	mA
5. Maritime or moist Polar	mP
6. Maritime or moist Tropical	mT

Thermodynamic property:

0. Indeterminate or questionable.
1. Warm relative to the surface (w).
2. Cold relative to the surface (k).

(*d*) *Symbols for types of fronts.*—The symbols representing the types of fronts are as follows:

⦶	Cold front.
⦷	Occluded front.
⊕	Warm front.
↑ ⊕ ↑	Warm front aloft.
↑ ⦶ ↑	Cold front aloft.
↑ ⦷ ↑	Occluded front aloft.
⦶⊕	Stationary front.
⦶+	Cold front frontogenesis.
⊕+	Warm front frontogenesis.
⦶ ⊕+	Stationary front frontogenesis.
⦶ −	Cold front frontolysis.
⊕ −	Warm front frontolysis.
⦶ ⊕ −	Stationary front frontolysis.
⦷ −	Occluded front frontolysis.

(*e*) *Miscellaneous symbols.*—Other symbols are as follows:

/ Used to indicate that the air mass to the left of the / is aloft while that to the right of it is at the surface (for instance, 52/11 indicates cAw at surface; mPk aloft).

• • End or intersection of front, or end of message.

\+ Between two air mass numbers, indicates a mixture of the two air masses.

→ "Becoming" (for instance 52→ 62 indicates mPk becoming mTk).

3–202. Methods of Indicating Coordinates of Points Along the Fronts.—Following the type-of-front group will be a space and then the latitude and longitude, in the order named, of the beginning point of that front, followed by the latitude and longitude of one or more (as many as are necessary to properly outline the position of the front) points on the front, the group of figures representing the latitude and longitude of any particular point, being separated from the next group by a space. Thus,

"48105 4590" would indicate latitude 48° and longitude 105° for the beginning point, and the latitude 45° and longitude 90° for the second point, etc. If a front is *continuous*, also, if a series of fronts are located with respect to each other so as to form a *continuous* smooth line, the transmission for the entire series is made without a break. When the type of front changes, a symbol for the new type will be sent for the first point on it and then will follow the coordinates of latitude and longitude. Further, if one front is attached to another at an acute angle and is plainly not a part of a continuous smooth front, or a continuous series of fronts, the latitude and longitude of the connecting point will be given in the first series of points in its proper order, and also the second series of points will either begin or end with the latitude and longitude of the connecting point.

3–203. Method of Indicating Air Masses.—Immediately following the two periods sent behind the last coordinate groups designating the locations of points on the fronts, there will be sent the air-mass groups, consisting of two, four or six 2-figure symbols for the appropriate air masses, followed in each case by a 4- or 5-figure group for the coordinates of latitude and longitude in the same manner as points on a front are sent. These will indicate the locations on the map at which the air mass designators should be placed to complete the analysis begun by the entries of the fronts. Following the last of the coordinates two periods will be sent.

3–204. Method of Indicating Separation of Various Fronts Included in Transmissions.—Each front, or series of fronts representing a single continuous line, is followed by two periods to separate it from data for other continuous fronts following it in the transmission.

Section IV

INSTRUMENTS

PART I.—INSTRUCTIONS FOR INSTALLATION AND OPERATION OF INSTRUMENTS FOR AIRWAY AND OFF-AIRWAY STATIONS

4–100. The information and instructions given below cover the essentials of standard installations of instrumental equipment at airway, 6-hourly, and off-airway stations, and in part for those at airport stations. Installations at airport stations are handled mostly by special correspondence and a circular of general information entitled, "Quarters and Instrumental Equipment for Weather Bureau Stations at Airports," is especially required for the initial planning.

CHAPTER I

STANDARD INSTRUMENTAL EQUIPMENT

4–101. Airway Stations.—The completeness and scope of equipment depends largely upon the frequency and kind of observations, ranging from a thermometer and instrument shelter for stations furnishing occasional observations on call to the complete outfit provided for a station reporting frequently by teletype or other means. Airway stations are usually equipped as follows:

One shelter, cotton region shelter with support.
Two exposed thermometers (one extra); or one psychrometer (without handle) with an extra tube.
One psychrometer fan (when needed).
One one-sixtieth mile anemometer, complete with cups and wrench, when used. (Special oils, one for summer and one for winter use, are required for use with the anemometer.)
One support, wind instrument, 12-foot for erection on roof of building; complete with cross arm for anemometer; or supports, for erection on beacon-light towers.
One contacting wind-vane bearing, 4-contact or 8-contact.
One 3-foot metal wind vane.
One indicator, wind direction and velocity, 4-light or 9-light.
One barograph, open scale.
One projector, ceiling light.
One clinometer.
Ceiling balloons, inflation equipment and timing (Wasp) clock.
One 8-inch rain and snow gauge with box support.
One weighing type rain and snow gage.

4–102. When teletype map report or special 6-hourly observations are required at airway stations, the equipment is expanded to include the instruments, etc., listed below for 6-hourly reporting stations.

4–103. Six-hourly or Off-airway Reporting Stations.—Observations from this network of stations are required primarily in connection with weather forecasts along airways, and their instrumental equipment is essentially as follows:

One cotton-region instrument shelter with support.
One psychrometer (without handle) and one extra tube.
One psychrometer fan.
Two maximum and two minimum thermometers (one spare of each).
One Townsend thermometer support.
One 1/60-mile anemometer with cups and wrench (when needed); also special oil as mentioned for airway stations.
One support, wind-instrument, 12-foot, complete with anemometer cross arm.
One contacting wind-vane bearing, 4-contact or 8-contact.
One 3-foot metal wind vane.
One indicator, wind-direction and velocity, 4-light or 9-light.
One mercurial barometer with shielded board for mounting.
One barograph, open-scale.
One 8-inch rain and snow gage with box support.

4–104. When an airway station is located where a Department of Commerce beacon-light tower is available, separate supports for wind vane and anemometer for mounting on the tower platform are often substituted for the above-listed 12-foot support, and no cross arm for the anemometer is used.

4–105. For airway stations not reporting for the teletype, the equipment is usually simplified by the omission of the contacting bearing, and also the wind vane and tower support therefor for a tower exposure, and a wind-velocity indicator is substituted for the combined wind-direction and velocity indicator. The ceiling-light projector and clinometer are omitted where night observations are not required.

4–106. Airport Stations.—At airport stations a large-sized standard shelter with steel support is usually substituted for a smaller shelter or very occasionally a cotton-region shelter with psychrometer fan is employed. The large shelter is required when a whirling apparatus for wet- and dry-bulb thermometers is used. For the wind instruments a standard 18-foot pipe support is customary, usually equipped with a 4-foot vane, a Fergusson wind-vane bearing and old-style direction contacts in a cast-iron contact box; otherwise a contacting wind-vane bearing and a 17-foot support are used instead.

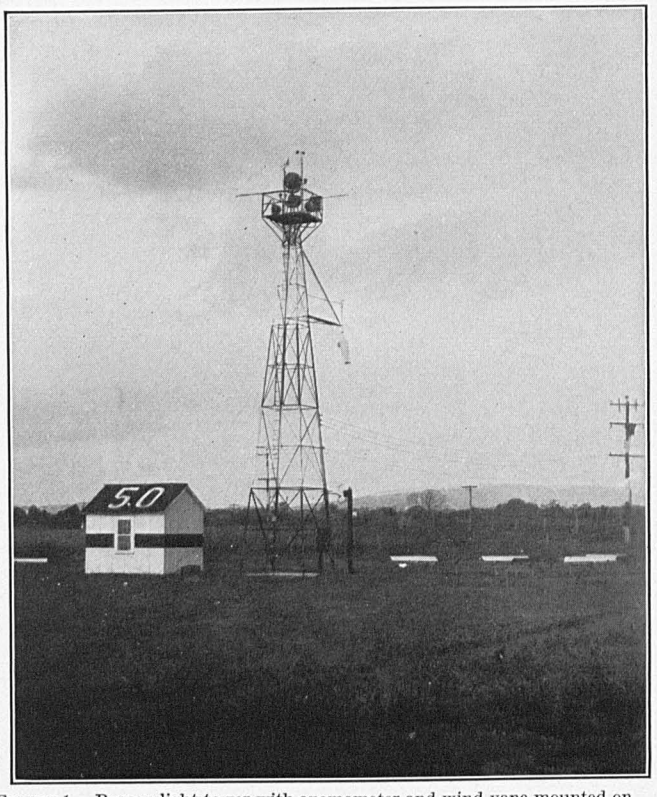


FIGURE 1.—Beacon-light tower with anemometer and wind vane mounted on separate 7-foot pipe supports erected on platform at apex.

4–107. Additional equipment to that provided for an airway station generally includes one or two mercurial barometers with mounting, occasionally pilot-balloon and radiosonde apparatus, and less frequently a telethermoscope; all as discussed in detail in the circular, "Quarters and Instrumental Equipment for Weather Bureau Stations at Airports."

CHAPTER II

WIND INSTRUMENTS

4–108. Exposure.—Wind instruments will be exposed where a free movement of the wind occurs, obstructed as little as possible by near-by structures or objects. This is obtained by elevating the vane or anemometer by means of vertical pipe supports, usually mounted on buildings or towers. The instruments must be readily accessible for cleaning, oiling, and occasional adjustments.

4–109. Wind-instrument Supports.—Two types of supports are standard for airway weather stations: (1) A 7-foot support of 1-inch pipe for either the anemometer or the contacting wind vane used on airway beacon-light towers; and (2) a 12-foot support of 1¼-inch pipe for wind vane and anemometer for roof installation. The latter is also used at off-airway stations.

4–110. Tower Support for Anemometer or Wind Vane.—The tower support, figure 1 for anemometer or wind vane consists essentially of a 1-inch pipe screwed into a railing base fastened to a corner of the square wooden or iron grating platforms of the tower. A 1-inch by ½-inch coupling surmounts the upper end of the pipe, 6 feet 9 inches high, into which coupling a brass anemometer pin or the wind-vane bearing is screwed, the former fitting the recess in the base of the anemometer casing.

4–111. When one support for the anemometer only is required, it should be placed over a tower corner nearest the point from which the prevailing winds come. When both anemometer and contacting wind vane are needed, the pipe supports should be located at diagonally opposite corners of the platform, if possible, the line of centers of the supports approximately normal to the prevailing wind direction. When submitting requisitions for supports, state the kind of platform with which the tower is equipped.

4–112. As shown in figure 2, the 1-inch pipe of the support is anchored to the tower handrailing by an angle iron 18 inches long, the pipe attached to the angle iron by two hook bolts and a pipe strap, and the angle iron held in turn to the handrailing by two similar hook bolts.

4–113. Twelve-foot Wind-instrument Support.—The 12-foot support, figure 3, is intended for erection on the roof of a building, the combined height of building and support being sufficient usually to give the anemometer a reasonably free exposure.

4–114. While the support will be so installed as to secure a good exposure of the wind instruments, at the same time ample safety must be provided for the man who will have to climb it in all kinds of weather. This safety is accomplished almost entirely by the secure attachment of the guy-rod footings to the roof. Three 8-inch eye bolts, each with nut and washer, also three foot plates, are provided with each support, one bolt or plate for each footing, the bolts to be used where access can be had to the underside of the roof. Otherwise the shoes are required and fastened to the roof with lag screws, one shoe for each of the three guy rods.

4–115. The base plate and shoes should be placed, if practicable, over the roof rafters. If this cannot be done, or the roof is of unusually light construction, 2-inch wooden blocks or short planks should first be screwed to the roof, the shoes being attached to the blocks. Roof cement placed under the timbers or other member attached to the roof will prevent leakage. Give the support a coat of paint after erection.

4–116. Eighteen-foot Wind-Instrument Support.—This support, illustrated in figure 4, is of the same general construction as the 12-foot support but more strongly built, 2-inch pipe being used instead of 1¼-inch. The contact box near the base contains the wind-direction contacts, the rotor of which is connected by an inside pipe to the wind-vane axis above. For further details consult Circular D or WB drawing No. 299.

4–117. A less costly assembly, for identification called a 17-foot support, is used when a contacting wind-vane bearing is employed instead of the old-style cam-collar contacts. In this case the contact box and Fergusson bearing with inside pipe are omitted, and the contacting bearing screws into a 1½ by ½-inch reducing coupling at the top of the support.

4–118. Anemometers.—The anemometer consists essentially of a cup wheel rotated by the wind, rigidly attached to a vertical axis turning in bearings. In the large standard anemometer, figure 5, suitable gearing communicates the motion of wheel and spindle to dials graduated in miles and tenths, approximately 640 turns of the cups corresponding to a movement of 1 mile of wind past the instrument, when a 3-cup anemometer is used having cup arms 6.29 inches long. Tables for correcting indicated to true wind velocities, will be found in Weather Bureau Instructions No. 1, January 2, 1935, repeated in section II of this circular as table No. 7. The correction tables are also issued as a separate on a convenient card.

4–119. Description of Large 3-Cup Anemometer.—Referring to figure 5A, the cup wheel (1) is made of three hemispherical cups of duralumin or copper mounted on arms of steel tubing. The wheel is attached by a set screw (2) to a steel spindle within the casing having a plain bearing at the upper end and a step bearing at the bottom. A steel worm on the spindle transmits motion to the wheel (3) (see fig. 5B) on the axis of which is a second worm meshing with the pinion (4) which turns the two dial wheels (5), the outer one of which has 100 teeth and the inner 99, so that for each revolution of the former, the inner wheel moves one graduation, equivalent to an indicated wind movement of 10 miles. The inner dial therefore gives the reading to tens of miles as referred to the zero of the outer dial, and the latter gives the additional miles and tenths

by reference to the index at (6). For operation of the electrical indicator, pins set into the side of wheel (3) close the circuit at spring (7).

4–120. Small One-sixtieth Mile Airway Anemometer.—This type of anemometer illustrated in figure 6 was introduced about the beginning of the year 1938. It is much smaller than the standard type described above, being only about 7 inches high, and equipped with 3 conical cups on arms, 733 turns of the cups corresponding to 1 mile of wind movement. Since there are no dials in the instrument or mile contacts, its use is

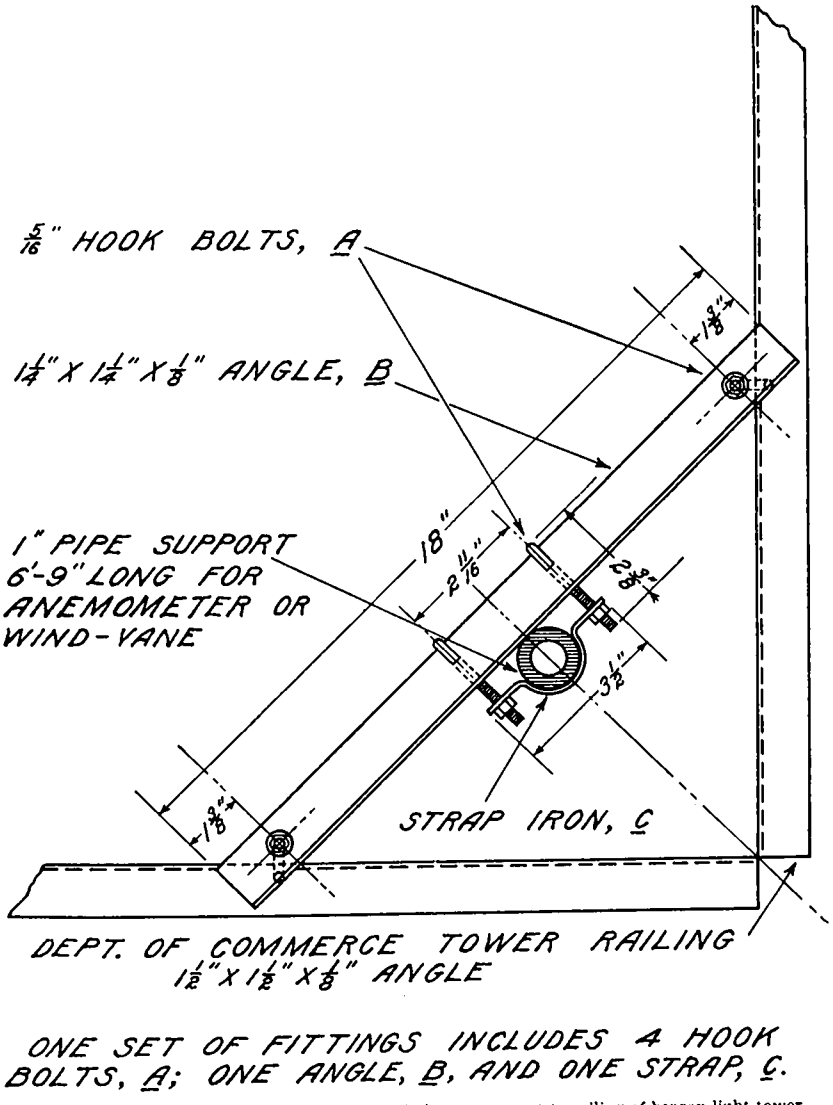


FIGURE 2.—Clamp to hold anemometer or wind-vane support to railing of beacon-light tower.

confined entirely to the indication of velocity, and therefore meets the need for a simple, inexpensive instrument for airway observations and similar usage. Instructions for its care and operation will be found in chapter VIII.

4–121. Wind Vanes.—The vane generally used, figure 7, consists of a plate of metal forming a tail attached to one side of a vertical axis free to rotate in response to changes in wind direction. The windward part of the vane is formed of an arrow-tipped rod which points into the wind and also serves to counterweight the tail. The spindle is a

steel rod about 2 feet long, the lower end turning in a pivot bearing. The bearing proper for the contacting wind-vane assembly, and that for a vane used without contacts, are alike.

4–122. Four-contact Wind-vane Bearing.—As shown in both figures 7 and 8, the device consists of the following parts: One wind-vane bearing made of half-inch pipe, with keyway bushing to form the top bearing and a pivot support to form the lower bearing; one wind-vane axis with a special cam-equipped weather housing rigidly attached; one set of insulated contact springs spaced 90° apart on a collar that fits over the half-inch pipe; one wind-vane clamping nut.

4–123. Installation.—To set up the device for use, first erect the half-inch pipe bearing firm and vertical in the desired location. Then fill the bearing about half full of light automobile oil, the contents of the bottle of oil sent out with the bearing. Next slip the contact-spring assembly over the pipe and temporarily clamp it, springs upward and lower edge of brass collar between the two rings that will be found on the pipe $2\frac{13}{16}$ and 3 inches, respectively, below the top. (These rings mark safe working limits and provide for longer life by occasional change of position.) Now insert the axis, being careful to rotate it slowly so as to *feel* the key in the axis through the keyway in the top bearing. This key arrangement permits withdrawal in one, and only one, position. Next put on the vane with due regard to provisions made for insuring its position relative to its axis, generally a pin extending into a hole in the brass housing of the axis.

4–124. Orienting.—This requires that the vane be tied or otherwise temporarily secured in a true north direction. The contact-spring assembly is then rotated until one of the springs, no matter which one, comes evenly spaced opposite a notch in the housing which indicates the mid-position of the contact cam. This contact spring now becomes the north one, and should have the north wire attached. The other three wires are then clamped to the corresponding binding posts, which are sufficiently identified by their positions. The common or battery wire is to be well grounded to the upright metal support by fastening with screw to brass ring. As in all electrical installations, it pays to take time to connect terminals carefully with well-formed loops under the binding nuts. The resulting indications should, of course, be verified by two observers, one holding the vane in its positions, the other observing the indications in the office. There is also a sleet shield which should be temporarily removed, then replaced after all connections have been made.

4–125. Indicators.—These are for use in making observations of the wind and are of two principal kinds: One for wind velocity, the other for both the direction and velocity, the latter being much more frequently employed.

4–126. Velocity Indicators.—These are comprised simply of a board 8 by 10½ inches on which are mounted a bell-ringing transformer, the secondary of which is wired in series with a switch, a 25-ohm rheostat, a buzzer, and two binding posts to which the anemometer leads are connected as shown under "wiring" below. Excepting for the addition of the direction lamps and binding posts, it is essentially the same as the indicator shown in figure 10. One form required where alternating lighting current is not available utilizes a buzzer and push-button switch wired in series with a 2-cell dry battery placed within the box, forming a part of the indicator.

4–127. Wind-direction and Velocity Indicator, Board Type.—This includes four 6- to 8-volt automobile-type lamps for the indication of wind direction in addition to the velocity buzzer. These lamps are mounted in the form of a square so that when the board is attached to a wall, the lamps are at the cardinal points, i. e., north at the top, east at the right hand, etc. The 25-ohm rheostats are employed to adjust the current from the transformer secondary connected to the anemometer and wind-vane circuits so as to give positive operation of the buzzer but with only enough current to light two of the lamps to a moderate brightness. By thus diminishing the current flow the anemometer contacts are protected from injurious sparking.

4–128. Eight- and Twelve-contact Wind-vane Bearings (fig. 9).—This consists of the following parts: A short length of standard half-inch pipe, with keyway bushing forming the top bearing and a pivot support forming the lower bearing; one wind-vane axis with special cam and a rigidly attached weather housing; one set of insulated

8-contact springs mounted 45° apart on a brass collar fitted to the half-inch pipe; one wind-vane clamping nut. A 12-contact bearing is required for the combined operation of the 9-light indicator and the triple register, or the equivalent wind-rain-sun recorder now being introduced at a few stations. The 12-contact bearing is the same in construction as the one illustrated in figure 9, excepting for the addition of four sets of contacts, and is specially needed when city office activities are consolidated with those at the airport station. Special instructions are issued for its use. See paragraph 4–134.

4–129. Nine-light Wind-direction and Velocity Indicator (fig. 11). This consists of a round metal box having a dial front with the direction lamps located around the periphery. At the center of the dial is a flashing lamp for indicating the velocity of the wind. A single direction lamp indicates the position of the vane to within 11¼°, approximately. For example, the north lamp is lighted when the position of the vane is within 11¼° on either side of the north. When two direction lamps are burning, the position of the vane is within 11¼° of a point midway between the two. In addition to the lamp for indicating the velocity, a buzzer is installed within the metal box for audible indication. The wind velocity in miles per hour is the number of flashes or buzzes per minute caused by the closing of the one-sixtieth-mile contact of the anemometer; subject, of course, to the anemometer correction. Current for the lamps and audible signal is supplied from a transformer, located within the indicator, which in turn is connected by means of an attachment plug and flexible cord to an alternating current outlet of about 110 volts. The dial may be removed from the indicator by a straight pull. When replacing dial, see that alignment pin in bottom of indicator enters slot in bezel, and press until latch buttons engage locking grooves. Lamps may be removed by pressing in slightly and turning to the left.

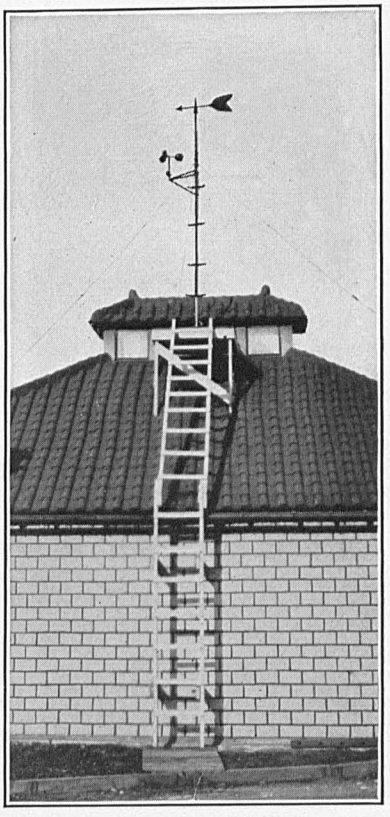


FIGURE 3.—Twelve-foot wind-instrument support on roof of building.

4–130. The three switches projecting from the bottom of the case control, in order, from left to right, the direction lamps, the buzzer, and the velocity lamp. The switches should be turned off when the indicator is not being used in order to increase the life of the lamps.

4–131. Installation and Wiring.—To install the indicator, screw or bolt the casting in place. If bolts are used, drill two 7/32-inch diameter holes on a horizontal line, 4⅜ inches apart. A ¾-inch hole is sufficient to carry all the wires through the panel or wall; for ¾-inch conduit fitting, drill a 1 1/16-inch hole. Connect wire marked "G" to ground connections on wind instruments, employing some convenient screw or bolt when anemometer has no ground binding post; "V" to 1/60-mile anemometer binding post, and the direction wires to proper direction contacts of the wind-vane bearing.

4–132. To set up the wind-vane bearing for use, screw the lower end of the half-inch pipe into a standard half-inch pipe fitting in such a manner that the bearing will be firm and vertical in the desired position. Next, loosen the two set screws in the brass ring carrying the contacts, rotate until the contact marked "N" stands truly north, and lock in place by retightening the set screws. Ten No. 16 wires, cable or single conductor, should be used between the wind instruments and the indicator at stations where no indicator has previously been installed; on old installations, cable having fewer conductors may be added to take care of the greater number of direction lamps.

4–133. After the wiring has been completed, insert in the pipe bearing about 1½ fluid ounces of oil of a quality that will not solidify at the winter temperature expected.

Insert the wind-vane axis, being careful to rotate it slowly to feel the key into the keyway in the top bearing. In placing the vane on the axis, care should be exercised to see that the positional pin is properly oriented with respect to the arrow head of the vane. If the pin is found to be on the wrong side of the vane it may be reversed by removing the two set screws at the sides of the weather shield and rotating the shield 180°. After placing the vane on the axis the indications should be checked by two observers, one holding the vane in its several positions, the other observing the corresponding indications in the office.

4–134. Diagram of Circuits.—Figure 12 indicates the connections required between contacting bearing, anemometer, and indicator. For multiple operation of two or more indicators, see wiring diagram WB No. 339, and special instructions for installation of 8-direction and velocity indicators combined with a 4-direction triple register, both obtainable from the Instrument Division and required when city and airport stations are consolidated at the airport.

4–135. For best results the 9-light indicators should not be placed more than 375 feet (cable distance) from the wind instruments. This distance, however, may

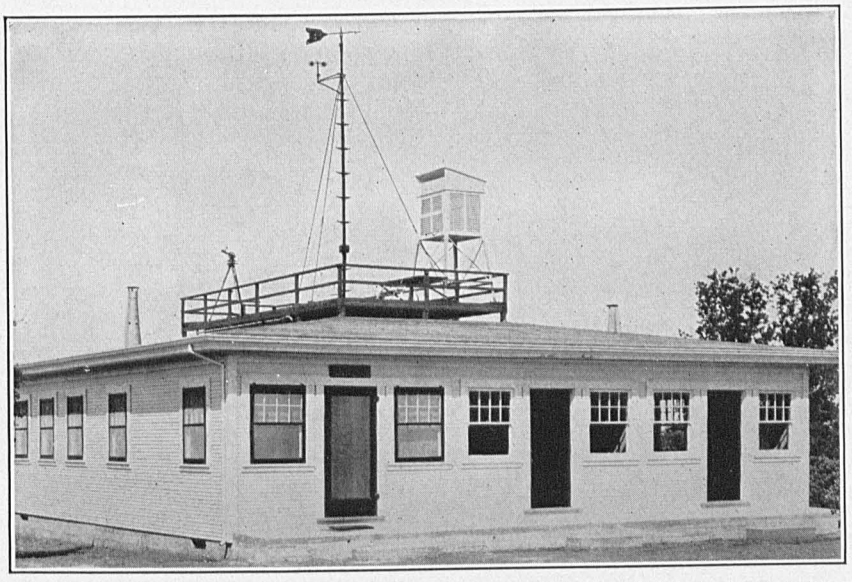


FIGURE 4.—Eighteen-foot wind-vane and anemometer support mounted on platform on roof of observatory together with large-sized shelter on 5-foot steel support and theodolite for pilot-balloon observations.

be increased up to approximately 625 feet (cable distance), provided the buzzer may be dispensed with and the lamp alone used for the velocity. Local line voltage and other conditions have a direct bearing upon the maximum distance between indicator and wind instruments; consequently this distance will not be the same in all cases.

4–136. Wiring of Anemometers and Four-light Indicators.—The anemometers in airway service are all of the electrical-indicating one-sixtieth mile type; the wind vanes either indicating or nonindicating.

4–137.—When using any of the several indicators, wire from the two velocity-indicator binding posts to the anemometer, employing cable with No. 16 conductor wires, lead or braid-covered as desired. Lead-covered cable is often desirable for more or less permanent installations, especially on towers and is essential when the circuit from a tower is to be buried underground; otherwise use braid-covered cable. The outdoor terminals of the circuit will be firmly secured to the left-hand binding posts of the anemometer (observer facing the dials); one terminal to the large post near the base of the casing, the other to the post at the back of the dial case.

4–138. As shown in the circuit diagram, figure 13, the *combined direction and velocity* four-light indicator requires one wire to each of the four direction contacts in addition to the anemometer connections, the transformer lead to the support, or battery when

used, being common to both anemometer and direction circuits. Seven-conductor lead or braid-covered cable is issued for the wiring of this indicator. Wiring of the newer nine-light indicator is covered above.

4–139. Transformer-operated Indicators.—These require connection to the alternating-current lighting circuit, usually 110 volts. This connection is neatly made

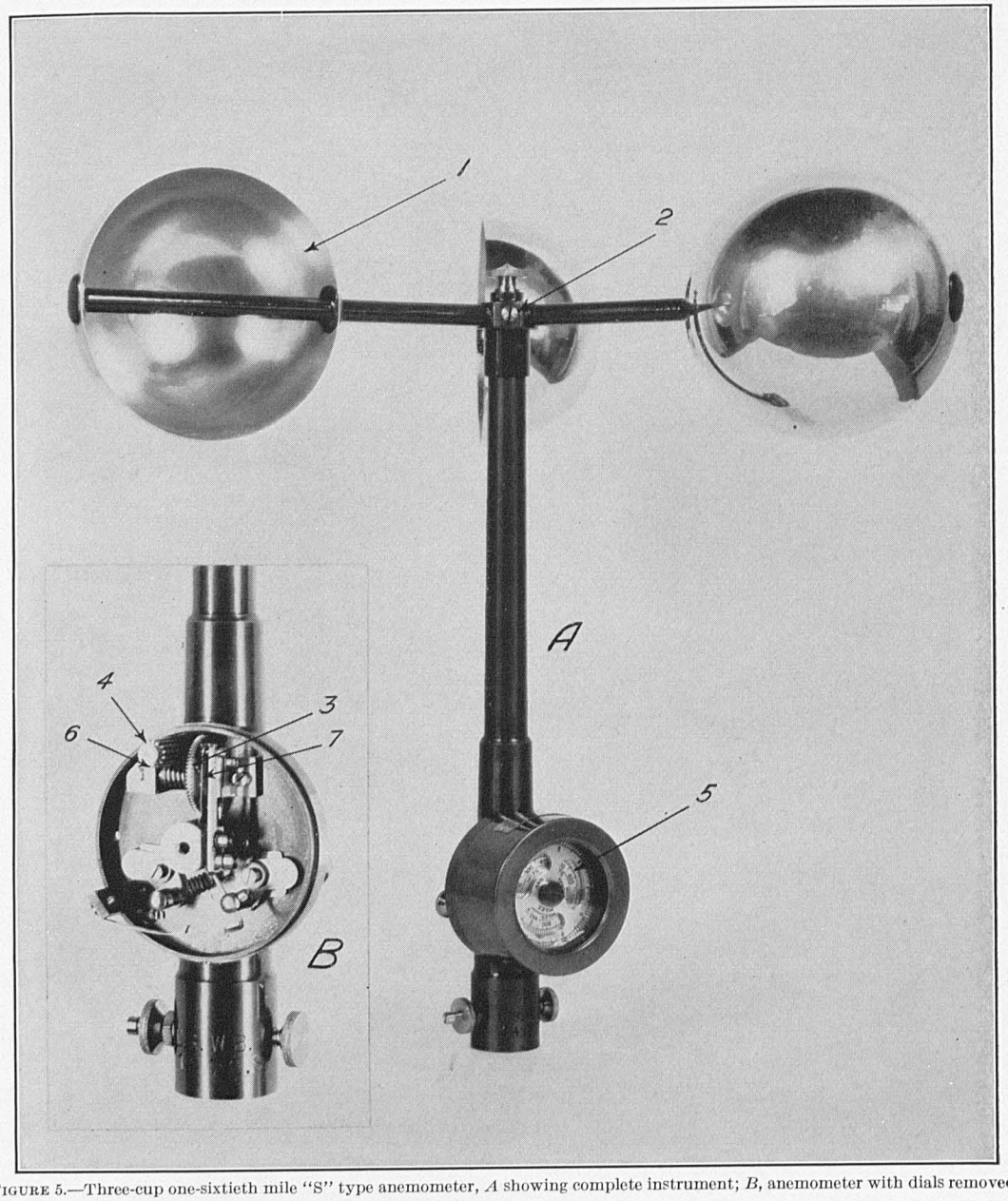


FIGURE 5.—Three-cup one-sixtieth mile "S" type anemometer, *A* showing complete instrument; *B*, anemometer with dials removed.

with No. 14 lamp cord, although other forms of conductor will do, and should be as short as practicable, and the light socket or other outlet or switch so placed as to be convenient to the observer. A switch is also placed in the transformer secondary circuit. A location on or over a desk is desirable. To operate, it is only necessary to turn on

the lighting current, close the switch on the indicator, and the buzzer is then free to respond to the circuit closures through the anemometer, as many times per minute as the wind is blowing miles per hour, and one or two of the direction lamps are lighted, giving the direction of the wind.

4–140. Battery-operated anemometer indicators are similarly employed, excepting that a push-button switch on the indicator is used to close the circuit.

4–141. Should the lighting current fail when an observation is required, dry cells may be substituted temporarily for the transformer secondary of the indicator. The

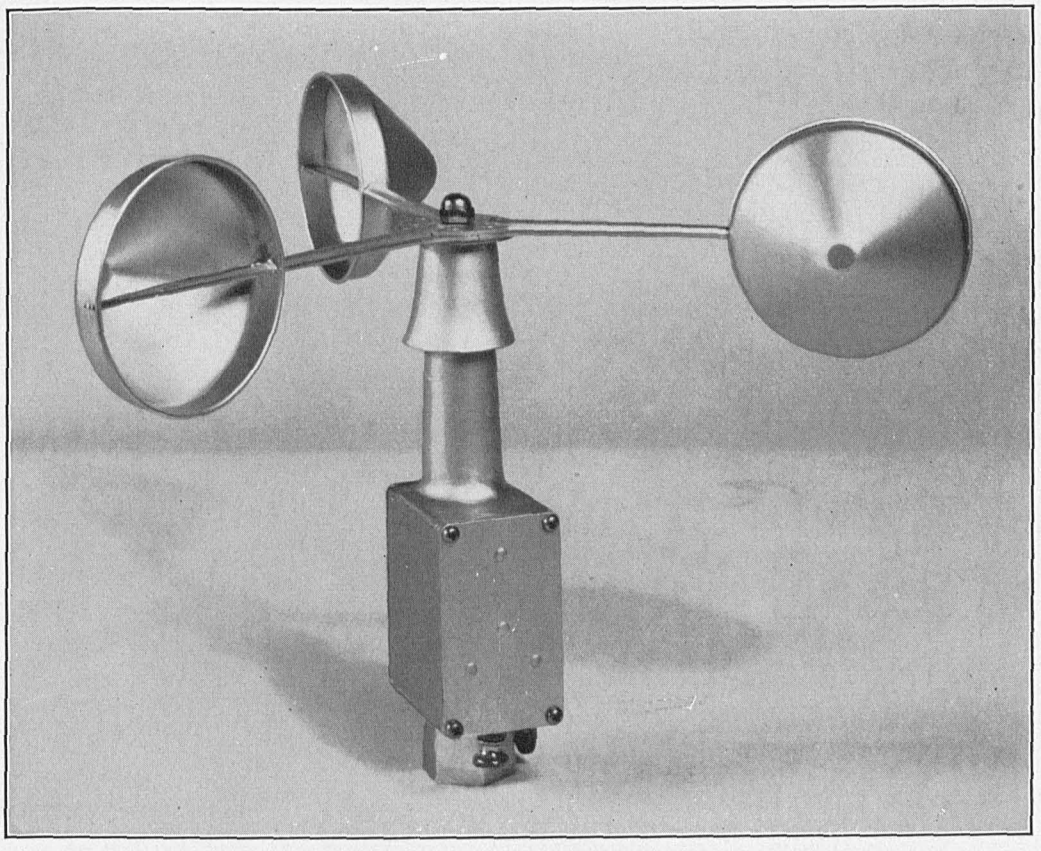


FIGURE 6.—Three-cup one-sixtieth mile "SA" type anemometer without dials.

alternative is to estimate velocity and direction of the wind, employing the Beaufort scale in connection with the former.

4–142. A weather-proofed metal strap called Wraplock furnished on stores requisition is usually employed to attach the cable to a tower or other object.

4–143. The wiring of ceiling-light projectors is given below in connection with the installation and use of projectors.

CHAPTER III

PRESSURE-MEASURING INSTRUMENTS

4–144. Airport and airway stations are frequently equipped with ruggedly constructed aneroid barometers of the type described below.

4–145. Aneroid Barometers.—Referring to figure 14, the essential feature of an aneroid is a metallic box or cell (1), corrugated in order to make it flexible, and exhausted of air. This cell tends to collapse under the pressure of the air, but a strong

steel spring (2) balances the air pressure and prevents such collapse. As the pressure of the air changes, the upper or free surface of the cell contracts or expands slightly, and this small movement is magnified and transmitted to the hand (5) through a train of links (3) and a fine chain (4); the effects of temperature are compensated by means of a bimetallic link (6) made of brass and steel, the flexure of the link being such as to nearly offset the temperature effect on the spring and cell and connected linkage.

4–146. Exposure of Aneroids.—Suspend the barometer indoors from a cup hook, screwed into the wall or woodwork where it will not be subject to extremes of heat or cold or rapid changes in temperature, and where it will not be unduly jarred. The back of the instrument should rest flatly against the vertical surface.

4–147. Mercurial Barometers.—Mercurial barometers are used at airport and 6-hourly stations. Weather Bureau officials should be thoroughly familiar with the information regarding their construction, exposure, installation, and use, given in

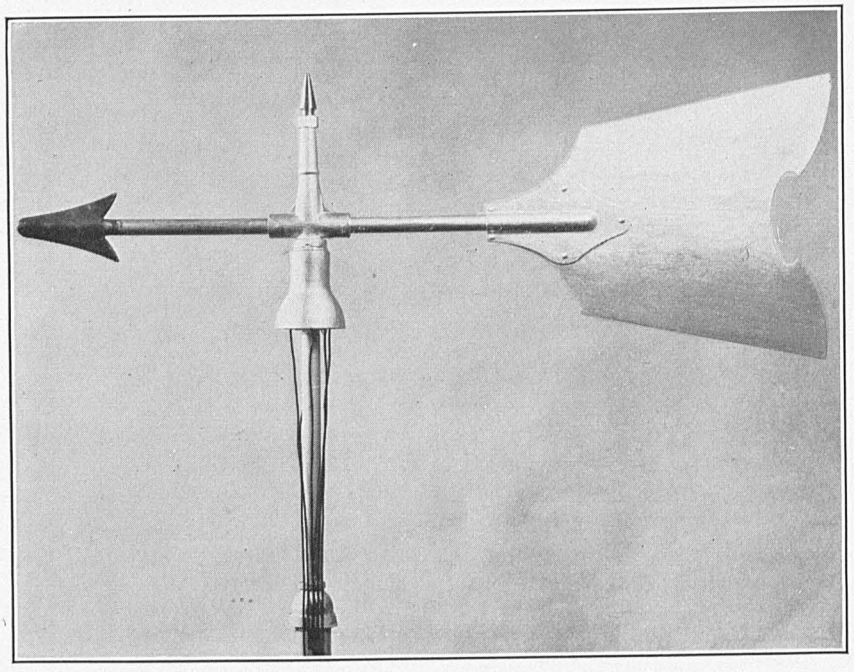


FIGURE 7.—Three-foot metal wind vane with contacting bearing, four contacts.

great detail in Circular F, "Barometers and the Measurement of Atmospheric Pressure."

4–148. Comparison of Mercurial Barometers.—Comparisons of mercurial barometers at stations equipped with two or more mercurial barometers will be submitted quarterly to the central office on WB Form 1027 in March, June, September, and December, on the 15th of the month, or the 16th if the 15th falls on Sunday, in accordance with special instructions. At stations equipped with only one barometer, comparisons with an inspector's barometer will be made as frequently as practicable.

4–149. Exposure.—Briefly stated, mercurial barometers should be located where they are not unduly subject to vibration, to extremes of heat or cold, to rapid variations of temperature, and where the sun will not strike them, but at the same time the barometer should be well illuminated by both artificial and natural light.

4–150. Description of Mercurial Barometer.—Referring to figure 15, which shows the Fortin-cistern barometer, the standard in Weather Bureau service, mounted on a shielded barometer board, (1) is the glass tube having an inside diameter of nearly one-fourth inch. This is inclosed in a thin brass tube (2) having openings on opposite

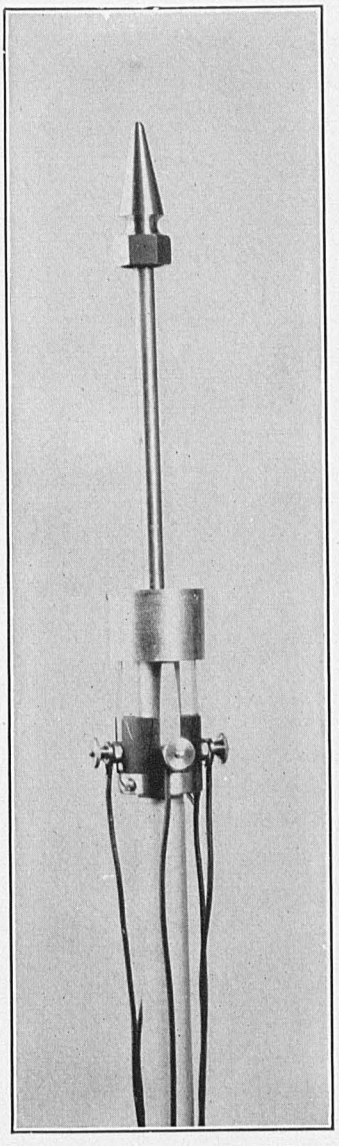


FIGURE 8.—Four-contact wind-vane bearing with shield removed.

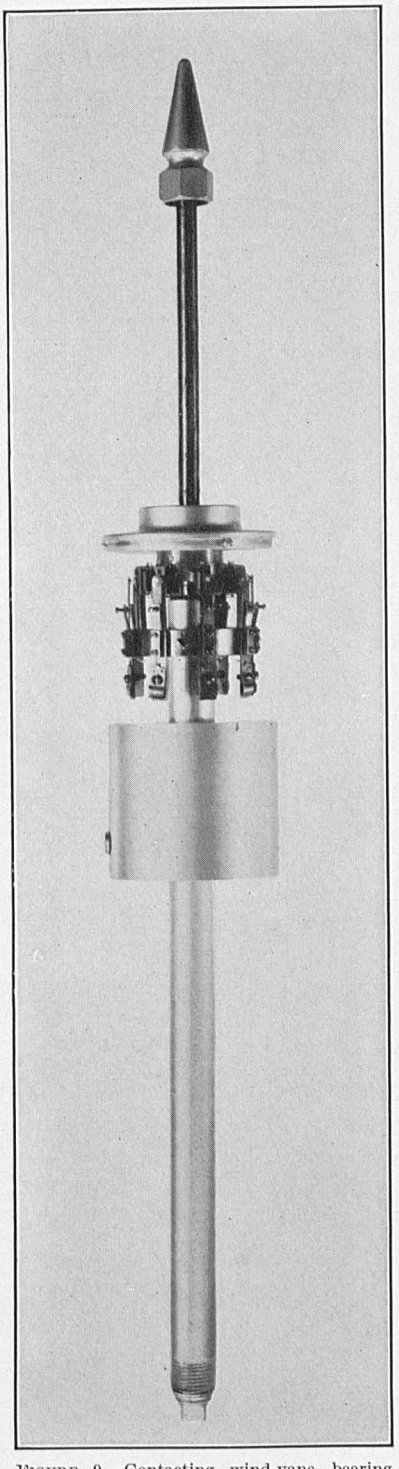


FIGURE 9.—Contacting wind-vane bearing with shield removed, eight contacts. The 12-contact bearing is essentially the same.

sides near the top through which the height of the mercury in the tube within is measured on the scale (3) and by the vernier (4) to the nearest thousandth of an inch. The vernier (4) is attached to a second tube free to slide within tube (2), the motion being produced by a rack and pinion, the knurled head of the latter being seen at (5). The attached thermometer (6) has its bulb placed between the metal case and the barometer tube proper so as to indicate approximately the mean temperature of case

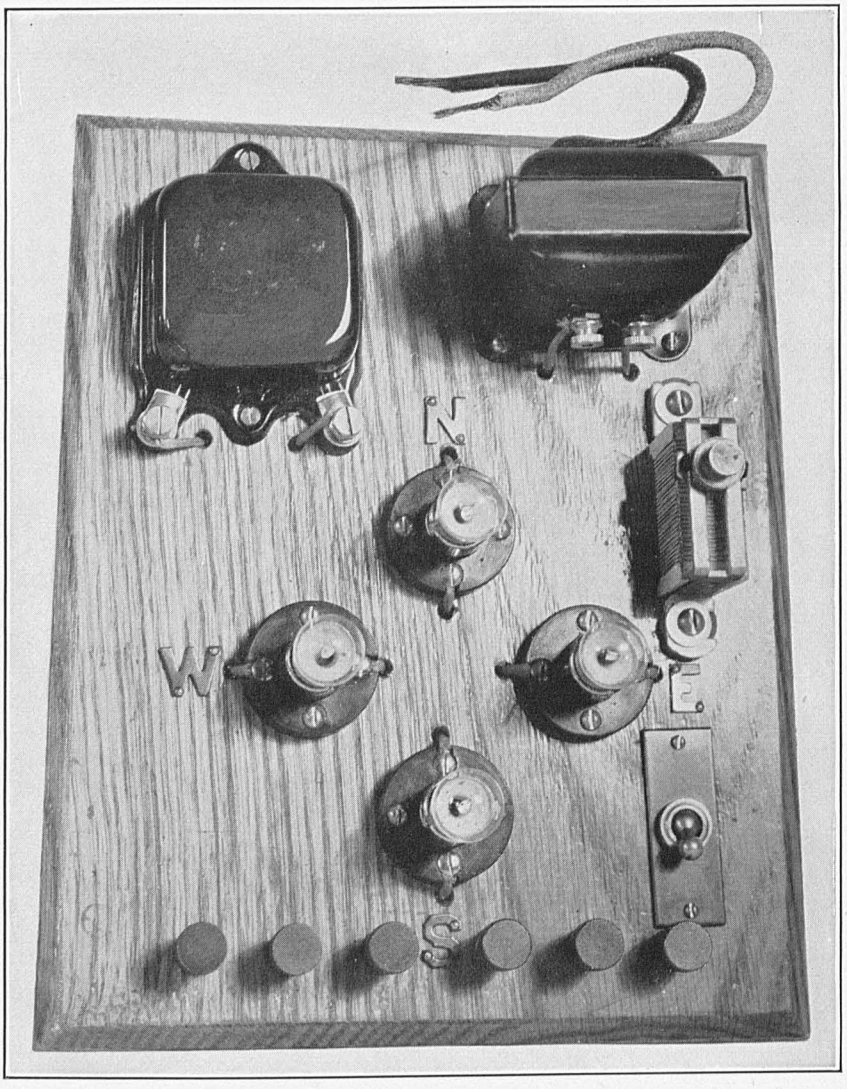


FIGURE 10.—Wind-velocity and direction indicator.

and mercury. The cistern (7) is of the Fortin type, the special feature being the manner of adjustment of the mercury to the fixed ivory point forming the zero of the scale. The raising and lowering of the mercury is accomplished by means of the screw (8), the inner or upper end of which acts on the kid-leather bag forming the bottom of the cistern proper. Details of the cistern are shown in figure 15*B*. Air passes into it through the flexible leather joint between the upper boxwood portion and the glass tube. The brass ring (9), figure 15*A*, engages a hook whereby the instrument is suspended from the top of the box or board used to house the barometers.

Verticality of the barometer is secured by allowing it to come to rest under gravity when suspended from the hook and then clamping the cistern end by means of the three screws in ring (10) attached to the back of the box.

4–151. Barometer Scales.—These should be so chosen as to permit of reading the lowest pressures likely to occur where the barometer is used. It is customary to

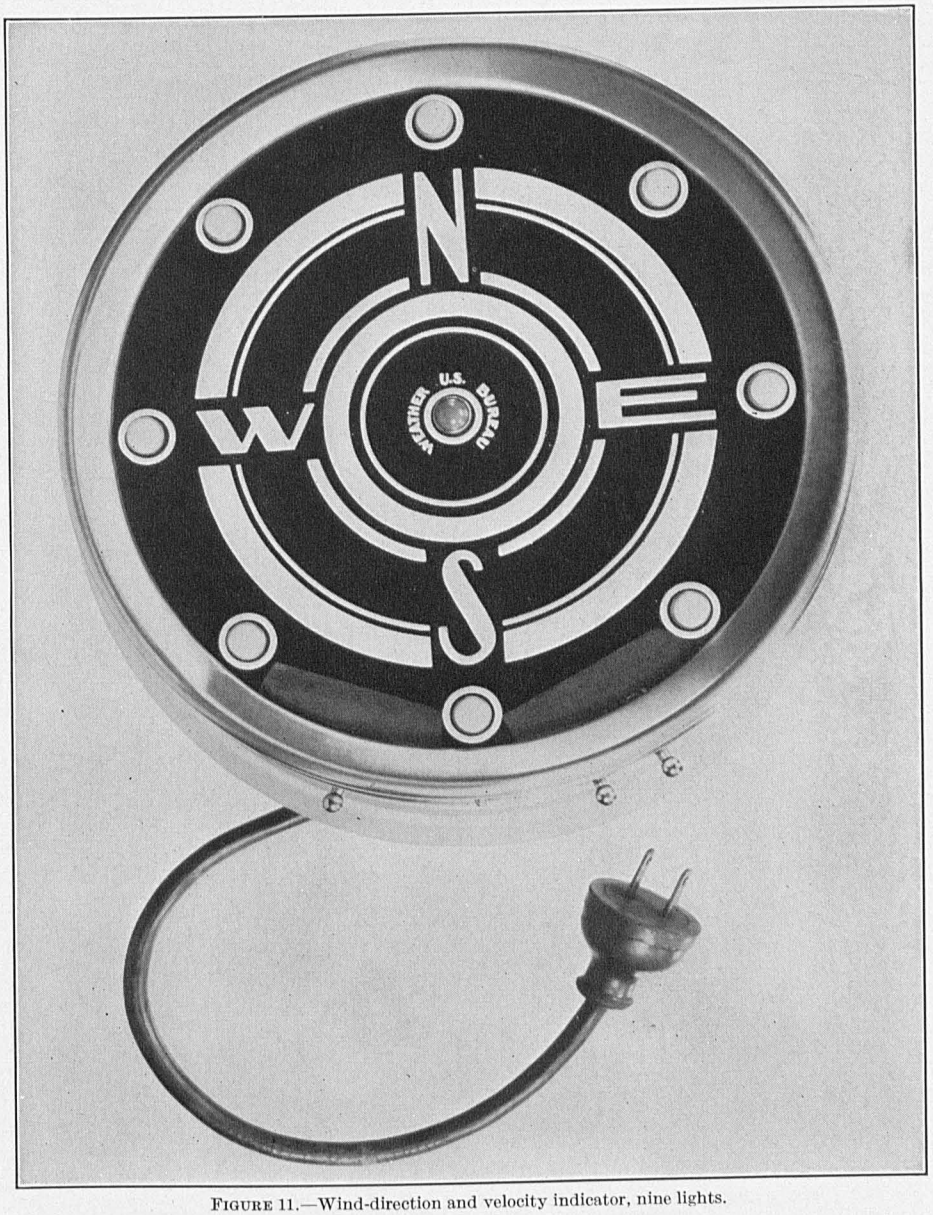


FIGURE 11.—Wind-direction and velocity indicator, nine lights.

subtract 1½ inches from the mean station pressure to obtain this minimum pressure. Barometers are usually scaled to read to a low of 26 inches for stations at ordinary elevations. Others read to 24, 22, 20, and 14 inches, which last will care for readings at any mountain observatory in the United States.

4–152. Barographs are used to determine the trend of the pressure change and its magnitude usually over a period of 3 hours, required primarily in connection with forecasting.

4–153. Two principal types of aneroid barographs are in service; one, the open-scale or microbarograph, figure 16*A*, which provides 2½ inches of pen movement over

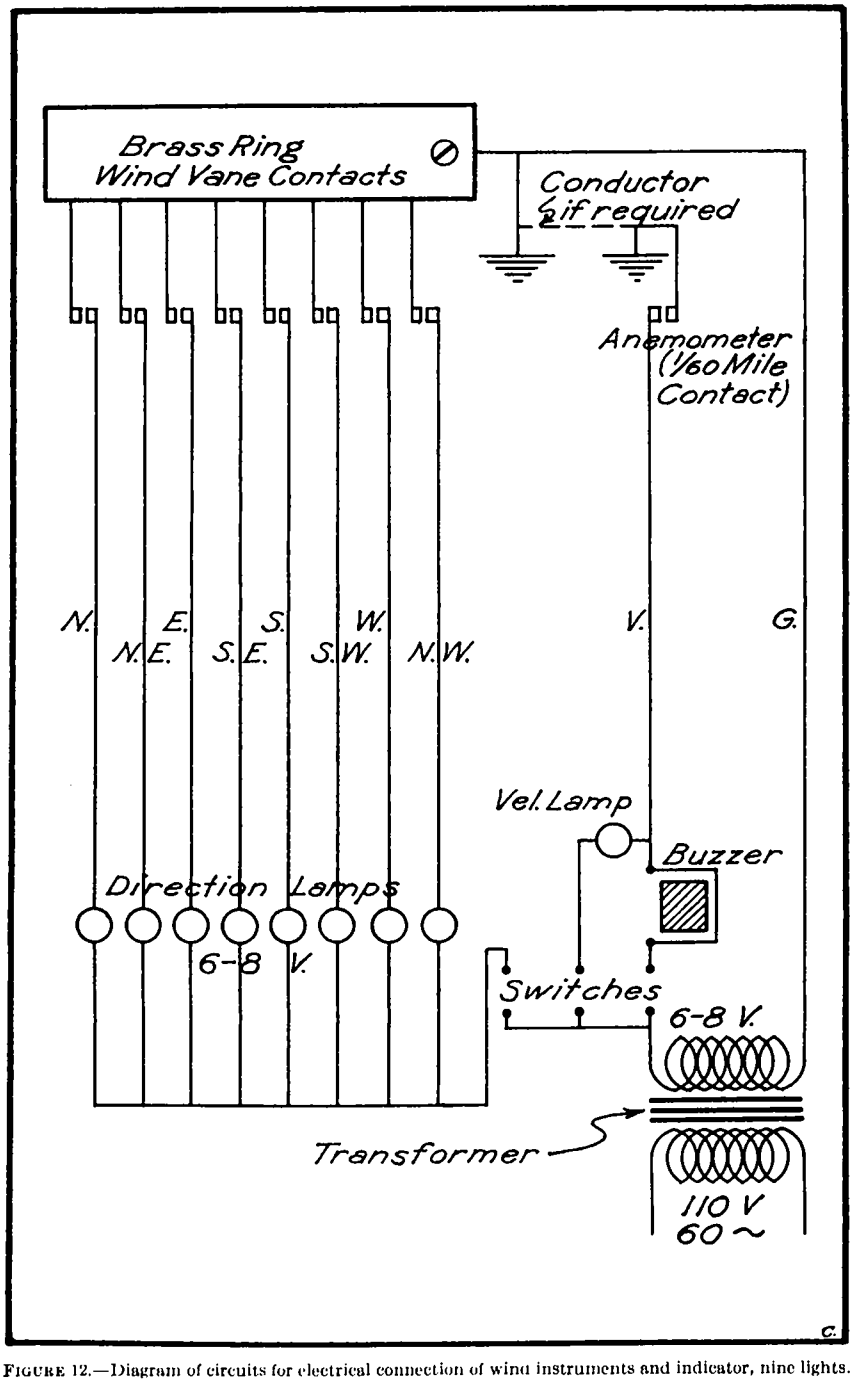


FIGURE 12.—Diagram of circuits for electrical connection of wind instruments and indicator, nine lights.

the record sheet for each 1 inch of change as given by a mercurial barometer. All the other barographs have a 1 to 1 scale, and differ among themselves as regards the

pressure element, older barographs of the Richard type, figure 16*B*, utilizing a pile of aneroid shells eight in number, while a more recently developed instrument employs a sylphon element instead.

4–154. Exposure of Barograph.—The barograph should be placed where it can not easily be disturbed or jarred accidentally and in a place in which the temperature is, at the same time, as nearly constant as possible. Particular care should be taken to see that the sun does not shine on it, that it is not near a stove or radiator, and that it is not near a window or door where it can be reached by sudden drafts of air from outdoors. If no place can be found which is free from such accidental jarring, the instrument should be supported on small sponge rubber blocks. A specially designed shock absorber utilizing coiled metal springs has also been employed. First-order stations will inspect the records obtained from the stations which they supervise for evidences of accidental disturbances and will take steps to see that the above precaution is observed in case such evidences are found.

4–155. Description of Open-scale Barograph.—Referring to figure 16*A*, the pressure element (1) consists of two joined sylphons mounted one above the other and inclosed in a cylindrical case with a thumbscrew (2) for adjusting the position of the pen (3) on the record sheet to correspond to the true pressure as shown by synchronous readings of a mercurial barometer. Motion originating in the sylphon element due to changes in atmospheric pressure are transmitted through linkage within base (4) to the pen-arm (5). Vibrations of the stand carrying the barograph are minimized by the liquid-filled dashpot (6). The recording cylinder (7) contains a driving clock, geared to give a 4-day record in one revolution. Details regarding the charts, etc., will be found in chapter VIII. The cover (8) is made of sheet metal with glass windows, through which the record is readily seen. The device for removing the pen from the record sheet is at (9).

4–156. The 1 to 1 Scale Barograph (shown in fig. 16B).—In principle of operation it is the same as the larger instrument, but differing in the construction of the pressure element as above mentioned, and having all the linkage above the base. The chart cylinder provides for a 7-day record. In the sylphon instrument, the pen adjustment is made by the thumbscrew at the extreme right hand of the base. In the Richard instrument a screw adjustment of the bottom aneroid shell of the pressure element reached from below is accomplished by a key to fit a squared shank, one end of a combined clock and adjustment key accompanying each instrument.

CHAPTER IV

TEMPERATURE-MEASURING INSTRUMENTS

4–157. Exposure.—A thermometer, psychrometer, thermal element of a telethermoscope, or other instrument for measuring temperature, should have free exposure to the outdoor air and at the same time be shielded from the direct or reflected rays of the sun, and be free from the effects of artificial heat. This is accomplished by placing such instruments in a specially constructed shelter through which the air can be freely circulated. Their installation is described and illustrated below.

4–158. Instrument Shelters.—Generally, either a large-sized standard shelter with 5- or 10-foot steel support or in most instances a cotton-region shelter with wooden support is furnished to stations. The large shelter, installed, costs nearly five times as much as the smaller, and a letter of explanation should accompany a requisition for the former, which is needed where a whirling apparatus is employed for psychrometric readings, or for housing hygrographs or hygrothermographs. For further information regarding the large shelter, see "Quarters and Instrumental Equipment for Stations at Airports." Figure 4 shows a large shelter and 5-foot steel support installed on a roof. The small airway shelters with which airway stations were formerly equipped are gradually being replaced; therefore, this type shelter is not illustrated.

4–159. Shelters should be placed with the door facing approximately toward the north and given a ground exposure whenever practicable. While the convenience of a roof exposure in making observations is often a deciding factor, the ground exposure

as is well known provides especially more accurate temperature data. Now that observations, including those for climatological uses, are frequently made at airport stations, *every effort should be made to secure a ground exposure of the shelter.*

4–160. Exposed Thermometers.—Thermometers furnished for airways work, are mercury-in-glass instruments, or those filled with red spirits, which are exposed vertically with the bulb end down.

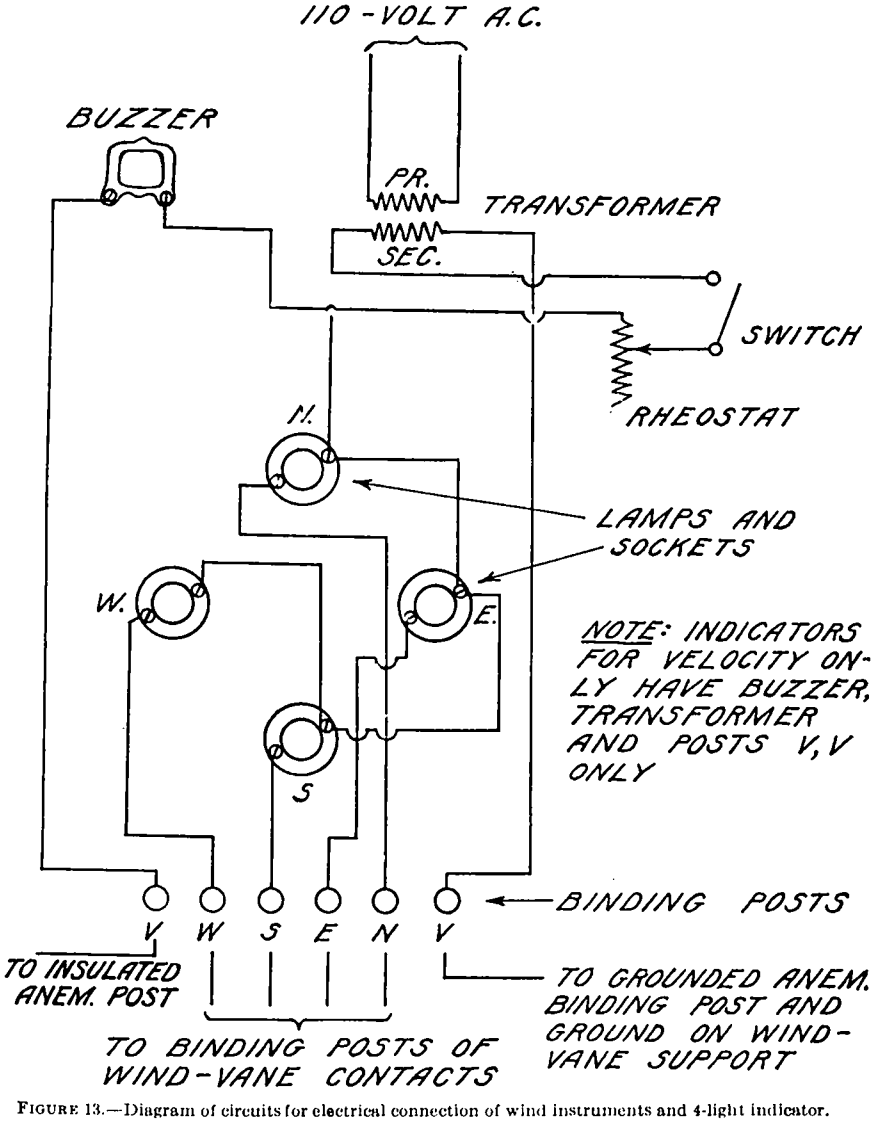


FIGURE 13.—Diagram of circuits for electrical connection of wind instruments and 4-light indicator.

4–161. Where temperatures below about −38° F., the freezing point of mercury, occur with some frequency, minimum thermometers which are alcohol-filled, are substituted for the mercury thermometers during the period of low temperatures.

4–162. Maximum and Minimum Thermometers.—These are included in the equipment of many reporting stations, especially those which render 6-hourly synoptic reports. In most cases the thermometers are exposed in a cotton-region shelter, mounted on a Townsend thermometer support as illustrated in figure 19. The maximum and minimum temperatures are recorded daily. Circular B and C contains detailed information.

4–163. Where frequent observations of the psychrometer are made, requiring the use of a psychrometer fan, the ordinary exposure of the maximum and minimum thermometer support results in vibration, which, in turn, causes movement of the index of the minimum thermometer. To avoid erroneous minimum temperature readings, the thermometer support is mounted on a post, the lower end of which is set firmly in the ground and the upper end carrying the support passes through a hole in the shelter floor enough larger than the post to prevent vibrations of the shelter from reaching the post. Either a wooden post or an iron pipe may be employed for mounting the support.

4–164. Description of Maximum and Minimum Thermometers Used by the Bureau.—All the thermometers used by the Bureau are stem-graduated by the maker, the freezing point found as usual by immersing the bulb and most of the column of mercury or alcohol in a bath of pure melting ice. The balance of the scale is determined by placing the thermometer in a temperature-controlled water or alcohol bath for

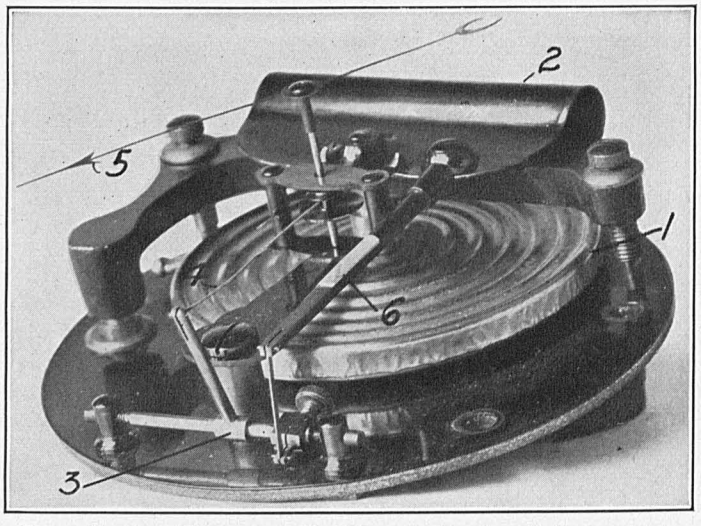
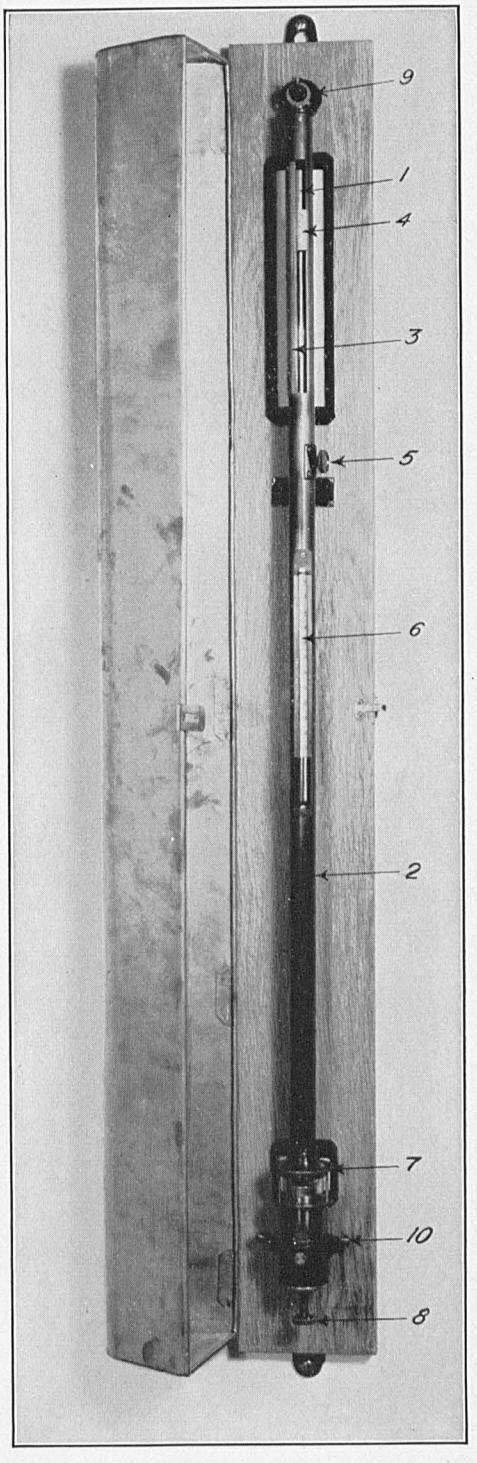


FIGURE 14.—Aneroid barometer with dials removed to show details of mechanism.

temperatures above and below the freezing point, respectively, the points of the scale being fixed by comparison with a substandard thermometer, the errors of which were originally found by reference to a gas thermometer or by comparison with another mercury-in-glass thermometer whose corrections are known.

4–165. Corrections are found at each 10° of the scale above and below the freezing point. The range of graduations is varied to meet the great differences of temperature found in the several sections of the United States and its territories.

4–166. Maximum Thermometer.—This thermometer (fig. 20) provides a record of the highest temperature occurring at the place of exposure, from the time of setting until read. The instrument differs from an ordinary mercurial thermometer in having the bore of the tube constricted near the bulb so that mercury forced above the constriction by a rise in temperature after setting cannot readily return to the bulb, unless the thermometer is whirled about an axis near the upper end. Maximum thermometers are filled with pure mercury at a temperature nearly equal to the highest the given instrument can experience, so that the space above the column at lower temperatures may be free of air. The maximum temperature for a given period after setting, usually 6 to 24 hours, is found by carefully lowering the thermometer bulb to a vertical position and reading on the scale the position of the top of the mercury column. Setting is accomplished by whirling in the support until the column of mercury is continuous and no further whirling will force the mercury farther into the bulb, after which it is placed with the bulb 5° above the horizontal.



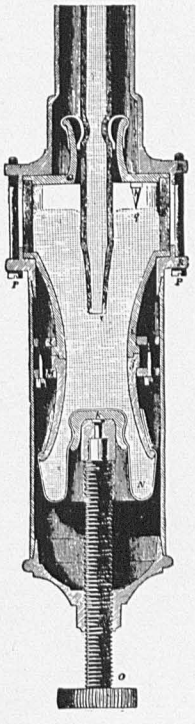
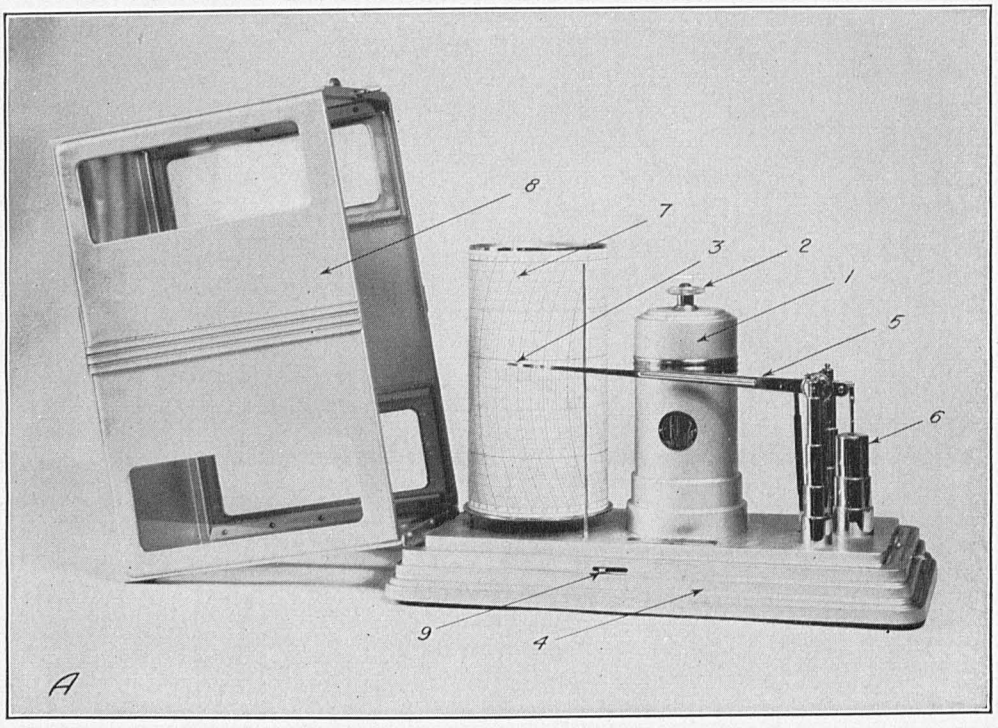


FIGURE 15.—*A*, mercurial barometer and shielded board; *B*, cut of Fortin barometer cistern.



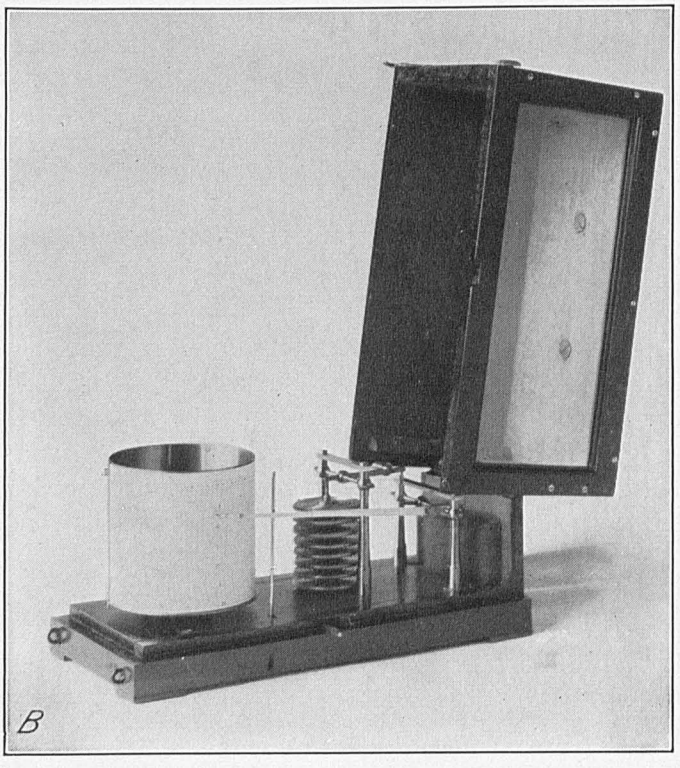


FIGURE 16.—Barographs: *A*, 2½ to 1 scale; *B*, 1 to 1 scale.

4–167. Minimum Thermometers.—These (fig. 20) provide a record of the lowest temperature occurring at the place of exposure from the time of setting until read. Uncolored ethyl alcohol is generally used to fill the tube, which is done with the bulb immersed in a mixture having a temperature of nearly zero Fahrenheit. Air is drawn into the tube at this relatively low temperature and the tube sealed, so that at higher temperatures the entrained air exerts a pressure considerably in excess of atmospheric, with the desired result that the diffusion of alcohol vapor into the air above the column and its subsequent condensation is largely prevented, thereby much increasing the accuracy of the thermometer. To provide against excessive internal air pressure at high temperatures, a small bulb is blown in the upper end of the tube. The bore of the tube is considerably larger than that of a mercury thermometer so as to provide sufficient room for the index, a double-ended piece of dark-colored glass, so shaped as to follow the movement of the upper end of the alcohol column as the temperature falls, but to remain at the lowest point when the temperature rises. As shown in figure 20, when in the set position the thermometer is placed with the bulb end about 5° below the horizontal. A scale reading of the end of the index farthest from the bulb

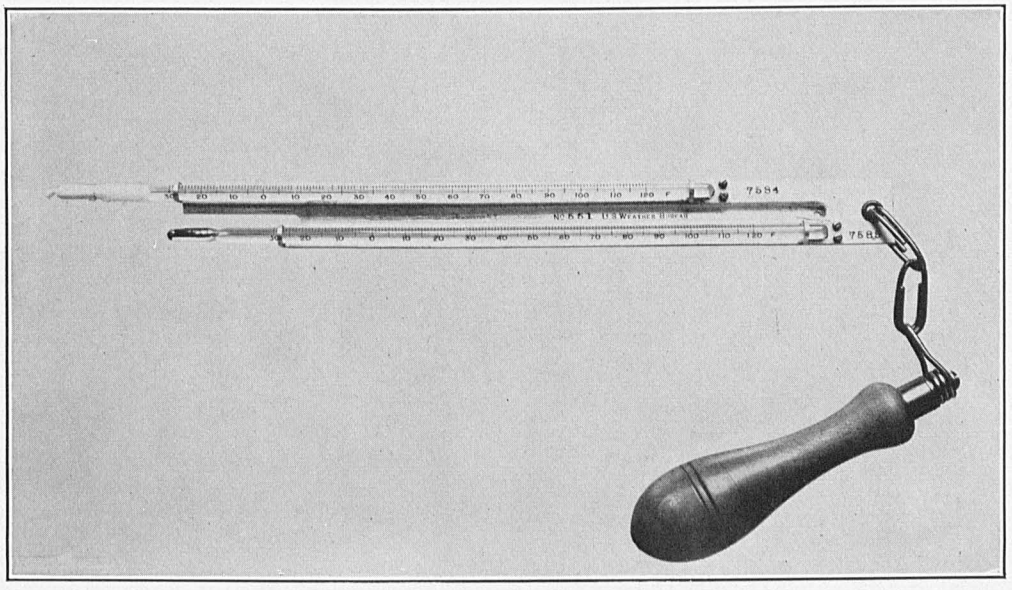


FIGURE 17.—Sling psychrometer.

gives the lowest temperature at the place of exposure since the instrument was last set. The setting of the thermometer is accomplished by turning it into a vertical position in the support, with bulb uppermost, when the index will fall to the end of the column. The thermometer is then returned to the original position.

4–168. Exposed Thermometers.—These are stem-graduated thermometers, mercury or spirit filled, employed for the measurement of free-air temperatures. When specially mounted for whirling, a pair of mercurial thermometers comprises the wet- and dry-bulb pyschrometer.

4–169. Psychrometers.—Ventilated wet- and dry-bulb psychrometers are used for humidity observations to determine the temperature of the dew point. Two kinds are employed, one which is ventilated by whirling of the thermometers, either by means of the whirling apparatus (fig. 18) installed in a large shelter (fig. 4), or by using a sling psychrometer (fig. 17) outside a shelter; the second, by drawing air past the psychrometer bulbs by means of a small hand-operated fan (fig. 19). This psychrometer fan has come into general use, psychrometer fans being adapted to both airway and cotton-region shelters. Two accurate mercury-in-glass thermometers are always

required. Those used with the whirling apparatus (fig. 18) are attached to counterbalanced arms, which are pinned to a spindle carrying a cast-iron pinion, meshed with a bevel gear, turned by the attached crank shaft. The whirling apparatus is securely screwed to the floor of a large instrument shelter with the crank shaft projecting through

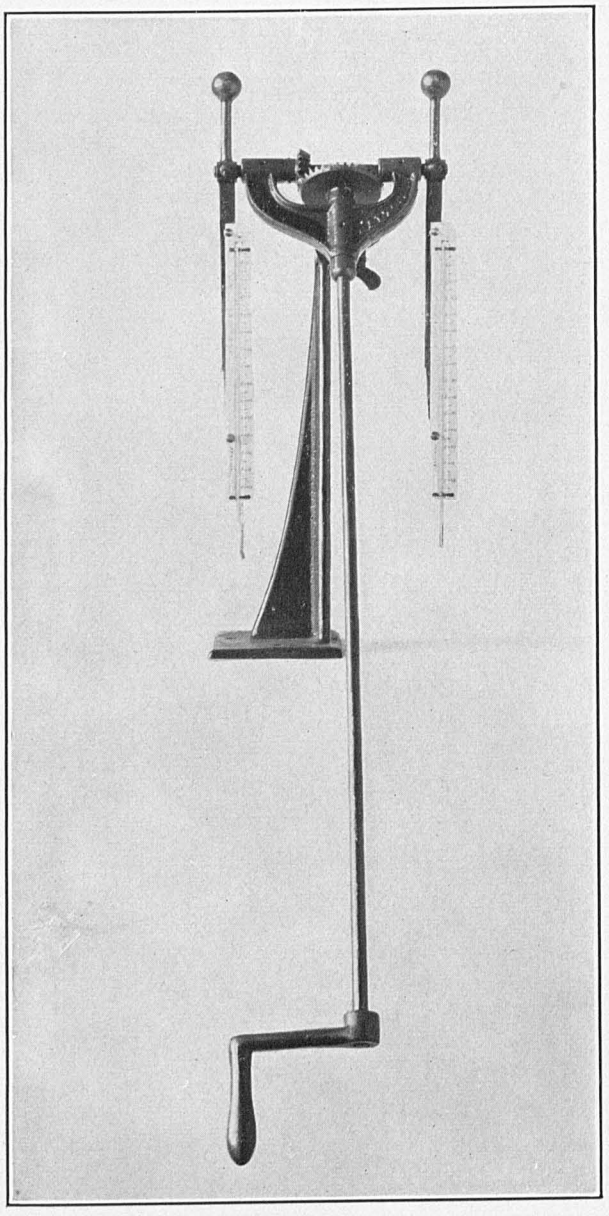
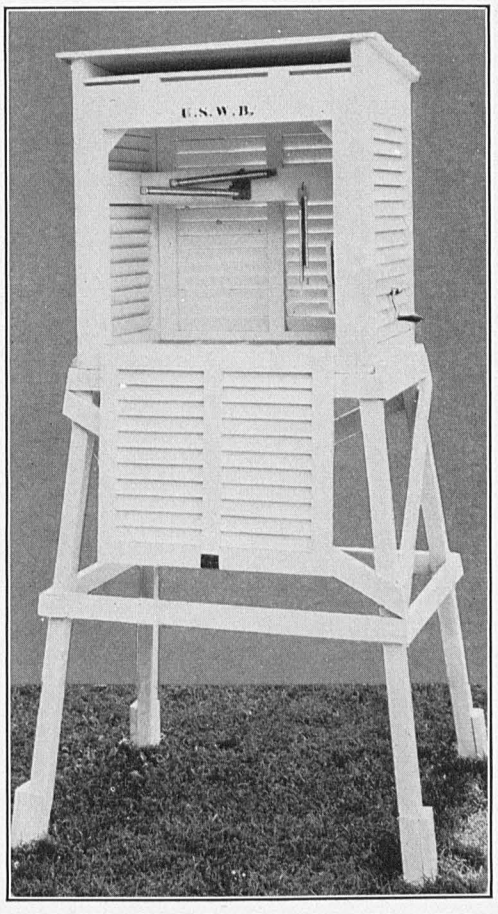


FIGURE 18.—Whirling apparatus for wet and dry bulb psychrometer.

the front of the shelter. The proper ventilation of a pyschrometer requires an air speed past the thermometers of about 15 feet per second, which is accomplished by the psychrometer fans in general use at airway and off-airway stations. A small hand grinder has been adapted to turn an 8-inch fan, which draws air past a psychrometer. Instructions for their installation accompany each fan but are also given in chapter



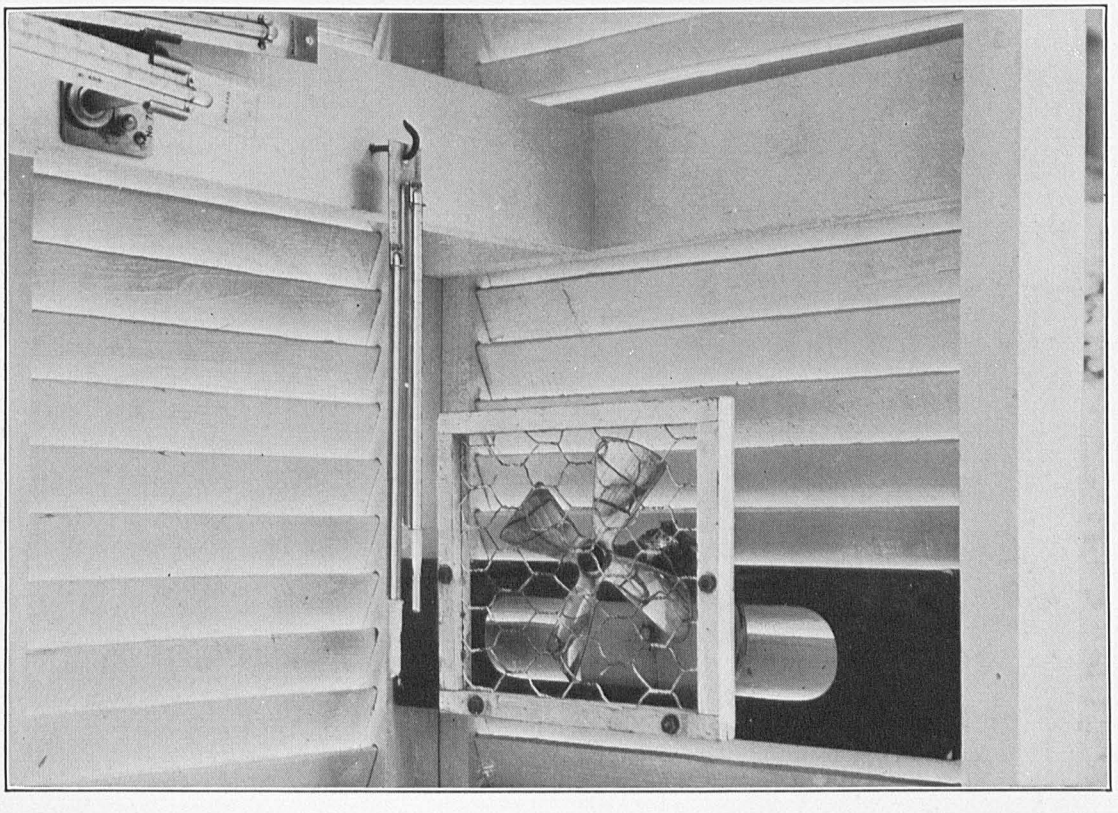


FIGURE 19.—Cotton-region shelter and psychrometer fan.

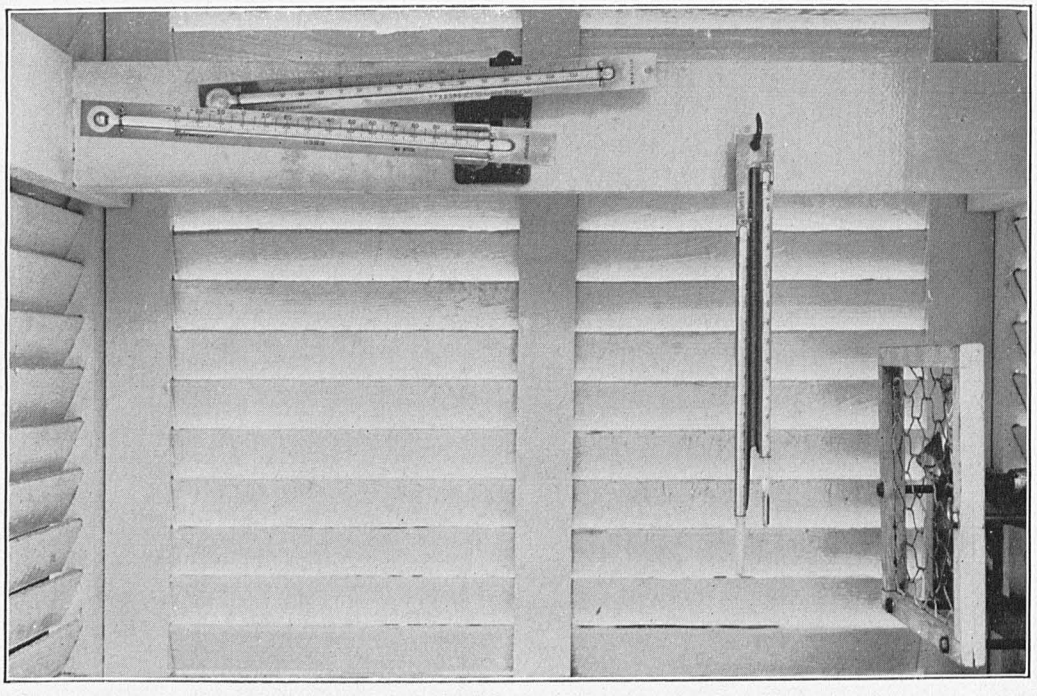


FIGURE 20.—Maximum and minimum thermometers with Townsend support at left; psychrometer fan and psychrometer at right

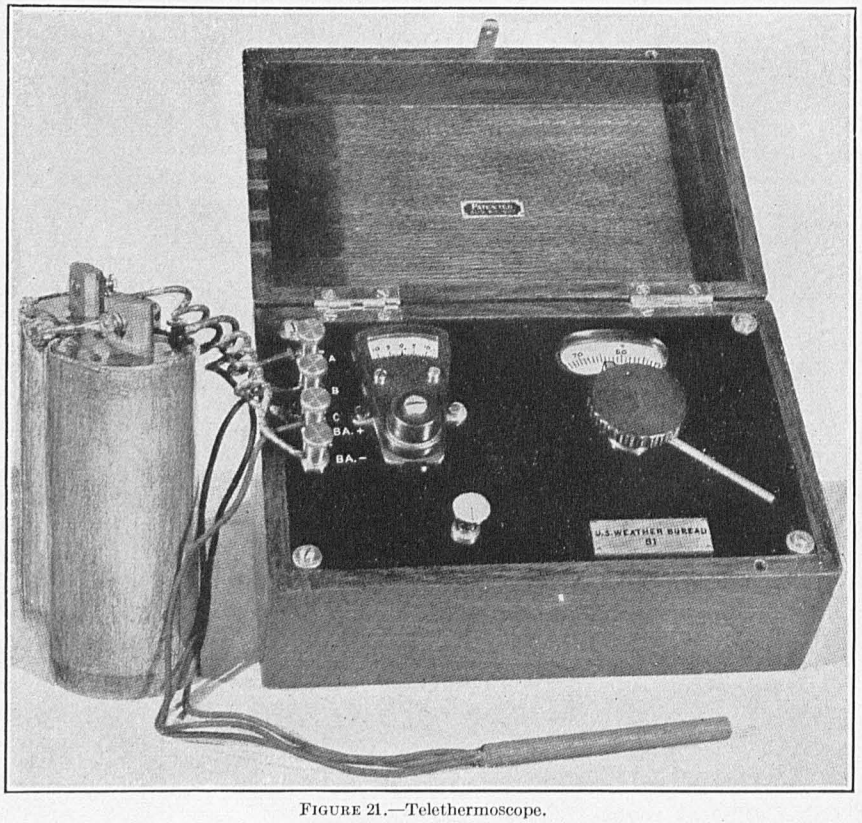


FIGURE 21.—Telethermoscope.

VIII. The wet bulb of each kind of psychrometer and a short length of the stem above the bulb are covered with fine, loosely woven muslin, carefully washed to remove the sizing. Pure, clean water is used for wetting, and the muslin must be replaced whenever it becomes at all dirty; otherwise the readings will be incorrect and practically valueless for the fog forecast. To obtain thoroughly accurate readings with a sling psychrometer, the instrument should be whirled in the shade, and the observer face the wind so as to avoid temperature effects due to the heat of the body. When a psychrometer is used, the single exposed thermometer may be dispensed with.

4–170. Telethermoscopes.—Telethermoscopes (fig. 21) are employed quite often at airport stations where frequent temperature observations are necessary. This is an electrical resistance thermometer, the temperature of the free air in the shelter housing the thermometer bulb (shown at the bottom of the picture), being read on the indicator located in the office indoors. The bulb consists of a coil of nearly pure nickel wire, having a resistance of about 100 ohms at ordinary temperatures, sealed

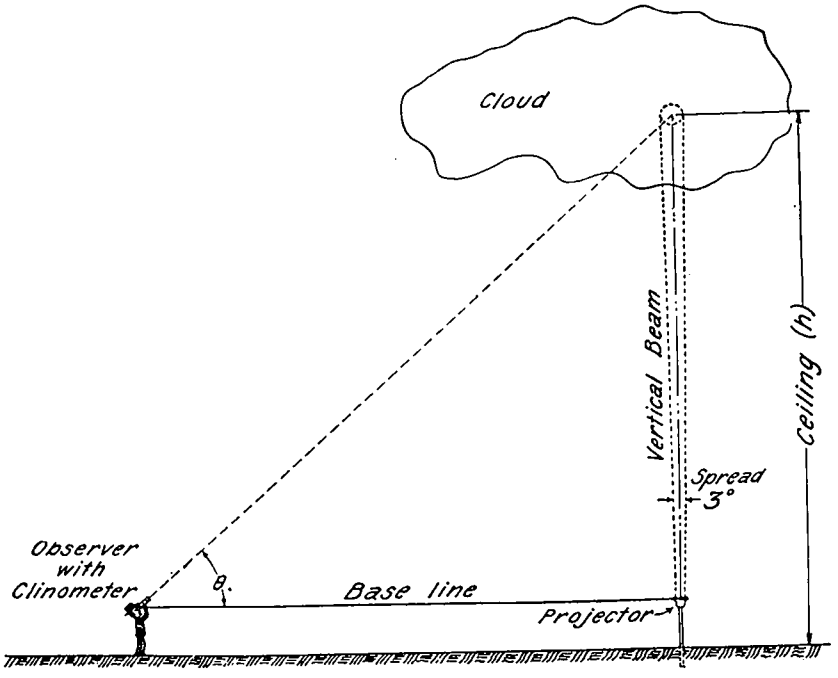


FIGURE 22.—Diagram showing relation of projector and angle-measuring device.

with paraffin into a plated brass tube. The coil is connected through a three-wire circuit with the indicator, the changes of temperature corresponding to changes in resistance of the thermal element being shown on the indicator scale. Detailed information regarding the installation and use of telethermoscopes will be found in a separate pamphlet obtained from the Weather Bureau Instrument Division.

CHAPTER V

EQUIPMENT FOR MEASURING THE HEIGHT OF CEILING

4–171. For accurate determinations of the height of ceiling so important for safe flying, ceiling-light projectors, a form of electric searchlight, are employed at night to throw a spot of light on the underside of the cloud layer. Daytime observations are made with ceiling balloons as described below. The projector is located horizontally

at a distance of 500 to 1,000 feet or more from the point of observation of the light spot. Knowing this fixed distance, it is only necessary to measure the angular elevation of the spot of light from the observing point to compute the height of the light spot or the ceiling. This is accomplished by means of a clinometer, although in the absence of an instrument the height is found by pacing off the distance from the projector to the point on the ground underneath the light spot in the zenith, the light beam from the projector being directed at either an angle of 45° or 63°26′ with the horizontal. For a 45° elevation the distance is equal to height of ceiling; for a 63°26′ angle, the height is twice the distance paced.

4–172. The arrangement of the projector and clinometer is shown diagrammatically in figure 22.

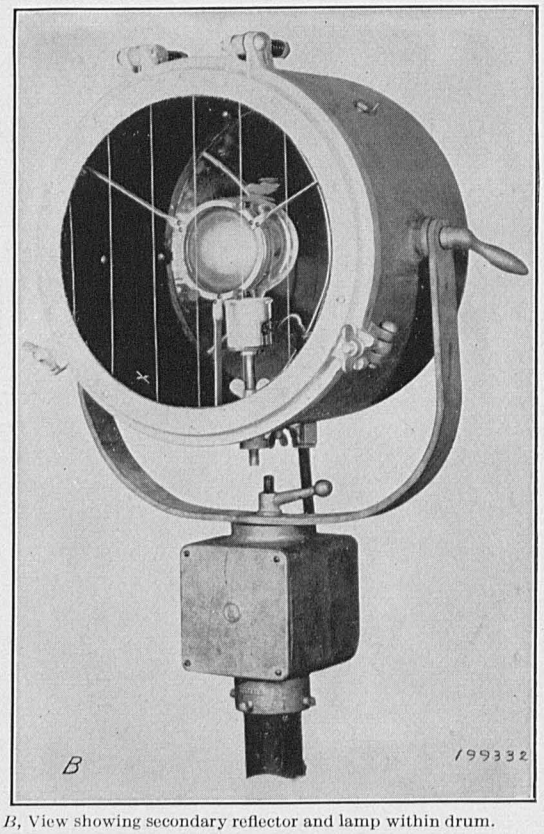


FIGURE 23.—*A*, Ceiling-light projector complete with mounting; *B*, View showing secondary reflector and lamp within drum.

4–173. Kinds of Ceiling Projectors.—Two principal kinds are in service, essentially alike as regards the concave mirror or reflector which focuses and directs the light from a high-powered, concentrated-filament lamp upward to the cloud layer. One, the most recently placed in service, uses alternating current at approximately 12 volts at the lamp socket, transformed from 100- to 120-volt service, the transformer being mounted on the projector standard. A 420-watt, 12-volt airplane headlight lamp is required. All projectors previously used take electric current direct from service, usually through a long line, and require lamps of 105 to 125 volts, depending upon the potential drop due to the length of the service connection and the voltage at service. For the latter, a variety of lamps are used, depending upon the intensity of light beam needed, location, and kind of projector, etc. These lamps vary from a 250-watt spotlight to 1,000-watt lamps, with either T or spherical bulbs. All lamps, of necessity, have condensed filaments, the filament being centered in the optical focus of the reflector mirror.

4–174. Description of Low-voltage Projector.—This projector, illustrated in figure 23, is comprised of an aluminum alloy drum mounted on trunnions which permits of the accurate elevation of the beam from 45° to the vertical. Within is a primary reflector of about 16 inches in diameter, a prefocused airplane headlight lamp, and a secondary reflector. A transformer is attached to the outside of the standard. The projector with transformer is mounted on a 4-inch pipe support, set firmly in the ground. The secondary reflector is used to prevent spill of the light beam and is more effective than methods employed on earlier types of projectors. The purpose of the transformer is to make available suitable lamp voltage from service lines of varying potential, within the range of 100 to 120 volts, by the use of a series of taps on the primary of the transformer.

4–175. Location of Projector.—The projector will be placed not less than 500 feet for old-type projectors, and 750 feet for the 12-volt type, and as a rule not more than 1,000 feet, distant from the observing point (measured horizontally) as directed by an official of the Weather Bureau. The longer base line is preferred especially in mountainous country. Accessibility for cleaning and opportunity for running cable must be considered. It is not necessary that projector and observing point be at the same level when a clinometer is used. The line of sight from switch to projector should be out of glaring lights, and preferably with the projector to *northward* of switch in order to avoid interference by moonlight.

4–176. Location of Control Switch.—The control switch should be located outdoors in a place where the observer will be somewhat out of the glare of lights, so that by noticing the effects of turning it on and off occasionally he can be assured that the projector lamp is burning. Moreover, a faint spot on high clouds can often be detected by the observer when it is possible to switch the projector on and off at the point of observation.

4–177. Setting Up Projector Over Ground.—Projectors are provided with a slip fitter for mounting at the top of a 4-inch (nominal) iron pipe. This device slips over the top of the pipe and is then clamped to it by set screws. The pipe need not be threaded. A section of 4-inch pipe, 6 feet long, is set 3 feet in the ground. A flat stone or equivalent should be placed under the end of the pipe. The ground should be thoroughly tamped about the lower end of the pipe to make sure of rigidity. A collar of cement concrete about 4 inches thick and extending about 8 inches beyond the pipe will then be provided at the surface of the ground to hold the pipe firm.

4–178. Setting Up Projector Over Wood Platform, Concrete Slab or Rock.—For such installation a 3-foot section of 4-inch pipe should be employed, the lower end being screw-threaded and fitted with a cast-iron flange (about 9 inches diameter, according to plumbers' supply catalogs). The flange should then be firmly secured by bolts or by lag screws with expansion shields, as may be appropriate.

4–179. Setting Up Projector Equipped With Flanged Base.—Some of the older projectors are fitted with a flanged base. The top end of the 4-inch pipe will then be screw-threaded and a 4-inch flange screwed thereon to form a seat. The projector will be secured to this seat by ⅜-inch through bolts. A cork gasket will be inserted between the two flanges.

4–180. Cable.—In order to keep down the drop of potential, No. 8 A. W. G. rubber-sheathed, nonmetallic parkway cable is employed for almost all installations. Exceptions to this rule may at times be justified where it is desired to utilize surplus No. 10 cable already the property of the Government. Projector cable is generally obtained on purchase requisitions drawn at the Central Office, based on information furnished by the supervising airway offices. Shipment is made direct to station from the contractor's shipping point. This cable is No. 8 solid, double-conductor, 0–600-volt class, rubber insulated and sheathed, designed for direct burial in the ground without the use of ducts or conduit.

4–181. Control Switch.—A post about 6½ feet long, 5 inches across the top, of wood known to last well in the ground, will be set 3 feet in the ground. At the upper part of the post a flat surface will be provided. A safety weatherproof switch 2-pole 30-ampere for outside use will be bolted to the post near the upper end.

4–182. Laying Underground Cable.—The cable will be buried in a trench deep enough to be safe from injury, the depth to be designated by an official of the Weather

Bureau. This requirement may need to be modified in case of rock formation or other circumstances that render it unreasonably costly. In some instances the cable may be in more than one length. Joint boxes are then needed to make waterproof splices.

4–183. Wiring from Cable to Switch.—Wires from underground cable to switch will be No. 12 lead-covered, in conduit, from a suitable watertight junction box placed in the ground near the switch post.

4–184. Wiring From Cable to Projector.—The following plan is recommended where appearance is important: A rectangular hole large enough to admit the cable will be cut in the 4-inch pipe, lower edge of hole 2 feet above lower end of pipe; also a ½-inch drainage hole will be drilled in the 4-inch pipe at a point 3 feet 1 inch above the lower end. Weatherproof leads, No. 12 copper, including 1 foot spare length, will be spliced to ends of cable conductors. Leads and cable will then be drawn upward through the rectangular hole so that splices and spare length may be coiled within the pipe near the top. In case the contractor is not prepared to cut the rectangular hole, he may thread the cable through the lower end of the 4-inch pipe, provided it be bent over a long radius and, provided also, the lower end of pipe be supported on several flat stones. The pipe will then be filled with loose, fine gravel or fine, crushed rock to a depth of 3 feet. Next, a 1-inch layer of bituminous waterproof compound will be inserted, the top of the layer to slant toward the ½-inch drainage hole. This layer of compound is designed to lessen moisture that otherwise might find entrance from the lower end of the pipe and cause trouble through condensation, while the ½-inch hole is intended to provide drainage in case water should accidentally get into the pipe. The extra length of No. 12 wire is intended for possible future requirements. The ends of leads should then be threaded through the hole in bottom of transformer box.

4–185. Where appearance is not important the cable may be run direct to a waterproof junction box, clamped to the outside of the 4-inch pipe. Leads will then run from junction box through a bushed hole in the pipe, thence to transformer box.

4–186. Wiring, Inside.—For inside wiring No. 10 AC will be used for dry locations; No. 10 ACL or rubber sheathed cable for damp locations.

4–187. Code Compliance.—All wiring shall comply with National Electrical Code requirements and with local regulations.

4–188. Painting.—Pipe in contact with the ground will be given one coat of asphaltum. Pipe above ground will be given a prime coat of oxide paint for iron and a top coat of aluminum. The switch post will be painted to conform with surroundings.

4–189. Remote-control and Two-projector Installations.—These will be cared for by correspondence with the Central Office.

4–190. Lamps.—The projectors are all equipped with parabolic reflectors. The theoretically best lamp for use would be one in which the source of light is a brilliant point. The carbon arc is nearly a point source of light and is most brilliant, but practical considerations are against its use for the purpose. Hence, an incandescent lamp of a type in which the luminous filament is concentrated in a small space is furnished for the projector by the Weather Bureau. The lamp for low-voltage projectors is of the type used in airplane-landing lights and is identified by the manufacturers as "airplane headlights." It has the following characteristics: 420 watts, 12 volts (nominal rating), 35 amperes, mogul prefocus base; light center length, 1 1/16 inches; maximum over-all length, 5 5/16 inches; filament, C–2; rated average life, 100 hours.

Lamps most used in older types of ceiling-light projectors are as follows:

Bulb	Watts	Light, center length (inches)	Filament	Base
G–30	250	3	C–5	Mogul screw.
G–40	500	4¼	C–5	Do.
T–20	1,000	4¾	C–13	Do.
G–40	1,000	4¼	C–5	Do.

4–191. Choice of lamp.—Projectors serially numbered from 301 to 481 will take either G–30, G–40, or T–20 lamp, and other projectors of older types require lamps suitable to their construction. When changing lamps, particularly from one type to another, the socket adjustment may need to be changed because the light center length (the distance from tip of base to luminous filament) is not the same for all lamps. The T–20 1,000-watt is recommended for use only where previous trial has established its suitability. The main reason for preferring the G or round-globe type is that such lamps are designed to be burned base horizontal. The T, or tubular-shaped lamps are designed to be burned base down; however, they are being used base horizontal at some stations without serious overheating, probably because of the short time required to make an observation; other stations have experienced distortion of the heat-softened bulb by expansion of the inclosed inert gas.

4–192. Effect of Heat.—In the use of the higher powered lamp there is serious risk of damage to mirror and to cover glass by the intense heat, particularly if turned on longer than a few minutes. Only in extreme cases where the general illumination of the sky is strong is the 1,000-watt lamp considered justified. For stations requiring this special treatment a G–40 1,000-watt lamp is also provided.

4–193. The airplane headlight lamp now in general use is costly and has a short life, and care should be used in its operation.

4–194. Lamp Voltage.—The G–30 and G–40 lamps are usually stocked in voltages of 105, 110, 115, and 120, in order that the measured socket voltage may be reasonably well matched. Requisitions for lamps should specify style and size of bulb, wattage, and voltage desired. If the rated lamp voltage is higher than the actual voltage, the intensity of beam will be lessened. If lower, the life of the lamp will be shortened. When screwing lamps into or out of sockets they should not be grasped by the part that has large diameter because the greater leverage may break the seal between brass and glass. It is a good plan to apply a little graphite to the threads of the brass base.

4–195. Focusing of Lamps.—New projectors are equipped with prefocussed lamps and should be ready for service without making any adjustments. The following information, however, will be useful in checking the focussing and in refocussing should occasion arise: It is of extreme importance that the lamp be in focus. Only a slight out-of-focus condition may reduce the light spot to half its intensity. A method of becoming familiar with the adjustments tried in the Instrument Division is to direct the beam upon a target which may be a sheet of white cloth 3 or 4 feet square, stretched between two rods, or some equivalent arrangement. The target need not be more than 40 feet or so distant. In nearly all projectors the lamp sockets are built upon stems that provide an adjustment of several inches transverse to the axis of the mirror: additional adjustments permit smaller movement of the lamp either transversely across the axis of the mirror or longitudinally with the axis in a way to place it nearer to or farther from the mirror. It is suggested that all employees responsible for measuring ceiling heights familiarize themselves with these adjustments. Possibly this can best be done on a cloudy day when the light spot on a screen can be observed with the adjusting screws in plain view at the same time. It is helpful to put a few drops of light machine oil on the threads of the adjusting screws to make them run free. Furthermore, mechanical features, such as springs, employed in the focussing adjustments of some projectors should be examined to make sure that they are functioning. Lamp sockets should be so firmly held that the lamp will be in the same position relative to drum whether beam is directed horizontally or vertically. Final check upon correct focus is by observation of the light spot upon a well-defined cloud layer at night, and by inspection of the vertically projected beam as it illuminates dust particles, etc., in its path. The best focus is realized with the smallest obtainable spot on a well-defined cloud layer or with the narrowest projected beam through the air. The rays should not cross each other. Projectors are provided with two peep holes and marks opposite on the inside of the drum, usually in the form of a + or of a punch mark. These marks were originally placed in the factory by sighting from the peep holes through the focussed lamp filament. Hence if any suitable lamp is thereafter so adjusted as

to bring the filament within the two lines of sight, it will be very nearly in focus; but a finer adjustment should be made subsequently. The wires inside the drum that lead to the lamp socket should be free. Otherwise, they may interfere with correct focusing, or may subsequently pull the lamp out of focus.

4–196. Slippage of Mirror.—Glass mirrors are necessarily rather loosely mounted to allow for expansion and contraction. Occasions are known of a slight edgewise shift of the mirror with the beam horizontal as compared with beam vertical. This alters to some extent the setting of the quadrant. A suggested means of holding the mirror in such instances is to insert small sections of asbestos or cork between the edge of mirror and the clamps that hold it. Rigid material should not be used for this purpose because of risk of breaking the mirror.

4–197. Orientation of Lamp Within Projector.—Examination of lamps with C–5 filament will disclose that the luminous windings form roughly an incomplete circle as viewed from the end opposite the base. The complete portion should be toward the mirror. Most projectors are filled with a lamp-socket stem that may be rotated slightly for this purpose and then clamped in place.

4–198. Directing Beam to Zenith; High-voltage Projectors.—The mirror should first be inspected to make sure that it does not slip edgewise within its clamps when the projector is turned to position beam horizontal as compared with position beam vertical. Then the axis on which the drum rotates must be permanently fixed in an assured horizontal position. Methods that have been suggested to accomplish this are: To level across the outer flange of the closed door, the spirit level or a straight-edged strip of wood to carry it resting on blocks of wood of equal thickness, placed on opposite sides of the door flange; to level across the edges of the mirror itself, using a parallel-sided strip of wood slightly shorter than the inside diameter of the drum as a rest for a small spirit level. After the axis has been set horizontal, the correct position in the plane of rotation must be assured. Most projectors are equipped with quadrants so arranged that after the beam has been once set vertical the drum may be lowered for examination and subsequently returned to the vertical position as indicated by marks or stops on the quadrant. Also, some quadrants have faced leveling perches for a small spirit level. These devices, while helpful, are not considered entirely dependable, and hence verticality should be checked by sighting a plumb line against the beam from two positions; one in line with the axis, the other at a right angle thereto. This check by plumb line should be made with the lamp in focus. When impracticable of performance because of daytime visit by inspector, arrangements should be made to have the check made by the observer and subsequently reported to the inspector by him.

4–199. Transformer; Low-voltage Projectors.—The new projectors, Weather Bureau numbers 481 and above, are equipped with a transformer for furnishing the reduced voltage required for the airplane headlight lamp with which this type of projector is equipped. The transformer is so designed that it is possible to compensate for the drop in potential along the conductors between the power supply and the projector in order to obtain the desired voltage, 11.8, at the lamp socket by adjustment of one of the line wires to the properly chosen tap on the primary. Projectors 481 to 665 (Westinghouse) are equipped with autotransformers with taps numbered from 1 to 8, projectors 666 and above (Crouse-Hinds) with conventional 2-coil transformers with primary taps marked 90, 95, 100, 105, 110, 115, and 120 volts.

4–200. After the projector has been set up and properly leveled, connect an alternating-current service line, having a nominal difference of potential of 100 to 120 volts, as follows:

For Westinghouse projectors, connect the line wires to taps 1 and 8 (120-volt connection) and connect an alternating current voltmeter of 150-volt range to the same taps; connect the leads from the lamp socket to taps *2* and *3* and insert the lamp in the socket of the projector. Turn on the current, and, with the lamp burning, read the difference in potential on the voltmeter. Turn off the current and remove the line wire from tap No. 8 and reconnect to the tap listed for the nearest voltage above the line voltage indicated by the voltmeter; for example, if the voltmeter indicates 112 volts, connect to the 115-volt tap (No. 7). The lamp should never be connected in any manner other than to taps Nos. *2* and *3* on this type of projector.

For Crouse-Hinds projectors, connect the line wires to the upper left and lower right-hand screws (120-volt connection) and insert the leads from the voltmeter into the receptacle provided for the purpose, insert the lamp in the socket of the projector and turn on the current. After checking the difference in potential, with the lamp burning, remove the wire to the 120-volt tap, if found necessary, and reconnect to the proper tap. The line voltage should be checked with the voltmeter, with the lamp burning, at several different times during the hours in which the projector will be operated. The line should then be fastened to the tap which is nearest to the average voltage observed. It is important that this be checked carefully as prolonged over-voltage greatly shortens the life of the lamp; on the other hand, operating the lamp at a voltage under the rating of the lamp materially reduces its candlepower.

4–201. As line voltage varies throughout the day, and from day to day, it will be necessary to check the line voltage several times during the period of normal operation to determine the maximum. The maximum voltage observed at the projector site

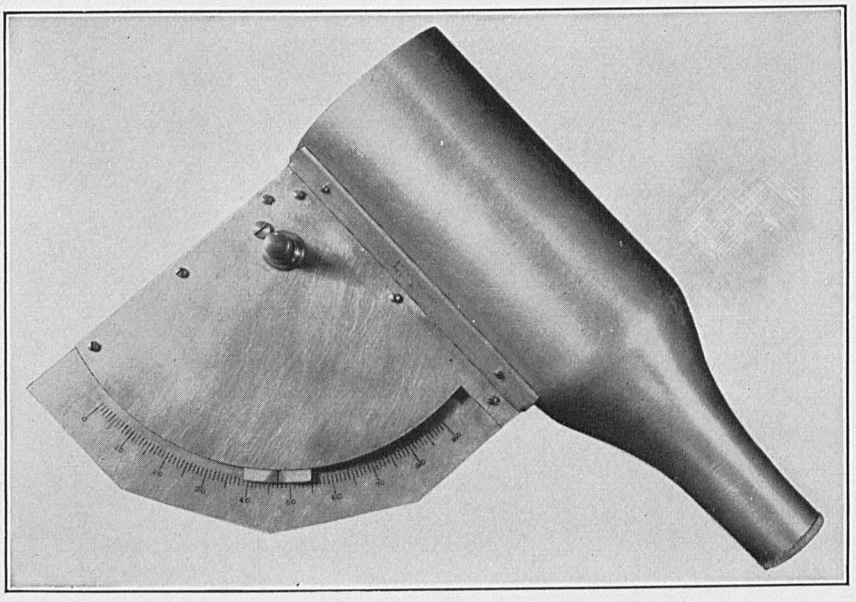


FIGURE 24.—Clinometer for measuring height of ceiling.

is to be considered the voltage of the line, and under no circumstances should the line be connected to a primary tap designed for lower voltage than that of the line.

4–202. Caution.—Some cases of severe burns have been reported due to reflection from the reflector when the sun shines upon it. A clean soft cloth or paper temporarily spread over the reflector will stop reflection while examining the projector. Or a time can be chosen when the sun is obscured by clouds.

4–203. Directing Beam to Zenith; Low-voltage Projector.—The trunnion axis on which the drum rotates must be permanently fixed in an assured horizontal position. The following method is suggested to direct the beam to the zenith: Level across the edges of the primary reflector, using a parallel-sided strip of wood slightly longer than the diameter of the reflector as a rest for the small spirit level. In using this method great care must be exercised to prevent the level from falling upon the reflector. Remove the level from the projector drum before making any adjustment of the set screws of the slip fitter. The projector is equipped with a device so arranged that after the beam has been once set vertical the drum may be lowered for examination and subsequently returned to the vertical position, as indicated by marks or stops. Verticality should be checked by sighting a plumb-line against the beam from two

positions; one in line with the axis, the other at a right angle thereto. When impracticable of performance because of daytime visit by inspector, arrangements should be made to have the check made by the observer and subsequently reported to the inspector by him. Mimeographed separates covering the installation and maintenance of projectors are available from the Instrument Division. Included are directions relative to lease of site and obtaining bids for projector installations.

4-204. Clinometers (illustrated in figure 24).—These are employed to measure the angular elevation from 0° to 90° of a spot of light projected on a cloud at night. The sighting tube is nearly 3 inches in diameter at its outer end in order that not only the light spot on the cloud but a portion of the surrounding dark sky as well may be included in the field of view for contrast. A pair of cross wires aid the eyes in centering on the light spot. A quadrant with scale zero to 90° in whole-degree graduations is rigidly attached to the underside of the tube, and a pendant is pivoted on a horizontal axis in a way to permit it to hang vertically of its own weight when the tube is sighted on an object. The zero line on the pendant matches the zero line on the quadrant when the tube is sighted on an object at the same level, and matches the 90° line on the quadrant when it is sighted to the zenith. A clutch, operated by turning a milled-head screw with the left hand, clamps the pendant in position when a sight is made. This clutch operates easily and positively with only slight pressure. Observers should practice until familiar with its action. Reasonable care should be exercised not to use too much force. Readings to the nearest whole degree are sufficient.

4-205. Use of Clinometer.—When this device is used the projector will be adjusted to direct the light to the zenith. The horizontal distance from the point at which the observer stands to the projector is known as the base line. The base line multiplied by the tangent of the angle of elevation of the spot of light as measured by the clinometer equals the height of the cloud or ceiling. It is not necessary that the projector be at the same level as the observer, a feature which is likely to be an advantage in some installations where, for example, it is expedient to place the projector on the roof of a building or on ground higher or lower than the position occupied by the observer.

4-206. Choice of a Base Line.—The clinometer is graduated to whole degrees, and errors of 1° or possibly 2° are considered likely. In the accompanying table (No. 1) the column of heights for a 500-foot base, it will be seen that the change in height per degree increases rapidly above the 60° part of the table. If, for example, it is desired to measure a cloud 1,800 feet high, the 2° of uncertainty in the instrument will result in a corresponding uncertainty in the height of 230 feet for a 500-foot base line, 150 feet for a 1,000-foot base line, and 130 feet for a 1,500-foot base line. From this it is apparent that since the accuracy of the angular measurement is fixed by the limits of the instrument, the accuracy of the height determination may be increased by choosing a longer base line, usually 750 to 1,000 feet.

4-207. Where the station is located in level country with good visibility, as a rule a 500-foot base line is sufficient, but, to provide for the measurement of high ceilings when required, a second observation point at some convenient location is established which may be 1,000 feet more or less horizontally from the projector. To measure ceilings with this longer base line when clouds at the 500-foot location are at a high angle, the observer will walk to the more distant point. At this time, however, low-voltage projectors are frequently installed with a 1,000-foot base line, and in addition a second projector, usually for high voltage, is installed on a 500-foot base line. The observer then employs the more suitable projector.

4-208. In any event, the base line chosen should be no longer than is necessary to give a reasonably accurate measurement in order to conserve costs of cable and installation. The drop in voltage over a long line is also a factor, especially when 110-volt current is used without a transformer at the projector.

4-209. Ceiling Balloons.—These balloons are usually inflated with hydrogen gas to a free lift of 40 grams, or with helium gas to a free lift of 45 grams, in accordance with instructions contained below.

4-210. The average rate of ascent of the balloons is 6 feet per second after the first 1½ minutes. A table is contained herein which gives the corresponding heights up to 3,010 feet (8 minutes). To obtain altitudes above 3,010 feet, multiply the number of seconds past 8 minutes by 6 and add to 3,010.

positions; one in line with the axis, the other at a right angle thereto. When impracticable of performance because of daytime visit by inspector, arrangements should be made to have the check made by the observer and subsequently reported to the inspector by him.

4-204. Clinometers (illustrated in figure 24).—These are employed to measure the angular elevation from 0° to 90° of a spot of light projected on a cloud at night. The sighting tube is nearly 3 inches in diameter at its outer end in order that not only the light spot on the cloud but a portion of the surrounding dark sky as well may be included in the field of view for contrast. A pair of cross wires aid the eyes in centering on the light spot. A quadrant with scale zero to 90° in whole-degree graduations is rigidly attached to the underside of the tube, and a pendant is pivoted on a horizontal axis in a way to permit it to hang vertically of its own weight when the tube is sighted on an object. The zero line on the pendant matches the zero line on the quadrant when the tube is sighted on an object at the same level, and matches the 90° line on the quadrant when it is sighted to the zenith. A clutch, operated by turning a milledhead screw with the left hand, clamps the pendant in position when a sight is made. This clutch operates easily and positively with only slight pressure. Readings to the nearest whole degree are sufficient.

4-205. Use of Clinometer.—When this device is used the projector will be adjusted to direct the light to the zenith. The horizontal distance from the point at which the observer stands to the projector is known as the base line. The base line multiplied by the tangent of the angle of elevation of the spot of light as measured by the clinometer equals the height of the cloud or ceiling. It is not necessary that the projector be at the same level as the observer.

4-206. Choice of a Base Line.—The clinometer is graduated to whole degrees, and errors of 1° or possibly 2° are considered likely. In the accompanying table (No. 1) the column of heights for a 500-foot base, it will be seen that the change in height per degree increases rapidly above the 60° part of the table. If, for example, it is desired to measure a cloud 1,800 feet high, the 2° of uncertainty in the instrument will result in a corresponding uncertainty in the height of 230 feet for a 500-foot base line, 150 feet for a 1,000-foot base line, and 130 feet for a 1,500-foot base line. From this it is apparent that since the accuracy of the angular measurement is fixed by the limits of the instrument, the accuracy of the height determination may be increased by choosing a longer base line, usually 750 to 1,000 feet.

4-207. Where the station is located in level country with good visibility, as a rule a 500-foot base line is sufficient, but, to provide for the measurement of high ceilings when required, a second observation point at some convenient location is established which may be 1,000 feet more or less horizontally from the projector. To measure ceilings with this longer base line when clouds at the 500-foot location are at a high angle, the observer will walk to the more distant point. At this time, however, low-voltage projectors are frequently installed with a 1,000-foot base line, and in addition a second projector, usually for high voltage, is installed on a 500-foot base line. The observer then employs the more suitable projector.

4-208. In any event, the base line chosen should be no longer than is necessary to give a reasonably accurate measurement in order to conserve costs of cable and installation. The drop in voltage over a long line is also a factor, especially when 110-volt current is used without a transformer at the projector.

4-209. Ceiling Balloons.—These balloons are generally either of two types. The oval-shaped balloons are inflated with helium gas to a free lift of 45 grams, or, if hydrogen gas is used, to a free lift of 40 grams, in accordance with instructions contained below. Spherical balloons are inflated with helium gas to a free lift of 75 grams, or, if hydrogen gas is used, to a free lift of 72 grams.

4-210. Cancelled.

4-211. Equipment.—The equipment necessary for this work consists of: (1) Compressed hydrogen or helium gas in cylinders, usually containing 200 cubic feet, furnished by the supervising Weather Bureau airport station; (2) hydrogen or helium regulator; (3) Brady free-lift device; (4) timepiece, indicating seconds, usually a so-called wasp clock.

4-212. Color of Balloons.—The balloons are usually furnished in two colors, red and purple. In general, the darker color is best seen against a dark background.

4-213. Inflation of Balloons.—A specially constructed inflation room is usually located as convenient as possible to the place of observation. This room should contain a rack for three helium tanks and a shelf for inflating the balloon. The tank is fitted with a valve; also a reducing valve (or regulator) having two gages, one registering the amount of pressure in the tank and the other the working pressure or pressure of the gas flowing into the balloon. A low-pressure valve on the regulator regulates the flow of gas. A ¼-inch rubber tube leads from the regulator to a three-way petcock. A small ⅛-inch rubber tube leads to the Brady free-lift device. (See fig. 25.)

4-214. The Brady device is placed on a shelf large enough to permit the small rubber tubing to rest thereon.

TABLE 1.—*Height of cloud or ceiling, feet, light beam projected vertically*

Angle	Tan	Base			Angle	Tan	Base		
		500′ h	1,000′ h	1,500′ h			500′ h	1,000′ h	1,500′ h
5	0.08749	44	87	131	46	1.0355	518	1,036	1,554
6	.10510	52	105	157	47	1.0724	536	1,072	1,608
7	.12278	62	123	185	48	1.1106	556	1,111	1,667
8	.14054	70	141	211	49	1.1504	575	1,150	1,725
9	.15838	79	158	237	50	1.1918	596	1,192	1,788
10	.17633	88	176	264	51	1.2349	618	1,235	1,853
11	.19438	97	194	291	52	1.2799	640	1,280	1,920
12	.21256	106	213	319	53	1.3270	664	1,327	1,991
13	.23087	116	231	347	54	1.3764	688	1,376	2,064
14	.24933	124	249	373	55	1.4281	714	1,428	2,142
15	.26795	134	268	402	56	1.4826	742	1,483	2,225
16	.28675	144	287	430	57	1.5399	770	1,540	2,310
17	.30573	153	306	459	58	1.6002	800	1,600	2,400
18	.32492	162	325	487	59	1.6643	832	1,664	2,496
19	.34433	172	344	516	60	1.7321	866	1,732	2,598
20	.36397	182	364	546	61	1.8040	902	1,804	2,706
21	.38386	192	384	576	62	1.8807	940	1,881	2,821
22	.40403	202	404	606	63	1.9626	982	1,963	2,945
23	.42447	212	424	636	64	2.0503	1,025	2,050	3,075
24	.44523	222	445	667	65	2.1445	1,072	2,144	3,216
25	.46631	233	466	699	66	2.2460	1,123	2,246	3,369
26	.48773	244	488	732	67	2.3559	1,178	2,356	3,534
27	.50953	255	510	765	68	2.4751	1,238	2,475	3,713
28	.53171	266	532	798	69	2.6051	1,302	2,605	3,907
29	.55431	277	554	831	70	2.7475	1,374	2,748	4,122
30	.57735	288	577	865	71	2.9042	1,452	2,904	4,356
31	.60086	300	601	901	72	3.0777	1,539	3,078	4,617
32	.62487	312	625	937	73	3.2709	1,636	3,271	4,907
33	.64941	324	649	973	74	3.4874	1,744	3,487	5,231
34	.67451	338	675	1,013	75	3.7321	1,866	3,732	5,598
35	.70021	350	700	1,050	76	4.0108	2,006	4,011	6,017
36	.72654	364	727	1,091	77	4.3315	2,166	4,332	6,498
37	.75355	377	754	1,131	78	4.7046	2,352	4,705	7,057
38	.78129	390	781	1,171	79	5.1446	2,572	5,145	7,717
39	.80978	405	810	1,215	80	5.6713	2,836	5,671	8,507
40	.83910	420	839	1,259	81	6.3138	3,157	6,314	9,471
41	.86929	434	869	1,303	82	7.1154	3,558	7,115	10,673
42	.90040	450	900	1,350	83	8.1443	4,072	8,144	12,276
43	.93252	466	933	1,399	84	9.5144	4,757	9,514	14,211
44	.96569	483	966	1,449	85	11.430	5,715	11,430	17,175
45	1.0000	500	1,000	1,500	86	14.301	7,150	14,301	21,441

NOTE.—Tables are also available on request for a light beam directed at an angle of 63°26′ to the horizontal.

4-215. The balloon is attached to the nozzle by means of two no. 17 rubber bands. This is accomplished by doubling two bands and placing them around the neck of the

4-211. Equipment.—The equipment necessary for this work consists of: (1) Compressed hydrogen or helium gas in cylinders, usually containing 200 cubic feet; (2) hydrogen or helium regulator; (3) Brady free-lift device; (4) timepiece, indicating seconds.

4-212. Color of Balloons.—The balloons are usually furnished in two colors, red and purple. In general, the darker color is best seen against a dark background.

4-213. Inflation of Balloons.—A specially constructed inflation room is usually located as conveniently as possible to the place of observation. This room should contain a rack for helium tanks and a shelf for inflating the balloon. The tank is fitted with a valve; also a reducing valve (or regulator) having two gages, one registering the amount of pressure in the tank and the other the pressure of the gas flowing into the balloon. A low-pressure valve on the regulator regulates the flow of gas. A 1/4-inch rubber tube leads from the regulator to a three-way petcock. A small 1/8-inch rubber tube leads to the Brady free-lift device. (See fig. 25.)

4-214. The Brady device is placed on a shelf large enough to permit the small rubber tubing to rest thereon.

Table 1.—*Height of cloud or ceiling, feet, light beam projected vertically*

Angle	Tan	Base			Angle	Tan	Base		
		500'h	1,000'h	1,500'h			500'h	1,000'h	1,500'h
5.....	0.08749	44	87	131	46.....	1.0355	518	1,036	1,554
6.....	.10510	52	105	157	47.....	1.0724	536	1,072	1,608
7.....	.12278	62	123	185	48.....	1.1106	556	1,111	1,667
8.....	.14054	70	141	211	49.....	1.1504	575	1,150	1,725
9.....	.15838	79	158	237	50.....	1.1918	596	1,192	1,788
10.....	.17633	88	176	264	51.....	1.2349	618	1,235	1,853
11.....	.19438	97	194	291	52.....	1.2799	640	1,280	1,920
12.....	.21256	106	213	319	53.....	1.3270	664	1,327	1,991
13.....	.23087	116	231	347	54.....	1.3764	688	1,376	2,064
14.....	.24933	124	249	373	55.....	1.4281	714	1,428	2,142
15.....	.26795	134	268	402	56.....	1.4826	742	1,483	2,225
16.....	.28675	144	287	430	57.....	1.5399	770	1,540	2,310
17.....	.30573	153	306	459	58.....	1.6002	800	1,600	2,400
18.....	.32492	162	325	487	59.....	1.6643	832	1,664	2,496
19.....	.34433	172	344	516	60.....	1.7321	866	1,732	2,598
20.....	.36397	182	364	546	61.....	1.8040	902	1,804	2,706
21.....	.38386	192	384	576	62.....	1.8807	940	1,881	2,821
22.....	.40403	202	404	606	63.....	1.9626	982	1,963	2,945
23.....	.42447	212	424	636	64.....	2.0503	1,025	2,050	3,075
24.....	.44523	222	445	667	65.....	2.1445	1,072	2,144	3,216
25.....	.46631	233	466	699	66.....	2.2460	1,123	2,246	3,369
26.....	.48773	244	488	732	67.....	2.3559	1,178	2,356	3,534
27.....	.50953	255	510	765	68.....	2.4751	1,238	2,475	3,713
28.....	.53171	266	532	798	69.....	2.6051	1,302	2,605	3,907
29.....	.55431	277	554	831	70.....	2.7475	1,374	2,748	4,122
30.....	.57735	288	577	865	71.....	2.9042	1,452	2,904	4,356
31.....	.60086	300	601	901	72.....	3.0777	1,539	3,078	4,617
32.....	.62487	312	625	937	73.....	3.2709	1,636	3,271	4,907
33.....	.64941	324	649	973	74.....	3.4874	1,744	3,487	5,231
34.....	.67451	338	675	1,013	75.....	3.7321	1,866	3,732	5,598
35.....	.70021	350	700	1,050	76.....	4.0108	2,006	4,011	6,017
36.....	.72654	364	727	1,091	77.....	4.3315	2,166	4,332	6,498
37.....	.75355	377	754	1,131	78.....	4.7046	2,352	4,705	7,057
38.....	.78129	390	781	1,171	79.....	5.1446	2,572	5,145	7,717
39.....	.80978	405	810	1,215	80.....	5.6713	2,836	5,671	8,507
40.....	.83910	420	839	1,259	81.....	6.3138	3,157	6,314	9,471
41.....	.86929	434	869	1,303	82.....	7.1154	3,558	7,115	10,673
42.....	.90040	450	900	1,350	83.....	8.1443	4,072	8,144	12,276
43.....	.93252	466	933	1,399	84.....	9.5144	4,757	9,514	14,211
44.....	.96569	483	966	1,449	85.....	11.430	5,715	11,430	17,175
45.....	1.0000	500	1,000	1,500	86.....	14.301	7,150	14,301	21,441

balloon after it is stretched over the nozzle of the device. All the air is expelled by opening the three-way pet cock and rolling the balloon to force the air out through the pet cock. The inflation is then begun by slowly turning the regulator handle to the right until a steady flow is maintained. The balloons should be inflated at such a rate that at least 1 minute is required for operation. The balloon is inflated until the device is just lifted from the supporting surface. When removing the balloon from the device, the neck should be twisted several times and secured by means of the two no. 17 rubber bands used to hold balloon on nozzle. The rubber bands are slipped over the twisted portion of the neck and tightly wrapped by a series of alternating half twists and loopings, accompanied by a firm tension to insure a tight joint. Cord or tape should not be used for tying neck of balloons.

4-216. Observations.—The inflated balloon should be carried to a point free from obstructions, such as houses, streets, etc. The balloon should be released on an even minute. Do not take the eyes from the balloon during its ascent and note (the time) the instant the balloon enters the clouds. The interval of time between the releasing of the balloon and its disappearance in the clouds should be accurately determined.

4-217. The following table, which has been divided into one-half minute intervals, is given for use in ascertaining the altitude of the clouds; fractional parts of a minute should be determined by interpolation:

Time interval (minutes)	½	1	1½	2	2½	3	3½	4
Altitude (feet)	250	480	670	850	1, 030	1, 210	1, 390	1, 570
Time interval (minutes)	4½	5	5½	6	6½	7	7½	8
Altitude (feet)	1, 750	1, 930	2, 110	2, 290	2, 470	2, 650	2, 830	3, 010

4-218. Average rate for higher ceilings, 6 feet per second.

4-219. Danger of Explosions.—It is a well-known fact that hydrogen and air when mixed in the proper proportion make a very explosive mixture. Therefore, the following instructions should be rigidly observed:

4-220. Smoking should be prohibited at all times in or near the balloon shelter or room where the balloons are being filled or where hydrogen is stored.

4-221. Whenever a balloon during the process of inflation is found to be leaking, it should be detached at once from the filling apparatus, taken outside, and exhausted of hydrogen in the open air.

4-222. In case a balloon bursts or leaks while being filled, the doors and windows of the shelter, or room used for the purpose, should be opened in order that all of the hydrogen may be driven out by the wind.

4-223. A sign, somewhat as follows, DANGER—NO SMOKING, should be posted in a conspicuous place where the ceiling balloons are inflated with hydrogen. Where helium is used such precautions are unnecessary.

4-224. Care of Balloons.—The balloons will deteriorate quite rapidly, especially in the summer months, and they should be kept in a cool place of more or less even temperature, preferably in an electric refrigerator when available.

4-225. Supplies of Helium or Hydrogen and Balloons.—Whenever the observer opens the last full cylinder of gas, he will notify the official in charge of the supervising station by mail, as follows: "The last helium (or hydrogen) cylinder has been tapped; please send ..... cylinders." When the full cylinders arrive, the empties should be returned, by freight, with Government bills of lading, which will be sent by the supervising station upon receipt of notification that the last cylinder has been tapped. Where only ceiling-balloon observations are made, single cylinders of gas will be furnished, and the observer will notify the supervising official when the gas pressure is down to 400 pounds.

4-215. The neck of the balloon is stretched over the inflation nozzle. All air is expelled by opening the three-way pet cock and rolling the balloon to force the air out through the pet cock. The inflation is then begun by slowly turning the regulator handle to the right until a steady flow is maintained. The balloons should be inflated slowly until the device is just lifted from the supporting surface. When removing the balloon from the device, the neck should be twisted several times and secured by soft cotton twine or by a band cut from the end of the long neck on synthetic rubber balloons.

4-216. Observations.—The inflated balloon should be released from a point free from obstructions, such as houses, trees, etc. Do not take the eyes from the balloon during its ascent. The interval of time between the releasing of the balloon and its disappearance in the clouds should be accurately determined.

4-217. The following table shows the average height of oval-shaped and spherical ceiling balloons at the *end* of each half-minute of elapsed time.

TABLE I

Time (minutes)	Altitude—feet	
	Oval-shaped balloon (45 grams free lift)	Spherical balloon (75 grams free lift)
1/2.....	205	280
1.....	410	560
1 1/2.....	615	840
2.....	820	1120
2 1/2.....	1005	1400
3.....	1190	1680
3 1/2.....	1375	1945
4.....	1560	2210
4 1/2.....	1745	2475
5.....	1930	2740
5 1/2.....	2115	3005
6.....	2300	3270
6 1/2.....	2485	3545
7.....	2670	3820
7 1/2.....	2855	4095
8.....	3040	4370
8 1/2.....	3225	4645
9.....	3410	4920
9 1/2.....	3595	5195
10.....	3780	5470

TABLE II

Ceiling Height Table for the Two Types of Ceiling Balloons in General Use, Based on Average Ascensional Rates as Shown in Table I.

Reportable height, feet	Range in time				Reportable height, feet	Range in time			
	Oval-shaped balloon 45 grams free lift		Spherical balloon 75 grams free lift			Oval-shaped balloon 45 grams free lift		Spherical balloon 75 grams free lift	
	From—	To—	From—	To—		From—	To—	From—	To—
0.....	0' 0"	0' 7"	0' 0"	0' 5"	2000.....	5' 4"	5' 19"	3' 31"	3' 42"
100.....	0' 8"	0' 21"	0' 6"	0' 15"	2100.....	5' 20"	5' 35"	3' 43"	3' 53"
200.....	0' 22"	0' 36"	0' 16"	0' 26"	2200.....	5' 36"	5' 52"	3' 54"	4' 4"
300.....	0' 37"	0' 51"	0' 27"	0' 37"	2300.....	5' 53"	6' 8"	4' 5"	4' 15"
400.....	0' 52"	1' 6"	0' 38"	0' 48"	2400.....	6' 9"	6' 24"	4' 16"	4' 27"
500.....	1' 7"	1' 20"	0' 49"	0' 58"	2500.....	6' 25"	6' 40"	4' 28"	4' 38"
600.....	1' 21"	1' 35"	0' 59"	1' 9"	2600.....	6' 41"	6' 57"	4' 39"	4' 49"
700.....	1' 36"	1' 49"	1' 10"	1' 20"	2700.....	6' 58"	7' 13"	4' 50"	5' 0"
800.....	1' 50"	2' 5"	1' 21"	1' 31"	2800.....	7' 14"	7' 29"	5' 1"	5' 12"
900.....	2' 6"	2' 21"	1' 32"	1' 41"	2900.....	7' 30"	7' 45"	5' 13"	5' 23"
1000.....	2' 22"	2' 37"	1' 42"	1' 52"	3000.....	7' 46"	8' 1"	5' 24"	5' 34"
1100.....	2' 38"	2' 53"	1' 53"	2' 3"	3100.....	8' 2"	8' 17"	5' 35"	5' 46"
1200.....	2' 54"	3' 10"	2' 4"	2' 14"	3200.....	8' 18"	8' 34"	5' 47"	5' 57"
1300.....	3' 11"	3' 26"	2' 15"	2' 24"	3300.....	8' 35"	8' 50"	5' 58"	6' 8"
1400.....	3' 27"	3' 42"	2' 25"	2' 35"	3400.....	8' 51"	9' 6"	6' 9"	6' 19"
1500.....	3' 43"	3' 58"	2' 36"	2' 46"	3500.....	9' 7"	9' 22"	6' 20"	6' 30"
1600.....	3' 59"	4' 15"	2' 47"	2' 57"	3600.....	9' 23"	9' 39"	6' 31"	6' 41"
1700.....	4' 16"	4' 31"	2' 58"	3' 8"	3700.....	9' 40"	9' 55"	6' 42"	6' 52"
1800.....	4' 32"	4' 47"	3' 9"	3' 19"	3800.....	9' 56"	10' 11"	6' 53"	7' 3"
1900.....	4' 48"	5' 3"	3' 20"	3' 30"	3900.....	10' 12"	10' 27"	7' 4"	7' 14"
					4000.....	10' 28"	10' 43"	7' 15"	7' 25"

There are many factors, such as shape of balloon, free lift, turbulence, cloudiness, etc., which affect the ascensional rates of ceiling balloons. Consequently, ceiling heights obtained by such means cannot be considered "measured" heights. The observer must use judgment in accepting the height indicated by balloons as the true cloud height. From a number of double theodolite observations on ceiling balloons, it has been established that if a large number of balloons were released, the average ascensional rate would closely approximate the averages given in Table I. However, any individual balloon can depart from the average values by a considerable amount, as shown in Tables III and IV.

TABLE III

Percentage of Observations Within Specified Departures From Average Altitudes Using Oval-shaped Balloons With 45 Grams Free Lift

Minute	Average altitude feet	± 100	± 200	± 300	± 400	± 500	± 600	± 700	± 800	± 900
1.....	410	77	97	100	.....	.....	.....	.....	.....	.....
2.....	820	42	78	94	98	100	.....	.....	.....	.....
3.....	1190	39	69	87	93	98	99	100	.....	.....
4.....	1560	34	69	83	93	96	99	99	99	100

TABLE IV

Percentage of Observations Within Specified Departures From Average Altitudes Using Spherical Balloons With 75 Grams Free Lift

Minute	Average altitude feet	±100	±200	±300	±400	±500	±600	±700	±800
1	560	92	100	.....	.....	.....	.....	.....	.....
2	1120	67	96	98	100	.....	.....	.....	.....
3	1680	58	88	98	100	.....	.....	.....	.....
4	2210	44	88	93	98	100	.....	.....	.....
5	2740	46	73	89	95	95	100	.....	.....
6	3270	47	72	83	89	92	97	97	100

For altitudes higher than those shown in Tables III and IV, the results generally are progressively more erratic.

The above values are applicable only when there is an overcast. When breaks occur, deviations from the mean become greater and continue to increase as the cloudiness changes from broken to scattered. More uniform results usually are obtained with spherical balloons than with oval-shaped balloons; results were more uniform with 75 grams free lift than with 45 grams free lift. (NOTE: The oval-shaped balloons should never be inflated to 75 grams free lift.)

4-218. Average rate for higher ceilings: 6 feet per second for oval-shaped ceiling balloons; 9 feet per second for spherical balloons.

4-219. Danger of Explosions.—Hydrogen and air when mixed in the proper proportion make a very explosive mixture. Therefore, the following instructions should be rigidly observed:

4-220. Smoking should be prohibited at all times in or near the balloon shelter or room where the balloons are being filled or where hydrogen is stored.

4-221. Whenever a balloon during the process of inflation is found to be leaking, it should be detached at once from the filling apparatus, taken outside, and exhausted of hydrogen in the open air.

4-222. In case a balloon bursts or leaks while being filled, the doors and windows of the shelter, or room used for the purpose, should be opened in order that all of the hydrogen may be driven out by the wind.

4-223. A sign, somewhat as follows, DANGER—NO SMOKING, should be posted in a conspicuous place where the ceiling balloons are inflated with hydrogen. Where helium is used such precautions are unnecessary.

4-224. Care of Balloons.—The balloons will deteriorate quite rapidly, especially in the summer months, and they should be kept in a cool place of more or less even temperature, preferably in an electric refrigerator when available.

4-225. Supplies of Helium (or Hydrogen) and Balloons.—Additional supplies of helium (or hydrogen) and balloons should be ordered in sufficient time to insure continuous observations.

4-226. When the last carton of 50 balloons is opened, advise the issuing station to that effect and a new supply will be sent by mail.

4-227. Cloud Forms.—Some clouds are smooth-based and a balloon rising to them disappears abruptly when it enters their base. Other types have billowy and broken bases and when a balloon enters the base at one of the lower points of these billows it represents the ceiling more accurately than when it enters into a hollow or higher place in the cloud.

4-228. Sometimes balloons drift into definite openings between the clouds and disappear. These disappearances do not indicate the ceiling height. If this happens, or any doubt as to the measurements is felt, another balloon should be released. The lowest of the two or more readings will be reported as the ceiling.

4-229. Caution.—When precipitation of greater intensity than light is occurring, ceiling balloons should not be released as their ascensional rate under such conditions is inaccurate.

4-230. Use of Pilot Balloons for Measurement of Ceiling Heights.—The 30-gram pilot balloons are issued to a selected list of stations to facilitate the accurate measurement of ceiling heights when adverse conditions such as high winds, poor visibility, etc., make such observations difficult or impossible with the standard 10-gram ceiling balloons. The advantage of using the pilot balloons on such occasions is due to their greater size and more rapid ascensional rate.

4-231. Inflation.—The procedure for inflating the pilot balloons is similar to that for inflating ceiling balloons as described above, the substitution of the pilot-balloon inflation nozzle for the Brady inflation nozzle being the only variation. Recent installations are equipped with a newly designed inflation device which combines two nozzles, one for inflating 10 gram balloons, the other for 30-gram balloons.

4-232. Ascensional Rate.—The following table, based on the ascensional rate of the pilot balloons, is given for use in ascertaining the altitude of the clouds:

Time interval (minutes)	½	1	1½	2	2½	3	3½	4	4½	5
Altitude (feet)	360	710	1, 035	1, 360	1, 685	2, 010	2, 320	2, 630	2, 940	3, 250

Time interval (minutes)	5½	6	6½	7	7½	8	8½	9	9½	10
Altitude (feet)	3, 545	3, 840	4, 135	4, 430	4, 725	5, 020	5, 315	5, 610	5, 905	6, 200

4-233. Fractional parts of a minute should be determined by interpolation and the average rate of 10 feet per second or 600 feet per minute should be used for ceilings greater than 6,200 feet.

4-234. Equipment.—Attention is called to the fact that inflation nozzles of two different weights are available for issue: one for use with hydrogen gas and the other for use with helium gas. They are accordingly stamped with the letters HY and HE, respectively. All stations receiving these nozzles are requested, therefore, to make certain that they have the proper one for the kind of gas they are using.

4-235. As the cost of pilot balloons is approximately three times that of ceiling balloons, stations are cautioned to not use the larger balloons except when conditions prevent satisfactory observations with ceiling ballons. It is important also that none of the pilot balloons be kept in the station stock until the quality of the rubber has deteriorated. It is requested, therefore, that whenever any such balloons have been in stock as long as 3 months they be forwarded to the nearest pilot balloon station to be used up. Supervising stations are to instruct all their substations accordingly.

CHAPTER VI

PILOT-BALLOON OBSERVATIONAL EQUIPMENT

4-236. Pilot Balloons.—These are employed at airport stations to obtain reliable information of both the velocity and direction of the wind at flying altitudes. They

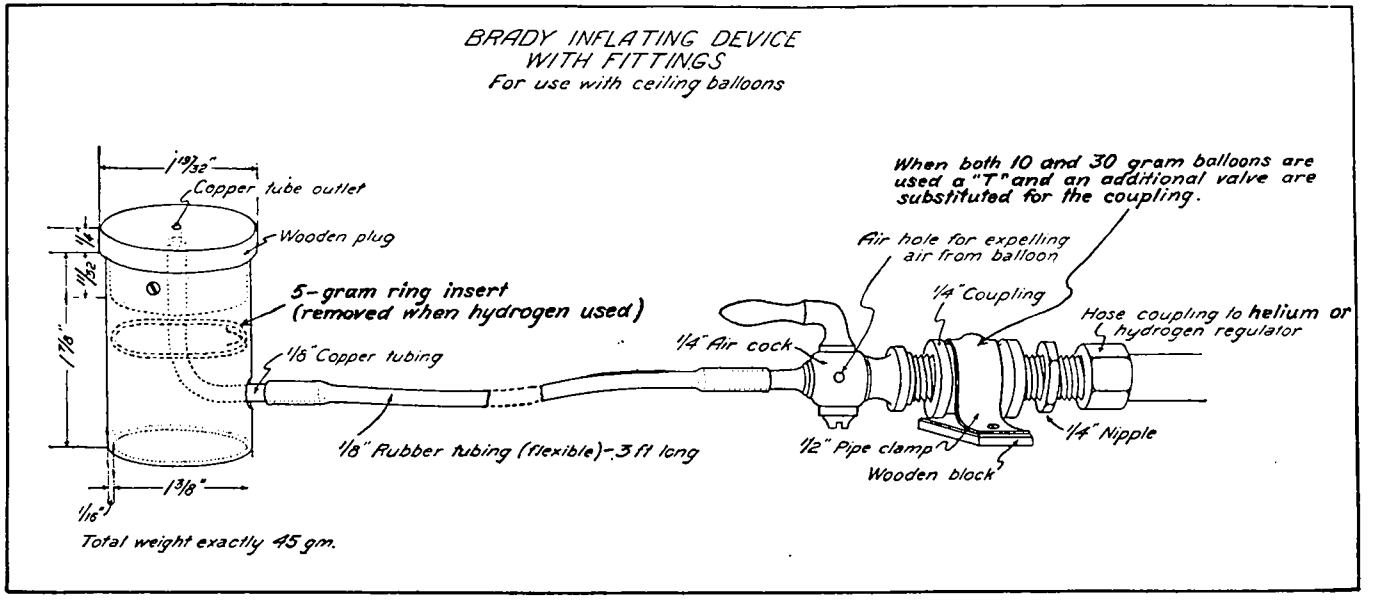


FIGURE 25.—Brady inflation device with fittings for ceiling balloons.

also serve to give height of ceiling. These balloons, made of pure rubber, are inflated with helium just before use to a diameter of about 24 inches to give an ascensional rate of nearly 600 feet per minute. After being released from the ground, or from the roof of a building, as may be most convenient, the path of the balloon is carefully followed, usually by means of a single theodolite, and its position observed each minute until the balloon bursts, or it passes from sight. The theodolite observations give the angular position of the balloon, and the altitude is known from the ascensional rate. These data are usually plotted immediately, an observer at the theodolite being in telephone communication with another observer located in the office at a plotting board. However, in many cases, these observations are made by only one man, in which case he does both the observing and plotting. At certain stations 100-gram (16-inch) pilot balloons are used having an ascensional rate of 280 meters per minute (919 feet per minute).

4–237.—For night observations the balloon is made visible by attaching to it a small paper lantern lighted by a paraffin candle or a small electric light.

4–238. Details regarding the installation and use of the equipment required will be found in Circular O and in "Quarters and Instrumental Equipment for Weather Bureau Stations at Airports," the latter giving information about the theodolite platform with windbreak, and the wiring to the same from the office.

Chapter VII

PRECIPITATION GAGES AND MEASUREMENT

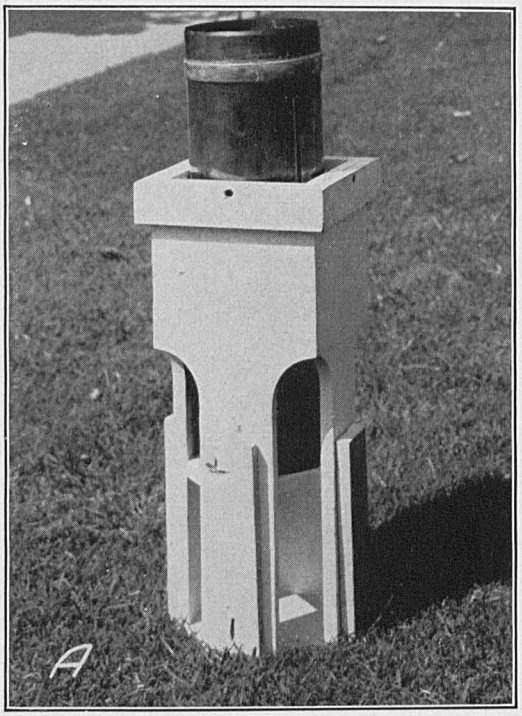
4–239. Eight-inch Rain and Snow Gages.—These are issued to most stations as regular equipment.

4–240. Exposure.—Details regarding the exposure, construction, and use of 8-inch gages are found in Circulars B and C, Instructions for Cooperative Observers. Briefly, precipitation gages will be placed in an open location, free from obstructions such as large buildings, trees, fences, etc. Low bushes, fences, and walls, if not appreciably higher than the top of the gage and not closer to the gage than 7 or 8 feet, such obstructions are beneficial in breaking the force of the wind which is the principal disturbing effect in collecting the rainfall. Ground exposures should be chosen whenever possible, but if a roof is used it should be flat and the gage placed centrally.

4–241. Description.—Figure 26 shows *A*, the 8-inch gage, placed in a wooden box support, and *B*, the parts of the gage. The collector (1) is made of brass tubing with the outside beveled to a sharp edge at the top so as to properly define the area of collection, which is a circle 8 inches in diameter, or the inside diameter of the tubing. The collector is soldered to a copper funnel having an opening at the small end of five-eighths inch, just large enough to permit of the insertion of the measuring stick. The collector is also so formed as to fit over the upper end of the 8-inch overflow can (2), also copper, and the brass measuring tube (3) which stands centrally within the overflow. The measuring stick (4) is made of heart cedar, 24 inches long, and graduated in inches and tenths, and, since the area of cross section of the measuring tube is one-tenth that of the 8-inch collector, the depth of water finding its way into the tube is 10 times that which has fallen. Ten inches on the measuring stick, therefore, correspond to 1 inch of rainfall, and the nearest hundredth of an inch of rainfall is easily read.

4–242. When the rainfall exceeds 2 inches, the capacity of the measuring tube, additional water passes into the overflow can, from which it is poured back into the tube for separate measurement and its depth added to the 2 inches already measured.

4–243. Snowfall Measurements.—In reporting the depth of snow, observers are required to measure such depth on the field at several points, using any stick graduated in inches, to determine the average depth. To measure snow which has fallen on a field already snow-covered, the same method applies in general, except that the depth must be measured from a surface which was practically free of snow at the beginning of the storm or when the previous observation was taken. The difference of density and color of new and old snow quite often permits of separating the two layers.



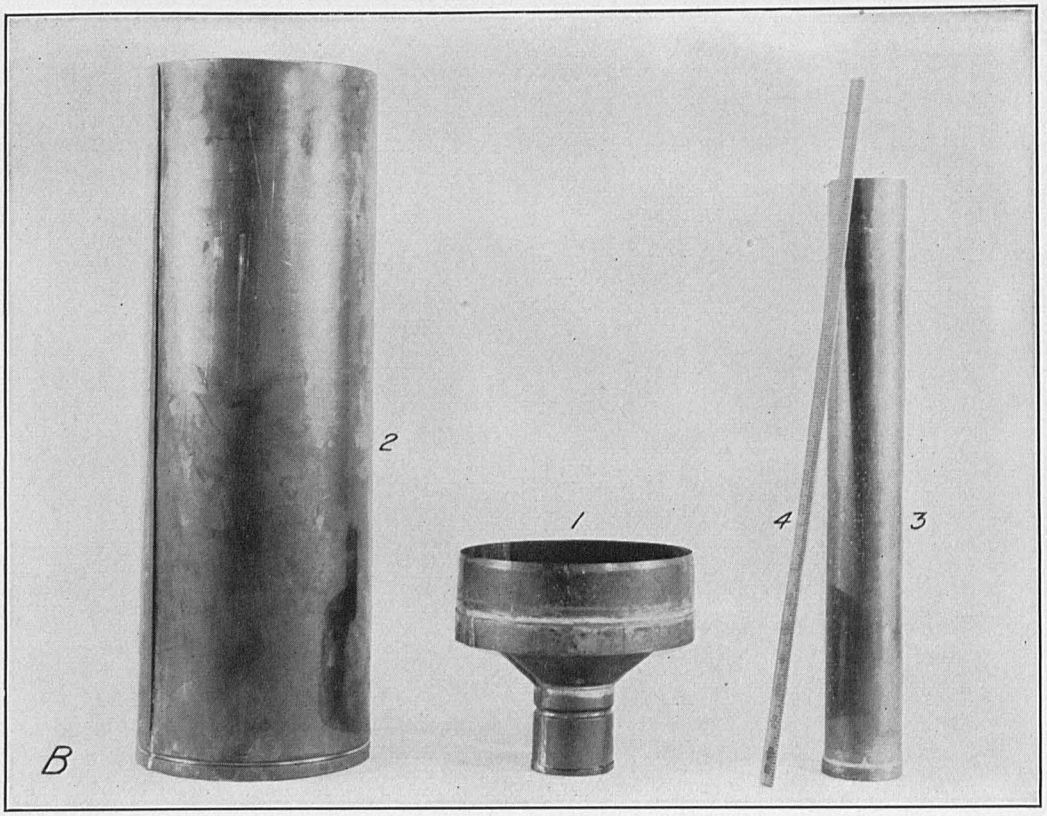


FIGURE 26.—Eight-inch rain and snow gage: *A*, gage in box support; *B*, parts of gage.

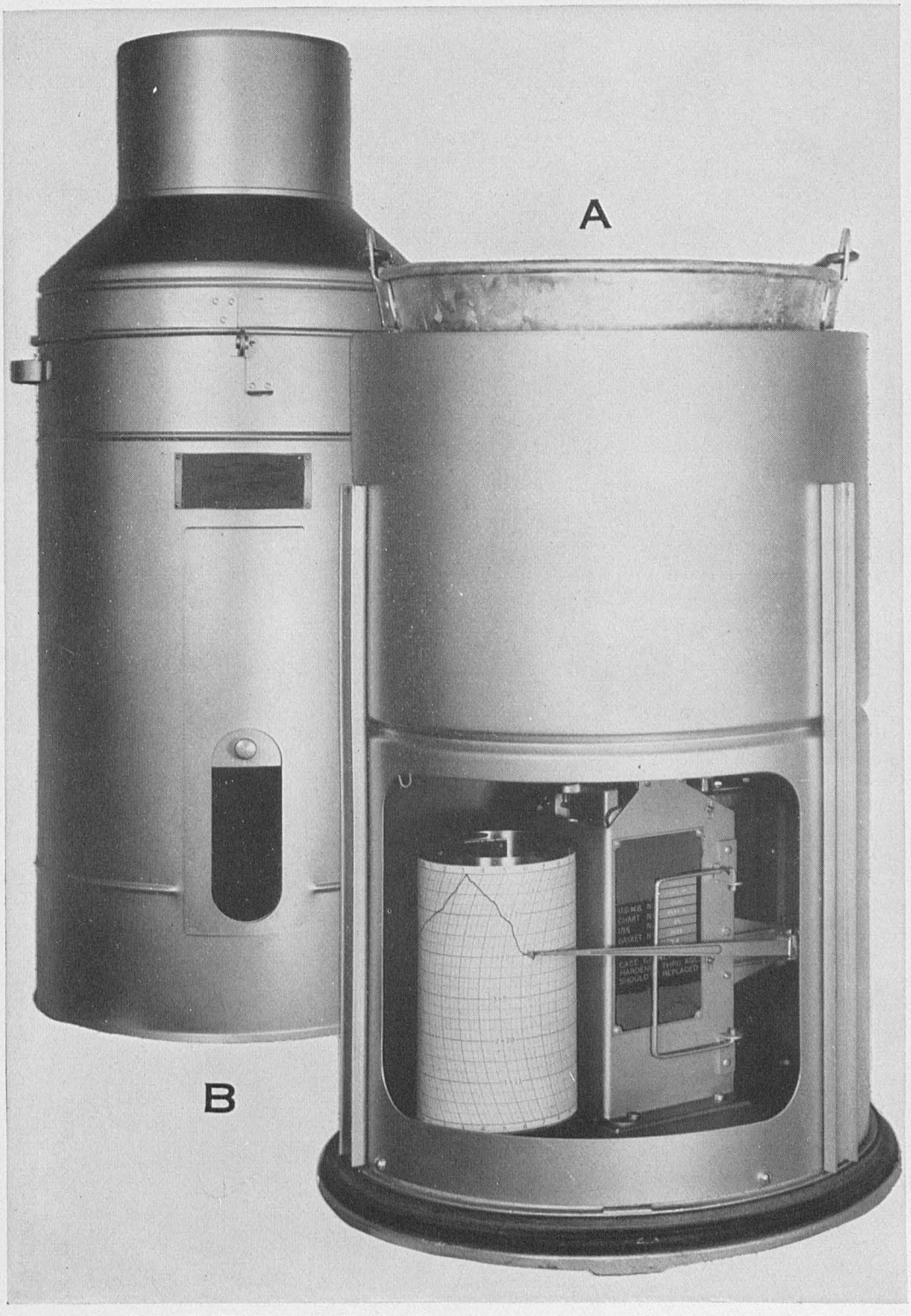


FIGURE 27.—Weighing-type rain and snow gage; *A*, gage with cover removed; *B*, cover alone.

4–244. Weighing-type Rain and Snow Gages.—This type of precipitation gage is being furnished to hourly reporting airway stations, either as new equipment or in addition to the 8-inch gage already in service. It is intended to eventually install such gages at all hourly reporting stations. Referring to figure 27, precipitation falls into an 8-inch collector ring with beveled edge and is carried through a removable funnel into an ordinary bucket mounted on a weighing mechanism consisting of platform, spring, and linkage. This weighing mechanism, which is quite similar to a platform spring scale, translates the weight of the catch to equivalent inches of precipitation through linkage to a pen which records it on a clock-driven chart cylinder. The capacity of the gage is 12 inches of precipitation, recorded on a 6-inch chart by a dual traverse pen which records from 0 to 6 inches on the upstroke and from 6 to 12 inches on the downstroke of the pen. A few gages of 6-inch and 9-inch capacity, single traverse, are being used. The entire mechanism is protected by a dust-proof cover provided with an inspection door.

When snow is to be caught in the gage, the funnel is removed. In regions where prolonged subfreezing temperatures are expected, the bucket is charged with a solution of calcium chloride which lowers the freezing point of the liquid in the bucket sufficiently to prevent freezing and possible damage to the gage. This feature permits continuous operation throughout the year and is one of the principal advantages of the gage. The gage may also be provided with an Alter type windshield to reduce turbulence.

CHAPTER VIII

INSTRUCTIONS FOR OPERATION AND CARE OF INSTRUMENTS

4–245. Large Standard Anemometer.—The upper and lower bearings of the spindle must be oiled once a week. The upper bearing is oiled by removing the cups, and the lower bearing and the spindle worm through the orifice in the back of the anemometer casing, which must at all other times be kept closed to prevent dust and water from entering. A drop of oil, such as will adhere to a match, applied once or twice, is in most cases sufficient. About once a month the anemometer should be removed from the support and cleaned. Take the anemometer apart and clean out all old oil and dirt by washing the parts in benzine or gasoline. Then wipe with a clean cotton cloth free from lint or any dirt, allow the parts to thoroughly dry, reassemble the instrument and renew the oil on all the bearings, placing a slight quantity also on the gears, worms, and wormwheels, and on the inclined face of the projection engaging the contact spring. Apply only a small quantity of oil to each bearing, using a pointed match or toothpick. Only the special oil provided should be used, two kinds of which are issued with each anemometer, one for use in warm weather, the other in cold. The former becomes thick at about 25° F., the latter at about 0° F., so that the use of cold-weather oil should begin in the fall when the temperature is likely to go below 25° for a considerable period. No oil is provided for extremely low temperatures.

4–246. Small 3-Cup Anemometer.—The cup wheel, sleet shield, top ball bearing, and spindle after having been initially assembled may thereafter be withdrawn as an assembled unit when desired by first backing off ⅛ inch the larger fillister-head screw that will be seen just above the label plate. Initial assembly of these parts is more readily made outside the anemometer body. In anemometers bearing serial numbers 2312–SA to 2511–SA a flat washer will be found just above the ball edge. It should be put in place with its rabbeted edge downward and care should be taken to prevent its loss. (In anemometers bearing higher serial numbers, the flat washer is rigidly attached to the sleet shield.) The cup wheel should be placed with rounded sides of the arms upward to shed water. The top nut should be drawn snug enough to hold the sleet shield firm.

4–247. Lubrication and Care (Small Anemometer).—The top bearing should have several drops of light machine oil (winter anemometer oil) applied, the worm a little oil rubbed on the threads, and the lower portion of the spindle a touch of oil on its side just above the lower bearing. The oil is best applied with a match stem. The anemometer should be oiled once a month and disassembled and cleaned at least once every three

months. The latter includes removal of the spindle assembly and, if necessary, cleaning the pure silver contact with crocus cloth or very fine sand paper. Exceptions to the rules for oiling and cleaning, as given above, may be made necessary in case of dust storms, or other sources of dirt.

4–248. The cup-wheel spindle assembly should be rotated back and forth by hand as it is being inserted in the anemometer body in order to permit the gears to find their mesh.

4–249. The lower bearing is a steel ball carried in a cup. It is factory adjusted to precisely the best position to carry a part of the load and thus insure low starting velocity and accurate indication of wind. The lower bearing adjustment should not be disturbed.

4–250. Electric Circuit (Small Anemometer).—One side of the circuit is grounded to the framework. Hence the ground terminal from the office may be attached to any convenient part of the wind-instrument support. The insulated wire terminal should be attached to the insulated binding post apparent upon inspection. The 6-volt 5-ampere label is intended to define maximum values. As a rule, 0.25 ampere will operate indicating devices.

4–251. The label plate is held by four No. 4–40 machine screws. It may be removed when necessary for inspection. The opposite plate is held by special screws, a signal that it should not ordinarily be opened because of the danger that the gears will bind upon reassembly if such work is done by one unskilled.

4–252. In setting the anemometer on the standard tapered pintle, the setscrew should be tightened only moderately, since otherwise the threads may be stripped.

4–253. It is best to operate the indicator with minimum current needed for signals in order to lessen sparking at contacts.

4–254. The contacts made in 1 minute represent the velocity of the wind in miles per hour. The correction to be applied is plus 1 mile for winds up to 35 miles. For winds above 35, the indications may be accepted for the present without correction, although it should be stated that it has not been tested above 57 m. p. h. for corrections.

4–255. Wind Vane.—The wind vanes, either with or without the contacts, have a pivot bearing at the bottom end of a vertical axis which turns in a recess made in a ½-inch pipe plug at the lower end of a ½-inch pipe. Reoiling is required at intervals of about 6 months. This is accomplished by removing the wind-vane assembly from the support, then drawing the wind-vane axis (made of ⅜-inch steel rod) out of the inclosing ½-inch pipe, thoroughly washing out the pipe with gasoline, draining and drying, and then reoiling with an amount of light engine oil sufficient to bring the oil level to the upper bearing after the axis is replaced. Each bearing first sent out for installation is accompanied by a bottle containing just enough oil to lubricate the bearing.

4–256. Four-contact Wind-vane Bearings.—Care will be used to keep the lubricating oil away from the contact springs or the upper cam, for in cold weather such oil acts as an insulator and will prevent the current flow. If oil should accidentally be spilled on the contacting members it should be washed off with gasoline.

4–257. Eight-contact Wind-vane Bearing and Nine-light Indicator.—The bearing contacts have been adjusted to the proper distance at the factory and, ordinarily, should not be changed. If, however, it should be found that a contact does not close, the small adjusting screw should be turned in until the gap is equal to that of the other contacts. Extreme care should be used not to bend or displace the contact springs.

4–258. For inspection or renewal of electric lamps, remove dial by straight pull. When replacing, be sure the alignment pin in bottom of indicator enters slot in bezel, then push until the latch buttons enter the locking groove.

4–259. Lamps are of the bayonet type, Mazda No. 64, double contact, 3 c. p., 6–8 volts; or in certain indicators Mazda lamps No. 68 are used instead, 12–16 volts. These latter are slowly being replaced. They are removed from the socket by pressing slightly and turning to the left.

4–260. Transformer and buzzer are nonadjustable, and in case of trouble should be replaced by new units.

4–261. Mercurial Barometers.—Since the lower end of the barometer tube must be always left open, there is the ever-present possibility that air may enter and impair

the vacuum in case the barometer is moved or the level of the mercury in the cistern brought below the open end of the tube. It is important, therefore, that a *mercurial barometer never be moved without authority*, and that no adjustments be made to it other than such as are required to make the observations. A mercurial barometer should not be placed on an outside wall unless no other location can be had. If such location is necessary, a board of insulating material should be placed next to the wall, and the barometer board should be spaced an inch or so from it by means of two horizontal strips of wood in order that the air of the room may circulate back of the barometer board.

4–262. Instrumental Correction.—Each mercurial barometer is compared with the Weather Bureau substandard in the Central Office, and the correction necessary to make it agree with the substandard is furnished with it. Readings used as a basis for the correction are made with the ivory point just touching the mercury in the cistern, and with the front and rear sighting edges of the part that carries the vernier just grazing the top of the curve of the meniscus. Obviously the same method of reading must be followed at station to make this correction applicable.

4–263. Cleaning and Handling Barometers.—At many airport stations two barometers are maintained, side by side—one known as station barometer for daily use, the other known as extra barometer for reference purpose and for emergency use. The extra barometer serves its reference purpose best in proportion as it is permitted to remain but little disturbed through the years. It is best that it be not cleaned more often than necessary. It will remain clean for a longer time if, when not in use, the mercury in the cistern is raised approximately to the top of the glass ring. Only in emergency should both station and extra barometer be cleaned without the intervention of at least several months' time.

4–264. Because of the large effect of temperature on the indications, caution should be observed to avoid artificial heating, such as would be caused by allowing an electric lamp to burn close to the instrument. Illumination of the background is possible with the lamp well away. Temperature correction tables are based upon the assumption of a uniform temperature throughout the entire instrument.

4–265. Mercurial barometers should be unpacked and placed in operating position only by experienced personnel. In case one is received in the absence of experienced personnel it should be examined to see that the shipment has been handled with care and then kept lying flat in the packing box until an inspector arrives.

4–266. Correction Cards and Tables.—As soon as the elevation and latitude, etc., of the station (WB Form 1058) is furnished the Central Office, a card (WB Form 1059), giving the corrections that must be applied to the readings, is furnished from the instrument division. A card (WB Form 1080), giving the correction for temperature applicable to a mercurial barometer, is available on requisition. At some stations local officials construct a table in which these two are combined for convenience.

4–267. Instructions for Reading a Mercurial Barometer.—1. Read the attached thermometer to the nearest half degree. Enter the readings on the record as 71.0°, 72.5°, etc.

2. Turn the milled-head adjusting screw, which projects out of the barometer at the bottom of the cistern, slowly until the surface of the mercury in the cistern just touches the ivory point. In a newly cleaned barometer this contact can be observed by noting the meeting of the ivory point with its reflected image, or by a slight dimple in the mercury surface. In case the mercury surface has become oxidized, the correct position can best be determined by sighting across the mercury surface against a white glass sometimes built into the barometer; also for these operations, an electric hand lamp or a flashlight is nearly indispensable.

3. Tap the barometer case smartly with the finger in the neighborhood of the meniscus. This tapping improves the evenness of distribution of the mercury at the top of the column.

4. Turn the vernier adjustment by means of the milled-head screw projecting from the right of the case until the line of sight across the front and rear sighting edges *just cuts off the light from across the extreme summit of the meniscus*. A white background is essential. White paper serves well if renewed occasionally.

5. Read the height of the column. Inches and tenths are taken from the main scale; the hundredths are taken from the vernier by selecting on the vernier the

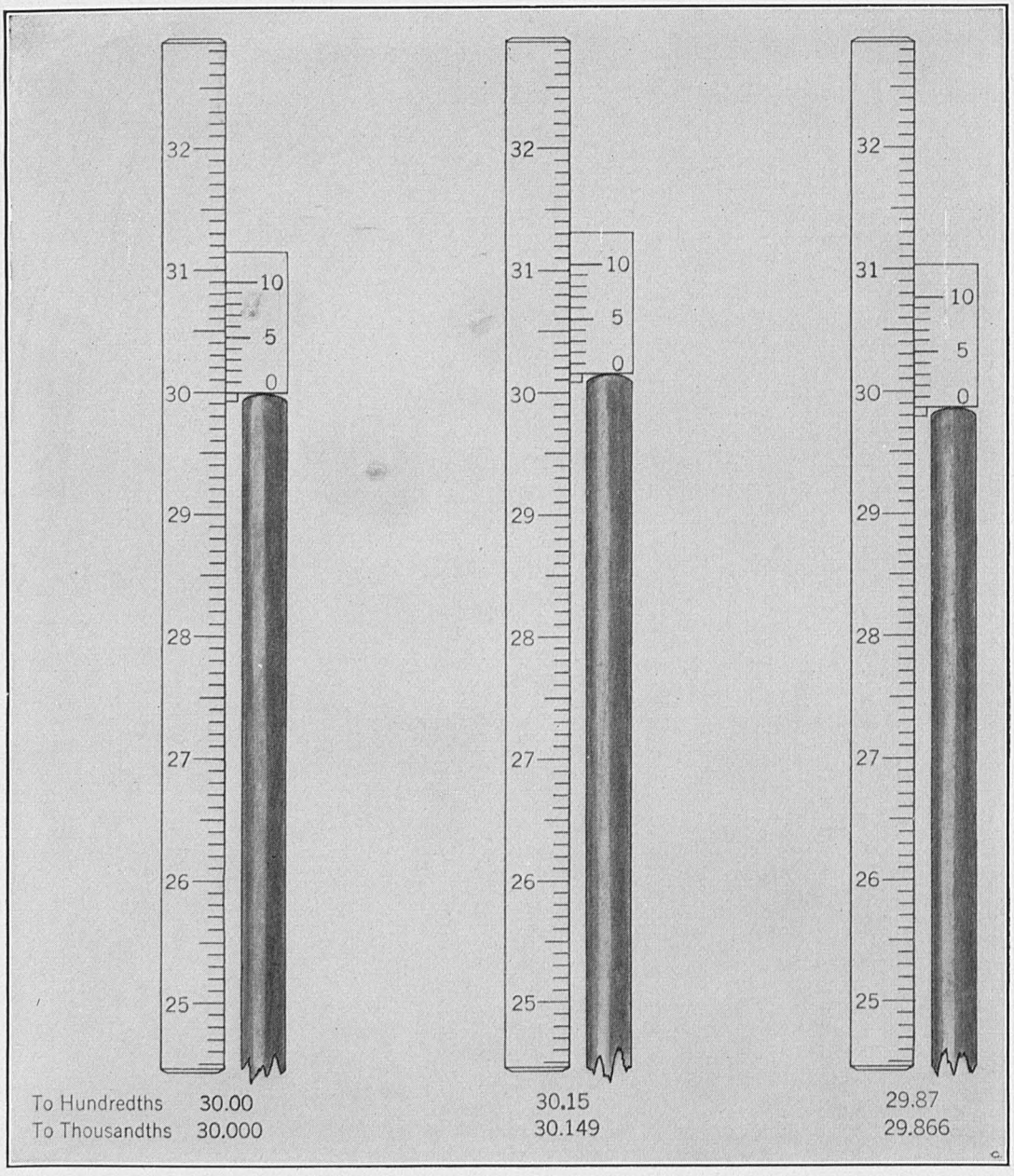


FIGURE 28.—Examples of vernier settings when reading a mercurial barometer.

graduation that most nearly coincides with or matches a line on the main scale. When readings to thousandths of an inch are made, the third decimal figure is estimated from the vernier. Examples are shown in figure 28.

4–268. Mounting Barometers, Verticality.—Mercurial barometers should hang plumb. Because buildings may settle, it is well to check them occasionally for plumbness. Because of the possibility of a barometer getting out of plumb, differences of view exist as to the wisdom of furnishing centering screws, but their advantage in holding the barometer steady for readings has been considered sufficient to warrant supplying them in most Weather Bureau boxes and boards. To center the barometer, advance the three screws until they almost touch the cistern. The amount by which they fall short of touching may be determined by sighting between the end of the screw and the cistern against a slip of white paper. After all screws have been thus adjusted complete the clamping by alternately advancing each screw by the same fraction of a turn. Thereafter the instrument may be loosened, if desired, by backing out only one of the three screws.

4–269. Aneroid Barometers.—Aneroids quite often become inaccurate with lapse of time, and therefore require occasional comparison with a mercury barometer. This will be done by a Weather Bureau official who will visit the airway station, carrying a barometer with him for comparisons and redetermination of the correction. The airway observer will make no adjustments. If the barometer readings are believed to be in error, report should be made to the supervising Weather Bureau office and appropriate action will be taken.

4–270. Barographs.—*Kind of ink.*—The pen should be filled with a special ink provided by the Weather Bureau for instruments of this sort (and no other). Upon request the proper brand of ink will be furnished to airway observers by the general supervising station. Other Weather Bureau stations may requisition the same from the Central Office. The ink may be started flowing by drawing a piece of smooth writing-paper, free from lint, carefully between the points so as to wet the inside faces. Care should be taken to see that the points are not bent or deformed in the operation and that no particles of the paper are caught between the points. Ink should not be spread over the outer surface of the pen or pen arm since such a surplus of ink tends to collect dust and dirt and eventually affects the precision of the record obtained. Enough ink, however, should be placed in the pen when changing forms to last for the entire period of the record. This avoids disturbing the record with the possible resulting change in the correction of the trace to the true barometric pressure due in part to the change in the weight of the ink in the pen.

4–271. Choice of Barograph Charts.—For barographs with 1 to 1 scale, use WB Form 1068 for 0–720-foot barometer elevation; WB Form 1068A for 1,200–1,650-foot elevation, and WB Form 1068B for all other elevations. For the open-scale barograph, use WB Forms 1068C and D, as given in table below.

4–272. For the 1 to 1 scale barograph WB Form 1068B has no pressure ordinate numbers, it being intended that the desired numbers should be put on in ink by the observer. These numbers should be written at the intersections of the noon time lines with the 10th, 20th, 30th, 40th, and 50th horizontal lines, counting from the bottom line of the sheet. On the lines for which the pressures end in the decimal fraction .50, the numeral 5 should be written. On those lines for which the pressures end in the decimal fraction .00, the number without the decimal fraction will be written. For example, if the elevation of the station barometer to the nearest whole foot (as obtained from the elevation given to hundredths or thousandths of a foot by use of the Weather Bureau rule for discarding decimals) is 1,670 feet, WB Form 1068B would be used and the figures 28 would be written at the intersections of the 30th horizontal line from the bottom (the midway isobar) with the noon time lines. The figure 5 would be written on the 20th and 40th isobars, the figures 27 would be written on the 10th isobar from the bottom and the figures 29 would be written on the 50th isobar from the bottom.

4–273. WB Form 1068C for open-scale barographs has only the decimal fraction part of the pressure ordinate numbers printed on them; it being intended that the remainder of these numbers shall be filled in with pen and ink. WB Form 1068C has the decimal-fraction part of the pressure ordinate numbers printed on it, so that if a horizontal line were drawn midway between the top and bottom isobars it would have

a pressure ordinate number ending in the decimal fraction .25 assigned to it. WB Form 1068D has the decimal fraction part of the pressure-ordinate numbers printed on it, so that this horizontal line would have a pressure-ordinate number ending in the decimal fraction .75 assigned to it. The type of chart to be used at a given station will be determined in accordance with the following table:

Elevation of station barometer (feet)	Number of form to be used	Midway isobar pressure	Elevation of station barometer (feet)	Number of form to be used	Midway isobar pressure
0–30	1068C	30. 25	2860–3367	1068D	26. 75
31–489	1068D	29. 75	3368–3894	1068C	26. 25
490–952	1068C	29. 25	3895–4430	1068D	25. 75
953–1515	1068D	28. 75	4431–4975	1068C	25. 25
1516–1879	1068C	28. 25	4976–5536	1068D	24. 75
1880–2360	1068D	27. 75	5537–6121	1068C	24. 25
2361–2859	1068C	27. 25	6122–6710	1068D	23. 75

4–274. Entry of Mercurial Barometer Station Pressure.—The station pressure as obtained from reading the mercurial barometer should be entered on the sheet in ink just above the approximate position of the pen where the record is started (near the left-hand margin). The corresponding mercurial barometer station pressure should also be entered immediately above the end of the trace after the sheet has been removed. Stations equipped with a barograph but with no mercurial barometer will enter "No mercurial barometer" on the face of each sheet in the upper left-hand corner, together with such entries as are required by paragraphs 4–284, 4–285, and 4–287 following.

4–275. Adjustment of Pen Reading to Mercurial Barometer Station Pressure.—The pen reading should be made to agree approximately with the corresponding mercurial-barometer station pressure by either properly adjusting a knurled head screw on top of the instrument or by adjusting a screw underneath the base of the instrument—as required for the instrument with 1 to 1 scale. In case it is necessary to make the latter type of adjustment, the barograph should be placed with the proper end projecting over the edge of a table and the screw should be turned by the use of the small end of the clock key furnished with the instrument.

4–276. Trimming Sheets.—Although an effort has been made to have the sheets trimmed, except at one end, to fit the barograph cylinders exactly, it will be found that, in many cases, the sheets need trimming on the lower edge since proper trimming of these sheets is difficult to accomplish in great numbers. Observers should, therefore, examine each sheet, and, if necessary, trim it to the correct dimensions as indicated by marginal lines, which may be seen near the edges of the imperfect sheets. (Note that this marginal line is never the bottom coordinate line, but it is always a line a little below the bottom coordinate line.) The left-hand end of the chart will not be trimmed but will be reserved for use in binding. If a metal straightedge is available, it will be found that the necessary trimming can be accomplished with greater ease and accuracy by placing the straightedge on the main part of the sheet and then cutting off the unwanted portion with a fairly sharp knife or razor blade.

4–277. Winding the Clock.—The clock within the cylinder should be wound between the time of removing the cylinder from the barograph and placing the sheet on the cylinder. It should be rewound thereafter whenever the sheet is changed. Precautions should be taken not to wind the clock too tight. It is possible to pull the end out of the main spring.

4–278. Adjusting Clocks for Gain or Loss of Time.—Clocks consistently gaining or losing time may be adjusted through the small inspection hole in the top of the cylinder. It is preferable that such adjustments be made at the time of changing sheets.

4–279. Placing Sheet on Cylinder.—The sheet, once trimmed, will be placed on the barograph cylinder so that it fits the cylinder tightly and its bottom edge is in contact with the flange at the bottom of the cylinder *all the way around.* If the sheet has been trimmed properly the ends of the horizontal coordinate lines will match after the sheet has been placed on the cylinder in this manner. Should they fail to do so, the sheet should be taken off and retrimmed. It should then be replaced on the cylinder so that the ends of the horizontal lines do match and so that the bottom coordinate line is the usual distance from the flange of the cylinder.

4–280. Adjusting Pen Reading for Time.—After the clock has been wound and placed on the barograph, the cylinder should be turned forcibly either one way or the other so that the pen, if put on the sheet, would contact the sheet at a point a little to the right of the proper time line. The cylinder should then be turned in a counter-clockwise direction (as viewed from above) until the pen reads correctly with respect to time.

4–281. Elimination of Frictional Effects.—After the pen has been placed in contact with the sheet, the barograph should be jarred lightly in order to overcome any frictional effects that may be preventing the various parts and levers from settling into their normal positions. This may be done by striking the palm of the hand on the table or shelf upon which the instrument rests.

4–282. Avoiding Loss of Record.—Whenever an observation is taken, the observer should see that the clock is running and that the ink is flowing properly. If a break or unusual discontinuity occurs in the record which cannot be ascribed to actual pressure variations, a note explaining the cause thereof should be written on the face of the sheet just above the break or discontinuity.

4–283. Making Time Check Lines.—After the barograph is put in operation, a time-check line of not over one-eighth of an inch in length will be made at a given time each day by touching the pen arm or by lightly jarring the instrument in the manner described in paragraph 4–281. It is preferred that the time-check line be made at noon, but if more convenient, this time-check will be made at the time of the 7:30 a. m., eastern standard time observation.

4–284. Recording Time of Making the Check Line.—The time, to the nearest minute, at which the pen is usually touched will be indicated on the face of the *first* sheet for each month. If the pen is touched more than 5 minutes from the regular time, a note placed just above the check line will be made stating the actual time of the check.

4–285. Labelling Sheets.—The name of the station, the dates of the beginning and end of the record contained on the sheet, and the standard of time on which the records are made (as 75th meridian time, 90th meridian time, etc.) will be written on it in ink. This will be done in the upper left-hand corner of the space on the sheet covered by the coordinate lines, except when the trace interferes. Under the latter circumstance, the data will be entered below the trace on the left-hand part of the sheet. The day of the month will also be put on in ink immediately above the noon-time line of each day's record.

4–286. Dates for Changing Sheets.—If the cylinder of the barograph makes a complete revolution every 7 days, the sheets should be changed on the 1st, 8th, 15th, 22d, and 29th of each month. If the cylinder revolves once in every 4 days, the sheets should be changed on the 1st, 5th, 9th, 13th, 17th, 21st, 25th, and 29th of each month. The time required for a complete revolution of the cylinder may easily be determined by noting the number of days of record provided for on the sheets furnished for the instrument.

4–287. Lifting Pen From Sheet Prior to Removing Cylinder.—Care should always be taken to see that the pen is lifted from the sheet before any attempt is made to remove the cylinder from the barograph. A lever integral with the instrument is provided for this purpose. The time of changing should be entered at the point where the pen is lifted from the sheet.

4–288. Avoiding Smearing Ink in Removing Sheets.—In removing the sheet from the cylinder, the latter portion of the record may not be thoroughly dry. Observers

4-279. PLACING SHEET ON CYLINDER.—The sheet, once trimmed, will be placed on the barograph cylinder so that it fits the cylinder tightly and its bottom edge is in contact with the flange at the bottom of the cylinder all the way around. If the sheet has been trimmed properly the ends of the horizontal coordinate lines will match after the sheet has been placed on the cylinder in this manner. Should they fail to do so, the sheet should be taken off and retrimmed. It should then be replaced on the cylinder so that the ends of the horizontal lines do match and so that the bottom coordinate line is the usual distance from the flange of the cylinder.

4-280. ADJUSTING PEN READING FOR TIME.—After the clock has been wound and placed on the barograph, the cylinder should be turned forcibly either one way or the other so that the pen, if put on the sheet, would contact the sheet at a point a little to the right of the proper time line. The cylinder should then be turned in a counter-clockwise direction (as viewed from above) until the pen reads correctly with respect to time.

4-281. ELIMINATION OF FRICTIONAL EFFECTS.—After the pen has been placed in contact with the sheet, the barograph should be tapped lightly in order to overcome any frictional effects that may be preventing the various parts and levers from settling into their normal positions. It may be tapped also at the time a pressure reading is taken. This may be done by allowing a pencil to drop lightly, eraser end down, on the top of the case.

4-282. AVOIDING LOSS OF RECORD.—Whenever an observation is taken, the observer should see that the clock is running and that the ink is flowing properly. If a break or unusual discontinuity occurs in the record which cannot be ascribed to actual pressure variations, a note explaining the cause thereof should be written on the face of the sheet just above the break or discontinuity.

4-283. MAKING TIME-CHECK LINES.—After the barograph is put into operation, a time-check line of about one-eighth of an inch in length will be made at each six-hourly observation at the time the correction to the barograph is determined from reading of mercurial barometer. Using the vertical pen release rod as a guide, rest one end of pencil on the pen arm, the other end on the finger so as to cause the pencil to depress the pen because of its weight. Care must be taken not to exert any force on the pencil which will be transmitted to the pen arm. On removing the pencil the pen arm should slowly come back to its original position. If there is excessive friction or play in the pivots, a jog in the trace may result. Depending upon the response of the instrument to the "pencil test," the observer may judge its sensitivity. Consideration must be given to the behaviour of the instrument during winter months when the dash pot liquid may become so cold that the effect of the depression of the pen arm may be noticeable for several hours. In such cases the observer may omit making the time check.

4-284. RECORDING TIME OF MAKING THE CHECK LINE.—The time, to the nearest minute, at which the pen is usually touched will be indicated on the face of the first sheet for each month. If the pen is touched more than 5 minutes from the regular time, a note placed just above the check line will be made stating the actual time of the check.

4-285. LABELLING SHEETS.—The name of the station, the dates of the beginning and end of the record contained on the sheet, and the standard of time on which the records are made (as 75th meridian time, 90th meridian time, etc.) will be written on it in ink. This will be done in the upper left-hand corner of the space on the sheet covered by the coordinate lines, except when the trace interferes. Under the latter circumstance, the data will be entered below the trace on the left-hand part of the sheet. The day of the month will also be put on in ink immediately above the noontime line of each day's record.

4-286. DATES FOR CHANGING SHEETS.—If the cylinder of the barograph makes a complete revolution every 7 days, the sheets should be changed on the 1st, 8th, 15th, 22d, and 29th of each month. If the cylinder revolves once in every 4 days, the sheets should be changed on the 1st, 5th, 9th, 13th, 17th, 21st, 25th, and 29th of each month. The time required for a complete revolution of the cylinder may easily be determined by noting the number of days of record provided for on the sheets furnished for the instrument.

4-287. LIFTING PEN FROM SHEET PRIOR TO REMOVING CYLINDER.—Care should always be taken to see that the pen is lifted from the sheet before any attempt is made to remove the cylinder from the barograph. A lever integral with the instrument is provided for this purpose. The time of changing should be entered at the point where the pen is lifted from the sheet.

4-288. AVOIDING SMEARING INK IN REMOVING SHEETS.—In removing the sheet from the cylinder, the latter portion of the record may not be thoroughly dry. Observers

should, therefore, be careful to avoid smearing the wet ink, and the sheets, after being removed from the cylinder, should be laid aside to dry.

4–289. Disposition of Sheets.—Second-order stations will forward the sheets for each month within 5 days after the end of the month to their general supervising station unless otherwise instructed by that general supervising station. These sheets should be arranged chronologically with the latest sheet at the bottom and fastened together in the center of the left-hand margin; the back of the packet should be marked with the name of the station, month and year, parallel to and about one inch below the fastened margin. The general supervising station or checking station will forward these sheets to "Chief U. S. Weather Bureau, Washington, D. C." with "WB Form 1068, for Climate and Crop Weather Division" written in the lower left-hand corner of the envelope, as soon as practicable. First-order stations will mail these sheets for their own station in the same manner as above except when 6-hourly forms for the station are checked at Elkins, W. Va., in which case, that checking station will forward the barograph trace sheets to Washington.

4–290. Adjusting Pen When it is About to go off Sheet.—When the pressure is such that the record might pass off the edge of the sheet or not be included in the coordinate-line space, the numbering of the lines should be increased or decreased by one and the pen should be adjusted accordingly, i. e., the position of the pen should be changed by 1 inch of pressure either one way or the other. This adjustment is to be made in the manner prescribed in paragraph 4–275.

4–291. Having Clock Cleaned or Repaired.—In case the clock fails to run after proper winding, it should be taken to a local jeweler for repairing and cleaning. When the bill for such work is rendered to an airway station, the words "Work completed," followed by the date and signature of the observer, should be written on it in ink, and it should be forwarded to the official in charge of the general supervising station. The latter official will, in turn, voucher it with cost charged to Circular I, paragraph 4, and forward in the usual manner to "Chief U. S. Weather Bureau, Washington, D. C.," with "Fiscal Section" written in the lower left-hand corner of the envelope. Bills for such work done on barographs at other stations will be handled as provided for in paragraph 99 of station regulations. Clocks which have stopped because of exposure to low temperatures will run again as a rule when warmed to normal room temperature. For emergency replacements by airway inspectors, a few clock and cylinder assemblies are available on stores requisition.

4–292. Preserving Effective Pen-Arm Length.—The term "effective pen-arm length" is here used to denote the distance of the point of the pen from the horizontal axis about which the pen arm moves as the pressure rises and falls, this distance being measured when the pen point is in contact with the cylinder, and when the pen is on the midway isobar. Such a distance is obviously changed by bending the pen or pen arm in any way. Hence, great care should be taken to avoid any bending of this nature and to keep the distance so defined exactly the same as it was when the instrument came from the factory. The effective pen-arm length is printed on the charts.

4–293. Cleaning Pen.—Whenever the pen fails to make a fine, clear line, it should be removed from the pen arm and cleaned. Before removing it, its exact distance from the axis about which it revolves should be noted so that its original position may be duplicated when it is replaced. Its removal may then be accomplished by holding the pen arm with the right hand and pulling the pen horizontally to the left with the left hand. It should then be thoroughly washed in water. Any dried ink remaining on it after washing should be removed by (1) scraping with a knife and (2) rewashing it before replacing it on the pen arm. Attention is again called to the fact that care should be taken to avoid bending the pen or pen arm in this process as explained in paragraph 4–292.

4–294. Worn Pens.—Whenever a pen becomes worn to the extent that it no longer makes the fine, clear record that it should, a replacement pen, if not on hand, should be ordered. When this occurs on stations at which there are no commissioned personnel, the observers in charge will notify their general supervising stations, from which replacement pens will be forwarded. Commissioned Weather Bureau personnel may sharpen pens by carefully rubbing the slanting under edge on a fine abrasive stone.

4-295. Replacing Diluted Ink.—The ink usually used contains considerable glycerine, which is hygroscopic. Because of the absorption of water vapor, the ink sometimes becomes diluted and the trace line does not have its proper deep color. On such occasions the diluted ink should be removed and replaced by fresh ink. The ink supply should be kept stoppered.

4-296. Sheets with Imperfect Records.—These sheets should not be destroyed under any circumstance, but should be preserved and forwarded in the regular manner.

4-297. Periodic Inspection for Abrupt Discontinuities in Record.—First-order Weather Bureau stations will periodically examine their own barograph traces, as well as those received from second-order stations, to determine whether abrupt discontinuities in the record are in evidence. Since the presence of such discontinuities may be an indication of excessive friction in the pen-arm mechanism, the instrument should be examined with this fact in mind. If trouble of this nature is found, it should be corrected by airway inspectors or qualified personnel of first-order stations, if practicable. Otherwise, the trouble should be called to the attention of the Central Office and the proper steps to remedy it will be taken.

4-298. Oiling.—Due to the fact that excessive oil on the pivots of the mechanism impairs the performance and accuracy of the instrument, *no oiling will be done by the observer*. The necessary oiling of the clock mechanism will be done by a jeweler only when the clock is cleaned or repaired.

4-299. Other Pen Arm Mechanism Adjustments.—The observer should make no other adjustments of the mechanism operating the pen arm than those described in paragraph 4-275. In the case of open-scale barographs, however, dash pots are used for damping pen-arm oscillations. If this dash pot needs any attention, special instructions will be furnished.

4-300. Use of Dash Pot.—A dash pot will be found on the base of the open-scale barograph. It is simply a cylindrical cup in which a dasher of slightly smaller diameter attached to the train of levers moves up and down with changes of pressure. The instrument will function without any liquid in the dash pot; but where accidental changes of pressure must be reckoned with, such as are occasioned by slamming doors or by gusts from an open window, or where vibrations or jars occur, a suitable liquid, is inserted in the dash pot for the purpose of checking sudden changes in motion and at the same time permitting slow ones to take place unimpeded. Some cases of instrument failure have been traced to an air bubble under the dasher. The formation of such an air bubble can be avoided by removing the dasher and cover before filling the dashpot.

4-301. Adjusting Dash Pot.—In case the dash pot needs adjusting, proceed as follows:

(*a*) Turn the large milled-head adjusting nut to the left to bring pen arm nearer lower edge of record sheet.

(*b*) Lift dash pot cover from dash pot, and hitch it temporarily to pen-arm shaft. A piece of strong thread may be threaded through the hole in dash pot cover for this purpose.

(*c*) Fill dash pot within about one-half inch of top with the special liquid shipped with the barograph.

(*d*) Replace dash pot cover and adjust pen arm to correct pressure. The dasher must be either completely covered at all times or completely free. If it should at any time coincide with the surface of the liquid, surface tension would prevent proper functioning of the barograph.

4-302. The bottle of liquid supplied with the instrument is about twice the amount required for a filling. The surplus should be retained for future requirements. Owing to the well-known hygroscopic nature of such liquids, the dash pot may in time overflow through absorption of atmospheric water. In such case the level may be lowered by removing part of the liquid with a medicine dropper.

4-303. Thermometers and Shelters.—Thermometers will be kept clean and the graduations in the stems refilled with black pigment when required, which latter attention will usually be given by Weather Bureau inspectors.

4-304. The shelter and wooden support will be repainted occasionally to keep them white and clean, and protected against decay. Galvanized metal supports will be

painted only when corrosion is becoming evident, when a coat of red lead will be applied, followed by a top coat of aluminum.

4-305. A small magnifying glass is often a help in reading the thermometer. Flashlights must be employed for night observations, unless the shelter is electrically lighted, which convenience is usually provided only for the larger shelters.

4-306. Care of Clinometers.—To avoid rough handling and damage of the clinometers, observers will see that the instrument is used with proper care, and that it is replaced in the box provided for it after each observation. The objective end should remain free from dents or bending, and the cross wires always secure and unbroken. Defective clinometers should be promptly reported to the supervising official, in order that repairs or replacement can be made without delay. It is considered good practice to fasten the clinometer box to a wall at a convenient location, with the table to reduce clinometer readings to ceiling heights attached to the inside of the box cover.

4-307. Care of Ceiling-light Projectors.—These will be kept clean, the projector mirror, cover glass, and the lamp being cleaned at least *once each week* so that the light beam will have maximum intensity. Cover glass and the exposed (concave) side of reflectors should be kept clean and dry by the methods customarily employed in cleaning glass. Ordinarily wiping off the surfaces with a soft, damp cloth will suffice, but, if oil or grease should be present, a little soap may be used if subsequently removed with clean water. Abrasive material should never be used. A ¼-inch hole, drilled through the center of the reflector with a corresponding hole through the drum, is provided to drain water which might gain entrance to the projector and collect in the reflector. Leakage of water into the projector around the cover glass has been prevented by use of calking compound when gaskets are not easily available. During periods in which frozen precipitation of any type collects on the lens, this, if possible, should be cleaned off before each ceiling measurement is made, and the observer is cautioned not to leave the ceiling light burning to melt such collection on the lens. In addition to the foregoing, see that the voltage of the lamp matches the current voltage at the projector socket, the lamp is kept in focus and is lighted only long enough to take the observation.

4-308. Repairs.—The following projector parts are stocked at and may be obtained from the Central Office for Westinghouse and Crouse-Hinds 12-volt projectors: Westinghouse—cover glass, secondary reflectors, reflector- mirrors and transformers; Crouse-Hinds—transformers and secondary reflectors. In addition, the Central Office has a contract for procuring any parts for Westinghouse projectors having serial numbers from 481 to 665, inclusive, and in most cases is able to obtain parts for any projectors in service more quickly than private contractors. In ordering parts for projectors stores requisitions should be submitted and the WB serial number of the projector, manufacturer's name, and a description and dimensions of each part needed as well as the manufacturer's serial number should be given. When major repair work becomes necessary it will probably be best to contact some trustworthy local concern, and if the contractor is able to procure the necessary repair parts locally, this procedure may be followed rather than ordering through the Central Office. Expenditures must be authorized in the prescribed manner before any such work is performed. Mirrors are usually resilvered by local contractors at a nominal cost.

4-309. Painting of Projector.—Aluminum paint is considered best for all parts except the interior of the drum, where only dead black should be used. Pipe supports for the projector should be repainted, when needed, with aluminum paint.

4-310. Miscellaneous; Reporting Broken or Defective Instruments.—In addition to the foregoing the observer will watch his equipment to see that it is maintained in good condition, reporting breakages and needs for repairs or replacements to the supervising Weather Bureau office in ample season to forestall break-downs. Instruments that are suspected of being defective should in particular be reported. Wind-instrument supports will need repainting occasionally. Extra lamps for projector and wind-direction and velocity indicator will be kept on hand.

4-311. Ordinary precautions are required in the use of instruments, and observers are requested to use every reasonable care to avoid accidents, breakage, and loss.

4–312. Instructions for the Installation of a Psychrometer Fan in the Cotton-region Instrument Shelter.—Materials furnished are as follows:

1 fan, psychrometer, assembly.
1 iron screw hook, No. 9, on which to hang psychrometer.
4 iron wood screws, 2½-inch, No. 10, flat-head, for attaching fan assembly to shelter.

4–313. To install the device, first whittle slots in the center of the third and fourth louvres from the bottom at the right-hand side of the shelter, with care not to split the louvres. The slots should be just deep enough to allow for the insertion of the handle shaft and free motion for both the handle and fan hub. Next, hold assembly in position and spot the four holes for 2½-inch, No. 10 screws, which attach assembly to shelter. Attach assembly by means of wood screws and attach handle to hub by means of nut. A special brass shaft extension is included in some cases. Be sure that both handle and fan shaft move free. Insert screw hook on which to hang the psychrometer, which is, of course, used without the handle on cross bars 7½ inches from right-hand cross-bar support. As planned, the pair of thermometers may be readily swung forward for the purpose of wetting the wet bulb. The fan needs to be operated at only moderate speed. A small quantity of light machine oil, such as is furnished for the anemometer, should be applied to the fan bearings occasionally. The fan blades are properly shaped, before issue, to cause an ample air movement past the psychrometer, about 15 feet per second. The fan blades, however, may be readily shaped to give maximum air movement by twisting them with the fingers.

4–314. Observer's Time-signaller.—In an effort to meet the need for a mechanical reminder to assist observers in the many observations required, a signal clock has been designed and constructed in the Instrument Division of the Central Office specifically for the purpose indicated.

4–315. The clock proper, a Seth Thomas No. 10, 8-day movement, well known for ruggedness of construction, has had the customary hands removed and a brass disc wheel about 2½ inches in diameter placed upon the arbor usually occupied by the minute hand. This wheel has 12 screw sockets, equally spaced, about its circumference, and since the wheel makes a complete turn in 1 hour, it will be apparent upon examination that if screws were inserted in all the sockets a contact would be made every 5 minutes. However, in operation only the screws necessary to accomplish the number of desired contacts are to be inserted. Several extra screws are provided in a rack attached to the door. The contact maker is the standard one-sixtieth mile contact from the anemometer, chosen in the interest of subsequent servicing.

4–316. The brass disc may be rotated by hand without injury to the clock, just as the hand is set. Operating current should be kept to the minimum to lessen sparking. A condenser across the terminals is an additional aid in this respect.

4–317. No buzzer nor battery are supplied since these are frequently available or may easily be procured locally.

4–318. It is not to be expected that this type of clock will equal a pendulum clock as a timekeeper.

4–319. Instructions for Installation and Operation of Weighing-type Rain and Snow Gages.—Recording gages should be mounted on a firm base and at a height such that the bottom of the inspection door is 24 inches above the ground. Insofar as is practicable, the inspection door should face away from the prevailing wind. It is imperative that the rain gage be solidly mounted to reduce vibration and consequent distortion of the pen trace. In general, gages will be installed and maintained by inspectors equipped for the work. If it becomes necessary for station personnel to make an installation, detailed instructions will be issued by the supervising office. Gages are to be checked occasionally with calibration weights, each weight being equivalent to one inch of rainfall. Field inspectors are furnished with these weights.

4–320. Duties of station personnel will be generally confined to changing charts and making visual observations of precipitation for 6-hourly reports, instructions for which follow:

(*a*) *Chart change.*—After removing cover, and before changing charts, note whether or not the clock is running; if not running, rotate the clock cylinder through a few degrees of arc so as to mark the position of the pen; if running, move bucket up and down slightly so that the pen will make a time-check line. Then, in either case, swing pen away from chart, empty bucket, change charts, and note on them the time of change. When replacing clock, turn it backwards to take up slack in gears and adjust pen to zero by turning the red knurled knob. Before leaving gage, the observer should see that the clock is running and that the ink is flowing properly. Ordinarily, the bucket will be emptied only at the time of chart change, but during periods of heavy precipitation, frequent inspections should be made so that the bucket is not allowed to overflow. Overflow from the bucket will damage the clock and probably destroy the record, in addition to losing the record from the time of overflow. The bucket may be emptied and the pen returned to zero without removing the clock.

(*b*) *Visual observations.*—Observations of accumulated precipitation may be made without removing the outside cover by reading through the inspection door the recorded amount and subtracting from this reading the amount noted at the previous observation. In order to obtain satisfactory readings there are a few precautions which must be followed. The chart must be placed so that its lower edge is flush with the bottom flange of the clock cylinder. During periods of high winds, a "pumping action" on the bucket in the gage may cause rapid fluctuations of the pen. This movement may be eliminated sufficiently to permit an eye reading by placing a board or other object over the top of the gage.

4–321. If necessary to use a calcium chloride solution during the winter months, the salt and oil will be furnished by the inspector or the supervising station, together with detailed instructions which will be appropriate to the temperatures to be expected.

4–322. When the bucket is charged with a solution of calcium chloride and has a thin protective covering of oil to eliminate evaporation or absorption of moisture, the mixture should be stirred occasionally during periods of precipitation to insure thorough mixing. The bucket should be emptied only when necessary rather than at each chart change.

APPENDIX I.—SUNRISE AND SUNSET DATA

The following tables 1 and 2 are provided for determining the approximate time of sunrise and sunset at points in the continental United States. The values of sunrise and sunset given in table 1 are in hours and minutes mean solar time. Table 2 is furnished for reducing mean solar time to local standard time.

EXPLANATION OF TABLE 1.—MEAN SOLAR TIME OF SUNRISE AND SUNSET, LATITUDE 20° TO 50° NORTH

The time of sunrise and sunset at a given place expressed in mean solar time varies from day to day throughout the year, depending principally on the latitude of the place and upon the declination of the sun on the given date. (The declination of the sun is its angular distance north or south from the plane of the equator.) Variations in the equation of time, apparent diameter of the sun, and the atmospheric refraction at the points of sunrise and sunset also affect the final result. These quantities, as well as the solar declination, do not have the same values on corresponding days from year to year, and it is, therefore, impracticable to give in any general table the exact times of sunrise and sunset, day by day.

The following table, which gives the mean solar time of sunrise and sunset for every fourth day of the month, was determined from the values of the solar declination and the equations of time given in the Nautical Almanac for the year 1899. In extreme cases the times of sunrise and sunset for any certain date for a given year may differ by 2 or 3 minutes from the times shown in the table. The table, therefore, gives results which are very close to the average over a number of years and may be accepted as approximately correct for all years. The values given in the table are computed for an ideal sea horizon. This is a condition only approximately realized at land surfaces and far from fulfilled in hilly and mountainous localities. The elevation of the observer above ground also determines the actual times of sunrise and sunset. Where the most exact results are necessary, these factors would also have to be taken into consideration.

TABLE 1.—*Sunrise and sunset (mean solar time)*

Date	Lat. 20° N.		Lat. 21° N.		Lat. 22° N.		Lat. 23° N.		Lat. 24° N.		Lat. 25° N.		Lat. 26° N.		Lat. 27° N.		Lat. 28° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Jan. 1	6 35	5 32	6 37	5 30	6 39	5 28	6 41	5 26	6 43	5 24	6 45	5 22	6 48	5 20	6 50	5 18	6 52	5 16
4	6 36	5 34	6 38	5 32	6 40	5 30	6 42	5 28	6 44	5 26	6 46	5 24	6 48	5 22	6 50	5 20	6 53	5 18
8	6 37	5 37	6 39	5 35	6 41	5 33	6 43	5 31	6 45	5 29	6 47	5 27	6 49	5 25	6 51	5 23	6 53	5 21
12	6 38	5 40	6 40	5 37	6 42	5 36	6 43	5 34	6 45	5 32	6 47	5 30	6 49	5 28	6 51	5 26	6 53	5 24
16	6 38	5 42	6 40	5 40	6 42	5 39	6 43	5 37	6 45	5 35	6 47	5 33	6 49	5 31	6 51	5 29	6 53	5 27
20	6 38	5 45	6 40	5 43	6 41	5 41	6 43	5 40	6 45	5 38	6 46	5 36	6 48	5 34	6 50	5 32	6 52	5 30
24	6 37	5 47	6 39	5 46	6 41	5 44	6 42	5 42	6 44	5 41	6 46	5 39	6 47	5 37	6 49	5 36	6 51	5 34
28	6 37	5 50	6 38	5 48	6 40	5 47	6 41	5 45	6 43	5 44	6 44	5 42	6 46	5 40	6 48	5 39	6 49	5 37
Feb. 1	6 36	5 52	6 37	5 50	6 38	5 49	6 40	5 48	6 41	5 47	6 42	5 45	6 44	5 44	6 46	5 42	6 47	5 40
4	6 35	5 53	6 36	5 52	6 37	5 51	6 39	5 50	6 40	5 48	6 41	5 47	6 43	5 46	6 44	5 44	6 46	5 43
8	6 33	5 56	6 34	5 54	6 36	5 53	6 37	5 52	6 38	5 51	6 39	5 50	6 40	5 48	6 42	5 47	6 43	5 46
12	6 31	5 58	6 32	5 57	6 33	5 56	6 34	5 55	6 35	5 54	6 37	5 52	6 38	5 51	6 39	5 50	6 40	5 49
16	6 29	6 00	6 30	5 59	6 31	5 58	6 32	5 57	6 33	5 56	6 34	5 55	6 35	5 54	6 36	5 53	6 37	5 52
20	6 26	6 02	6 27	6 01	6 28	6 00	6 29	5 59	6 30	5 58	6 31	5 57	6 32	5 56	6 32	5 55	6 33	5 54
24	6 23	6 03	6 24	6 03	6 25	6 02	6 26	6 01	6 26	6 00	6 27	6 00	6 28	5 59	6 29	5 58	6 30	5 57
28	6 20	6 05	6 21	6 04	6 22	6 04	6 23	6 03	6 23	6 02	6 24	6 01	6 25	6 01	6 25	6 00	6 26	6 00
Mar. 1	6 20	6 05	6 20	6 05	6 21	6 04	6 22	6 03	6 22	6 03	6 23	6 02	6 24	6 02	6 24	6 01	6 25	6 00
4	6 17	6 06	6 18	6 06	6 18	6 05	6 19	6 05	6 19	6 04	6 20	6 04	6 21	6 03	6 21	6 03	6 22	6 02
8	6 14	6 08	6 14	6 07	6 15	6 07	6 15	6 06	6 16	6 06	6 16	6 06	6 17	6 05	6 17	6 05	6 17	6 04
12	6 11	6 09	6 11	6 09	6 11	6 08	6 12	6 08	6 12	6 08	6 12	6 08	6 12	6 07	6 13	6 07	6 13	6 07
16	6 07	6 10	6 08	6 10	6 08	6 10	6 08	6 10	6 08	6 09	6 08	6 09	6 08	6 09	6 08	6 09	6 08	6 09
20	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11
24	6 00	6 12	6 00	6 12	6 00	6 12	6 00	6 13	6 00	6 13	6 00	6 13	5 59	6 13	5 59	6 13	5 59	6 13
28	5 57	6 14	5 57	6 13	5 56	6 14	5 56	6 14	5 56	6 14	5 56	6 14	5 55	6 15	5 55	6 15	5 55	6 16

TABLE 1.—*Sunrise and sunset (mean solar time)*—Continued

Date	Lat. 20° N.		Lat. 21° N.		Lat. 22° N.		Lat. 23° N.		Lat. 24° N.		Lat. 25° N.		Lat. 26° N.		Lat. 27° N.		Lat. 28° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Apr. 1	5 53	6 14	5 53	6 15	5 53	6 15	5 52	6 16	5 52	6 16	5 52	6 16	5 51	6 17	5 51	6 17	5 50	6 18
4	5 51	6 15	5 50	6 16	5 50	6 16	5 49	6 17	5 49	6 17	5 48	6 18	5 48	6 18	5 47	6 19	5 47	6 19
8	5 47	6 16	5 47	6 17	5 46	6 17	5 46	6 18	5 45	6 19	5 44	6 19	5 44	6 20	5 43	6 21	5 42	6 21
12	5 44	6 17	5 43	6 18	5 43	6 19	5 42	6 20	5 41	6 20	5 40	6 21	5 40	6 22	5 39	6 23	5 38	6 24
16	5 41	6 19	5 40	6 19	5 39	6 20	5 39	6 21	5 38	6 22	5 37	6 23	5 36	6 24	5 35	6 25	5 34	6 26
20	5 38	6 20	5 37	6 21	5 36	6 22	5 35	6 23	5 34	6 24	5 33	6 24	5 32	6 26	5 31	6 27	5 30	6 28
24	5 35	6 21	5 34	6 22	5 33	6 23	5 32	6 24	5 31	6 25	5 30	6 26	5 28	6 28	5 27	6 29	5 26	6 30
28	5 32	6 22	5 31	6 23	5 30	6 25	5 29	6 26	5 28	6 27	5 26	6 28	5 25	6 30	5 24	6 31	5 22	6 32
May 1	5 31	6 23	5 29	6 25	5 28	6 26	5 27	6 27	5 25	6 29	5 24	6 30	5 23	6 31	5 21	6 33	5 20	6 34
4	5 29	6 24	5 28	6 26	5 26	6 27	5 25	6 29	5 23	6 30	5 22	6 32	5 20	6 33	5 19	6 35	5 17	6 36
8	5 27	6 26	5 25	6 28	5 24	6 29	5 22	6 31	5 21	6 32	5 19	6 33	5 18	6 35	5 16	6 37	5 14	6 38
12	5 24	6 27	5 23	6 29	5 22	6 31	5 20	6 32	5 19	6 34	5 17	6 35	5 15	6 37	5 14	6 39	5 12	6 41
16	5 23	6 29	5 22	6 31	5 20	6 32	5 18	6 34	5 17	6 36	5 15	6 37	5 13	6 39	5 11	6 41	5 09	6 43
20	5 22	6 31	5 20	6 32	5 18	6 34	5 17	6 36	5 15	6 38	5 13	6 40	5 11	6 42	5 09	6 43	5 07	6 45
24	5 21	6 32	5 19	6 34	5 17	6 36	5 15	6 38	5 14	6 40	5 12	6 42	5 10	6 44	5 08	6 46	5 06	6 48
28	5 20	6 34	5 18	6 36	5 16	6 38	5 14	6 40	5 13	6 42	5 11	6 44	5 09	6 46	5 06	6 48	5 04	6 50
June 1	5 19	6 36	5 17	6 38	5 16	6 40	5 14	6 42	5 12	6 43	5 10	6 45	5 08	6 48	5 06	6 50	5 04	6 52
4	5 19	6 37	5 17	6 39	5 15	6 41	5 13	6 43	5 11	6 45	5 09	6 47	5 07	6 49	5 05	6 51	5 03	6 54
8	5 20	6 38	5 17	6 40	5 15	6 42	5 13	6 44	5 11	6 46	5 09	6 48	5 07	6 51	5 05	6 53	5 02	6 55
12	5 20	6 39	5 18	6 42	5 16	6 44	5 14	6 46	5 11	6 48	5 09	6 50	5 07	6 52	5 05	6 54	5 03	6 57
16	5 21	6 40	5 18	6 43	5 16	6 45	5 14	6 47	5 12	6 49	5 10	6 51	5 08	6 53	5 05	6 56	5 03	6 58
20	5 21	6 41	5 19	6 43	5 17	6 46	5 15	6 48	5 13	6 50	5 11	6 52	5 08	6 54	5 06	6 57	5 04	6 59
24	5 22	6 42	5 20	6 44	5 18	6 46	5 16	6 48	5 14	6 51	5 12	6 53	5 09	6 55	5 07	6 57	5 05	7 00
28	5 23	6 43	5 21	6 45	5 19	6 47	5 17	6 49	5 15	6 51	5 13	6 53	5 10	6 56	5 08	6 58	5 06	7 00
July 1	5 24	6 43	5 22	6 45	5 20	6 47	5 18	6 50	5 16	6 52	5 13	6 54	5 11	6 56	5 09	6 58	5 07	7 00
4	5 25	6 43	5 23	6 45	5 21	6 48	5 19	6 50	5 17	6 52	5 15	6 54	5 12	6 56	5 10	6 58	5 08	7 00
8	5 26	6 44	5 24	6 46	5 22	6 48	5 20	6 50	5 18	6 52	5 16	6 54	5 14	6 56	5 12	6 58	5 10	7 00
12	5 28	6 43	5 26	6 45	5 24	6 47	5 22	6 49	5 20	6 51	5 18	6 53	5 16	6 55	5 14	6 57	5 12	6 59
16	5 29	6 42	5 27	6 44	5 25	6 46	5 23	6 48	5 22	6 50	5 20	6 52	5 18	6 54	5 15	6 56	5 13	6 58
20	5 31	6 42	5 29	6 43	5 27	6 45	5 25	6 47	5 23	6 49	5 22	6 51	5 20	6 53	5 18	6 55	5 16	6 57
24	5 33	6 40	5 31	6 42	5 29	6 44	5 27	6 45	5 25	6 47	5 24	6 49	5 22	6 51	5 20	6 53	5 18	6 55
28	5 34	6 39	5 32	6 40	5 31	6 42	5 29	6 44	5 27	6 45	5 26	6 47	5 24	6 49	5 22	6 51	5 20	6 52
Aug. 1	5 35	6 37	5 34	6 39	5 32	6 40	5 31	6 42	5 29	6 44	5 28	6 44	5 26	6 46	5 24	6 48	5 22	6 50
4	5 36	6 36	5 35	6 37	5 33	6 39	5 32	6 40	5 30	6 41	5 29	6 43	5 27	6 44	5 26	6 46	5 24	6 48
8	5 38	6 33	5 36	6 35	5 35	6 36	5 33	6 37	5 32	6 39	5 31	6 40	5 29	6 42	5 28	6 43	5 26	6 45
12	5 39	6 31	5 38	6 32	5 36	6 33	5 35	6 35	5 34	6 36	5 32	6 37	5 31	6 39	5 30	6 40	5 28	6 41
16	5 40	6 28	5 39	6 29	5 38	6 30	5 37	6 32	5 36	6 33	5 34	6 34	5 33	6 35	5 32	6 36	5 30	6 38
20	5 41	6 25	5 40	6 26	5 39	6 27	5 38	6 28	5 37	6 29	5 36	6 30	5 35	6 32	5 34	6 33	5 32	6 34
24	5 42	6 22	5 41	6 23	5 40	6 24	5 39	6 25	5 39	6 26	5 38	6 27	5 37	6 28	5 36	6 29	5 34	6 30
28	5 43	6 19	5 42	6 20	5 42	6 21	5 41	6 21	5 40	6 22	5 39	6 23	5 38	6 24	5 37	6 25	5 36	6 26
Sept. 1	5 44	6 16	5 43	6 16	5 43	6 17	5 42	6 18	5 41	6 18	5 40	6 19	5 40	6 20	5 39	6 21	5 38	6 21
4	5 45	6 13	5 44	6 14	5 44	6 14	5 43	6 15	5 43	6 15	5 42	6 16	5 41	6 16	5 41	6 17	5 40	6 18
8	5 46	6 10	5 45	6 10	5 45	6 10	5 44	6 11	5 44	6 11	5 43	6 12	5 43	6 12	5 42	6 13	5 42	6 13
12	5 47	6 06	5 45	6 06	5 46	6 06	5 46	6 07	5 45	6 07	5 45	6 07	5 44	6 08	5 44	6 08	5 44	6 09
16	5 47	6 02	5 46	6 02	5 47	6 03	5 47	6 03	5 46	6 03	5 46	6 04	5 46	6 04	5 46	6 04	5 45	6 04
20	5 48	5 58	5 48	5 59	5 48	5 59	5 48	5 59	5 48	5 59	5 48	5 59	5 48	5 59	5 47	5 59	5 47	5 59
24	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55
28	5 50	5 51	5 50	5 51	5 50	5 51	5 51	5 51	5 51	5 50	5 51	5 50	5 51	5 50	5 51	5 50	5 51	5 50
Oct. 1	5 51	5 49	5 51	5 48	5 51	5 48	5 51	5 48	5 52	5 47	5 52	5 47	5 52	5 47	5 53	5 47	5 53	5 46
4	5 51	5 46	5 52	5 46	5 52	5 45	5 53	5 45	5 53	5 44	5 53	5 44	5 54	5 44	5 54	5 43	5 55	5 43
8	5 53	5 43	5 53	5 42	5 54	5 41	5 54	5 41	5 55	5 40	5 55	5 40	5 56	5 39	5 56	5 39	5 57	5 38
12	5 54	5 39	5 54	5 39	5 55	5 38	5 56	5 37	5 56	5 37	5 57	5 36	5 58	5 35	5 58	5 35	5 59	5 34
16	5 55	5 36	5 56	5 35	5 57	5 35	5 57	5 34	5 58	5 33	5 59	5 32	6 00	5 32	6 00	5 31	6 01	5 30
20	5 56	5 33	5 57	5 32	5 58	5 31	5 59	5 31	6 00	5 30	6 01	5 29	6 02	5 28	6 03	5 27	6 04	5 26
24	5 58	5 30	5 59	5 30	6 00	5 29	6 01	5 28	6 02	5 27	6 03	5 26	6 04	5 25	6 05	5 24	6 06	5 22
28	6 00	5 28	6 01	5 27	6 02	5 26	6 03	5 25	6 04	5 24	6 05	5 23	6 06	5 21	6 07	5 20	6 09	5 19
Nov. 1	6 02	5 26	6 03	5 24	6 04	5 23	6 05	5 22	6 07	5 21	6 08	5 20	6 09	5 18	6 10	5 17	6 12	5 16
4	6 03	5 24	6 05	5 23	6 06	5 22	6 07	5 20	6 08	5 19	6 10	5 18	6 11	5 16	6 12	5 15	6 14	5 14
8	6 05	5 22	6 07	5 21	6 08	5 20	6 09	5 18	6 11	5 17	6 12	5 16	6 14	5 14	6 15	5 13	6 17	5 11
12	6 08	5 21	6 09	5 20	6 10	5 18	6 12	5 17	6 13	5 15	6 15	5 14	6 16	5 12	6 18	5 11	6 20	5 09
16	6 10	5 20	6 11	5 19	6 13	5 17	6 14	5 15	6 16	5 14	6 18	5 12	6 19	5 10	6 21	5 09	6 23	5 07
20	6 12	5 20	6 14	5 18	6 15	5 16	6 17	5 15	6 19	5 13	6 20	5 11	6 22	5 09	6 24	5 08	6 26	5 06
24	6 14	5 19	6 16	5 18	6 18	5 16	6 20	5 14	6 21	5 12	6 23	5 11	6 25	5 09	6 27	5 07	6 29	5 05
28	6 17	5 19	6 19	5 17	6 21	5 16	6 22	5 14	6 24	5 12	6 26	5 10	6 28	5 08	6 30	5 06	6 32	5 04
Dec. 1	6 19	5 19	6 21	5 18	6 23	5 16	6 25	5 14	6 26	5 12	6 28	5 10	6 30	5 08	6 33	5 06	6 35	5 04
4	6 21	5 20	6 23	5 18	6 25	5 16	6 27	5 14	6 28	5 12	6 30	5 10	6 32	5 08	6 35	5 06	6 37	5 04
8	6 23	5 21	6 25	5 19	6 27	5 17	6 29	5 15	6 31	5 13	6 33	5 11	6 35	5 09	6 38	5 07	6 40	5 05
12	6 26	5 22	6 28	5 20	6 30	5 18	6 32	5 16	6 34	5 14	6 36	5 12	6 38	5 10	6 40	5 08	6 42	5 06
16	6 28	5 24	6 30	5 22	6 32	5 20	6 34	5 18	6 36	5 16	6 38	5 14	6 40	5 12	6 42	5 09	6 45	5 07
20	6 30	5 25	6 32	5 23	6 34	5 21	6 36	5 19	6 38	5 17	6 40	5 15	6 43	5 13	6 45	5 11	6 47	5 09
24	6 32	5 28	6 34	5 26	6 36	5 24	6 38	5 22	6 40	5 20	6 42	5 18	6 44	5 16	6 47	5 13	6 49	5 11
28	6 34	5 30	6 36	5 28	6 38	5 26	6 40	5 24	6 42	5 22	6 44	5 20	6 46	5 18	6 48	5 16	6 50	5 13

TABLE 1.—*Sunrise and sunset (mean solar time)*—Continued

Date	Lat. 29° N.		Lat. 30° N.		Lat. 31° N.		Lat. 32° N.		Lat. 33° N.		Lat. 34° N.		Lat. 35° N.		Lat. 36° N.		Lat. 37° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Jan. 1	6 54	5 14	6 56	5 12	6 59	5 09	7 01	5 07	7 04	5 04	7 06	5 02	7 08	5 00	7 11	4 57	7 14	4 54
4	6 55	5 16	6 57	5 14	6 59	5 11	7 02	5 09	7 04	5 06	7 06	5 04	7 09	5 02	7 12	4 59	7 14	4 56
8	6 55	5 19	6 57	5 17	7 00	5 14	7 02	5 12	7 04	5 10	7 07	5 07	7 09	5 05	7 12	5 02	7 14	5 00
12	6 55	5 22	6 57	5 20	7 00	5 18	7 02	5 15	7 04	5 13	7 06	5 11	7 08	5 09	7 11	5 06	7 14	5 04
16	6 55	5 25	6 57	5 23	6 59	5 21	7 01	5 19	7 03	5 17	7 05	5 15	7 08	5 12	7 10	5 10	7 12	5 08
20	6 54	5 29	6 56	5 27	6 58	5 25	7 00	5 23	7 02	5 20	7 04	5 18	7 06	5 16	7 09	5 14	7 11	5 12
24	6 53	5 32	6 54	5 30	6 56	5 28	6 58	5 26	7 00	5 24	7 02	5 22	7 04	5 20	7 06	5 18	7 09	5 16
28	6 51	5 35	6 53	5 34	6 55	5 32	6 56	5 30	6 58	5 28	7 00	5 26	7 02	5 24	7 04	5 22	7 06	5 20
Feb. 1	6 49	5 39	6 50	5 37	6 52	5 36	6 54	5 34	6 55	5 32	6 57	5 30	6 59	5 29	7 01	5 27	7 03	5 25
4	6 47	5 41	6 49	5 40	6 50	5 38	6 52	5 36	6 53	5 35	6 55	5 33	6 57	5 32	6 58	5 30	7 00	5 28
8	6 44	5 44	6 46	5 43	6 47	5 42	6 49	5 40	6 50	5 39	6 52	5 37	5 53	5 36	6 55	5 34	6 56	5 32
12	6 41	5 48	6 42	5 46	6 44	5 45	6 45	5 44	6 46	5 42	6 48	5 41	6 49	5 40	6 51	5 38	6 52	5 37
16	6 38	5 50	6 39	5 49	6 40	5 48	6 41	5 47	6 43	5 46	6 44	5 45	6 45	5 44	6 46	5 42	6 48	5 41
20	6 34	5 54	6 35	5 53	6 36	5 52	6 37	5 51	6 38	5 49	6 39	5 48	6 40	5 47	6 42	5 46	6 43	5 45
24	6 30	5 57	6 31	5 56	6 32	5 55	6 33	5 54	6 34	5 53	6 35	5 51	6 36	5 51	6 37	5 50	6 38	5 49
28	6 26	5 59	6 27	5 58	6 28	5 58	6 28	5 57	6 29	5 56	6 30	5 55	6 31	5 55	6 32	5 54	6 32	5 53
Mar. 1	6 25	6 00	6 26	5 59	6 27	5 58	6 27	5 58	6 28	5 57	6 29	5 56	6 29	5 56	6 30	5 55	6 31	5 54
4	6 22	6 02	6 23	6 01	6 23	6 01	6 24	6 00	6 24	5 59	6 25	5 59	6 26	5 58	6 26	5 58	6 27	5 57
8	6 18	6 04	6 18	6 03	6 19	6 03	6 19	6 03	6 19	6 02	6 20	6 02	6 20	6 02	6 21	6 01	6 21	6 01
12	6 13	6 07	6 13	6 06	6 14	6 06	6 14	6 06	6 14	6 05	6 15	6 05	6 15	6 05	6 15	6 05	6 15	6 04
16	6 08	6 09	6 09	6 09	6 09	6 09	6 09	6 09	6 09	6 08	6 09	6 08	6 09	6 08	6 09	6 08	6 09	6 08
20	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 11	6 04	6 12
24	5 59	6 14	5 59	6 14	5 59	6 14	5 58	6 14	5 58	6 14	5 58	6 14	5 58	6 15	5 58	6 15	5 58	6 15
28	5 54	6 16	5 54	6 16	5 54	6 17	5 53	6 17	5 53	6 17	5 53	6 18	5 52	6 18	5 52	6 18	5 52	6 19
Apr. 1	5 50	6 18	5 49	6 18	5 49	6 19	5 48	6 19	5 48	6 20	5 47	6 20	5 47	6 21	5 46	6 22	5 46	6 22
4	5 46	6 20	5 46	6 20	5 45	6 21	5 45	6 21	5 44	6 22	5 43	6 23	5 43	6 23	5 42	6 24	5 41	6 25
8	5 42	6 22	5 41	6 23	5 40	6 23	5 39	6 24	5 39	6 25	5 38	6 26	5 37	6 27	5 36	6 28	5 35	6 28
12	5 37	6 24	5 36	6 25	5 35	6 26	5 34	6 27	5 34	6 28	5 33	6 29	5 32	6 30	5 31	6 31	5 30	6 32
16	5 33	6 27	5 32	6 28	5 31	6 29	5 30	6 30	5 29	6 31	5 28	6 32	5 27	6 33	5 25	6 34	5 24	6 35
20	5 29	6 29	5 28	6 30	5 27	6 31	5 25	6 32	5 24	6 34	5 23	6 35	5 22	6 36	5 20	6 38	5 19	6 39
24	5 24	6 31	5 23	6 33	5 22	6 34	5 20	6 35	5 19	6 37	5 18	6 38	5 17	6 39	5 15	6 41	5 14	6 43
28	5 21	6 34	5 20	6 35	5 18	6 37	5 17	6 38	5 15	6 40	5 14	6 41	5 12	6 43	5 10	6 44	5 09	6 46
May 1	5 18	6 36	5 17	6 37	5 15	6 39	5 14	6 40	5 12	6 42	5 11	6 43	5 09	6 45	5 07	6 47	5 05	6 49
4	5 16	6 38	5 14	6 39	5 13	6 41	5 11	6 42	5 09	6 44	5 08	6 46	5 06	6 47	5 04	6 49	5 02	6 51
8	5 13	6 40	5 11	6 41	5 09	6 43	5 08	6 45	5 06	6 47	5 04	6 49	5 02	6 51	5 00	6 53	4 58	6 55
12	5 10	6 42	5 08	6 44	5 06	6 46	5 04	6 48	5 02	6 50	5 01	6 52	4 59	6 54	4 56	6 56	4 54	6 58
16	5 08	6 45	5 06	6 47	5 04	6 49	5 02	6 51	5 00	6 53	4 58	6 55	4 56	6 57	4 53	6 59	4 51	7 02
20	5 05	6 47	5 03	6 49	5 01	6 51	4 59	6 54	4 57	6 56	4 55	6 58	4 53	7 00	4 50	7 03	4 48	7 05
24	5 04	6 50	5 02	6 52	4 59	6 54	4 57	6 56	4 55	6 58	4 52	7 01	4 50	7 03	4 48	7 06	4 45	7 08
28	5 02	6 52	5 00	6 54	4 58	6 56	4 55	6 59	4 53	7 01	4 51	7 03	4 48	7 06	4 46	7 09	4 43	7 11
June 1	5 01	6 54	4 59	6 56	4 57	6 58	4 54	7 01	4 52	7 03	4 49	7 06	4 47	7 08	4 44	7 11	4 41	7 14
4	5 01	6 56	4 59	6 58	4 56	7 00	4 54	7 03	4 51	7 05	4 49	7 08	4 46	7 10	4 43	7 13	4 40	7 16
8	5 00	6 57	4 58	6 59	4 56	7 02	4 53	7 05	4 51	7 07	4 48	7 10	4 45	7 12	4 42	7 15	4 40	7 18
12	5 00	6 59	4 58	7 01	4 55	7 04	4 53	7 06	4 50	7 09	4 48	7 12	4 45	7 14	4 42	7 17	4 39	7 20
16	5 01	7 00	4 58	7 03	4 56	7 05	4 53	7 08	4 50	7 10	4 48	7 13	4 45	7 16	4 42	7 19	4 39	7 22
20	5 01	7 01	4 59	7 04	4 56	7 06	4 54	7 09	4 51	7 12	4 48	7 14	4 46	7 17	4 43	7 20	4 40	7 23
24	5 02	7 02	5 00	7 05	4 57	7 07	4 55	7 10	4 52	7 12	4 49	7 15	4 47	7 18	4 44	7 21	4 41	7 24
28	5 03	7 03	5 01	7 05	4 59	7 07	4 56	7 10	4 53	7 13	4 51	7 15	4 48	7 18	4 45	7 21	4 42	7 24
July 1	5 05	7 03	5 02	7 05	5 00	7 08	4 57	7 10	4 54	7 13	4 52	7 15	4 49	7 18	4 46	7 21	4 43	7 24
4	5 06	7 03	5 04	7 05	5 01	7 07	4 58	7 10	4 56	7 12	4 53	7 15	4 51	7 18	4 48	7 20	4 45	7 23
8	5 08	7 02	5 06	7 04	5 03	7 07	5 00	7 09	4 58	7 12	4 56	7 14	4 53	7 17	4 50	7 20	4 47	7 23
12	5 10	7 01	5 07	7 03	5 05	7 06	5 02	7 08	5 00	7 11	4 57	7 13	4 55	7 16	4 52	7 19	4 49	7 21
16	5 11	7 00	5 09	7 02	5 07	7 05	5 05	7 07	5 02	7 09	5 00	7 12	4 58	7 14	4 55	7 17	4 52	7 19
20	5 14	6 59	5 12	7 01	5 10	7 03	5 07	7 05	5 05	7 07	5 03	7 10	5 01	7 12	4 58	7 15	4 56	7 17
24	5 16	6 57	5 14	6 59	5 12	7 01	5 10	7 03	5 08	7 05	5 06	7 07	5 03	7 09	5 01	7 12	4 58	7 14
28	5 18	6 54	5 16	6 56	5 14	6 58	5 12	7 00	5 10	7 02	5 08	7 04	5 06	7 06	5 04	7 08	5 02	7 11
Aug. 1	5 20	6 52	5 19	6 54	5 17	6 55	5 15	6 57	5 13	6 59	5 11	7 01	5 09	7 03	5 07	7 05	5 05	7 07
4	5 22	6 49	5 21	6 51	5 19	6 53	5 17	6 55	5 15	6 57	5 13	6 58	5 12	7 00	5 09	7 02	5 07	7 04
8	5 24	6 46	5 23	6 48	5 21	6 50	5 20	6 51	5 18	6 53	5 16	6 55	5 15	6 56	5 13	6 58	5 11	7 00
12	5 27	6 43	5 26	6 44	5 24	6 46	5 22	6 47	5 21	6 49	5 19	6 51	5 18	6 52	5 16	6 54	5 14	6 56
16	5 29	6 39	5 28	6 40	5 26	6 42	5 25	6 43	5 23	6 45	5 22	6 46	5 21	6 48	5 19	6 49	5 17	6 51
20	5 31	6 35	5 30	6 36	5 29	6 38	5 28	6 39	5 26	6 40	5 25	6 42	5 24	6 43	5 22	6 44	5 21	6 46
24	5 33	6 31	5 32	6 32	5 31	6 33	5 30	6 34	5 29	6 35	5 28	6 37	5 27	6 38	5 25	6 39	5 24	6 40
28	5 35	6 27	5 34	6 28	5 34	6 29	5 33	6 30	5 32	6 31	5 31	6 32	5 30	6 32	5 29	6 34	5 27	6 35
Sept. 1	5 37	6 22	5 37	6 23	5 36	6 24	5 35	6 24	5 34	6 25	5 34	6 26	5 33	6 27	5 32	6 28	5 31	6 29
4	5 39	6 19	5 38	6 19	5 38	6 20	5 37	6 21	5 36	6 22	5 35	6 22	5 35	6 23	5 34	6 24	5 33	6 25
8	5 41	6 14	5 41	6 14	5 40	6 15	5 40	6 15	5 39	6 16	5 38	6 17	5 38	6 17	5 37	6 18	5 36	6 19
12	5 43	6 09	5 43	6 10	5 42	6 10	5 42	6 10	5 41	6 11	5 41	6 11	5 41	6 12	5 40	6 12	5 40	6 13
16	5 45	6 04	5 45	6 05	5 45	6 05	5 44	6 05	5 44	6 05	5 44	6 06	5 44	6 06	5 43	6 06	5 43	6 07
20	5 57	5 59	5 47	6 00	5 47	6 00	5 47	6 00	5 47	6 00	5 47	6 00	5 46	6 00	5 46	6 00	5 46	6 00
24	5 49	5 55	5 49	5 54	5 49	5 54	5 49	5 54	5 50	5 54	5 50	5 54	5 50	5 54	5 50	5 54	5 50	5 54
28	5 52	5 50	5 52	5 50	5 52	5 49	5 52	5 49	5 52	5 49	5 52	5 49	5 52	5 49	5 53	5 49	5 53	5 48
Oct. 1	5 53	5 46	5 53	5 46	5 54	5 45	5 54	5 45	5 54	5 45	5 55	5 45	5 55	5 44	5 55	5 44	5 56	5 44
4	5 55	5 42	5 55	5 42	5 56	5 42	5 56	5 41	5 56	5 41	5 57	5 41	5 57	5 40	5 57	5 40	5 58	5 39
8	5 57	5 38	5 58	5 37	5 58	5 37	5 59	5 36	5 59	5 36	6 00	5 35	6 00	5 35	6 01	5 34	6 02	5 33
12	5 59	5 34	6 00	5 33	6 01	5 32	6 01	5 32	6 02	5 31	6 03	5 30	6 04	5 29	6 04	5 29	6 05	5 28
12	6 02	5 29	6 03	5 29	6 03	5 28	6 04	5 27	6 05	5 26	6 06	5 25	6 07	5 24	6 08	5 23	6 09	5 22
20	6 04	5 25	6 05	5 24	6 06	5 23	6 07	5 22	6 08	5 22	6 09	5 20	6 10	5 20	6 11	5 18	6 13	5 17
24	6 07	5 21	6 08	5 20	6 09	5 19	6 10	5 18	6 12	5 17	6 13	5 16	6 14	5 15	6 15	5 13	6 16	5 12
28	6 10	5 17	6 11	5 17	6 12	5 15	6 14	5 14	6 15	5 13	6 16	5 12	6 17	5 10	6 19	5 09	6 20	5 07
Nov. 1	6 13	5 15	6 14	5 13	6 15	5 12	6 17	5 10	6 18	5 09	6 20	5 08	6 21	5 06	6 23	5 04	6 24	5 03
4	6 15	5 12	6 17	5 11	6 18	5 09	6 20	5 08	6 21	5 06	6 23	5 05	6 24	5 03	6 26	5 01	6 28	5 00
8	6 18	5 10	6 20	5 08	6 21	5 07	6 23	5 05	6 25	5 03	6 26	5 02	6 28	5 00	6 30	4 58	6 32	4 56
12	6 21	5 07	6 23	5 06	6 25	5 04	6 26	5 02	6 28	5 00	6 30	4 58	6 32	4 57	6 34	4 55	6 36	4 53
16	6 24	5 05	6 26	5 04	6 28	5 02	6 30	5 00	6 32	4 58	6 34	4 56	6 36	4 54	6 38	4 52	6 40	4 50
20	6 28	5 04	6 30	5 02	6 32	5 00	6 34	4 58	6 36	4 56	6 38	4 54	6 40	4 52	6 42	4 50	6 44	4 47
24	6 31	5 03	6 33	5 01	6 35	4 59	6 37	4 57	6 39	4 54	6 42	4 52	6 44	4 50	6 46	4 48	6 48	4 45
28	6 34	5 02	6 36	5 00	6 38	4 58	6 41	4 56	6 43	4 53	6 45	4 51	6 47	4 49	6 50	4 46	6 52	4 44

TABLE 1.—*Sunrise and sunset (mean solar time)*—Continued

Date	Lat. 29° N.		Lat. 30° N.		Lat. 31° N.		Lat. 32° N.		Lat. 33° N.		Lat. 34° N.		Lat. 35° N.		Lat. 36° N.		Lat. 37° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Dec. 1	6 37	5 02	6 39	5 00	6 41	4 57	6 43	4 55	6 45	4 53	6 48	4 51	6 50	4 49	6 52	4 46	6 55	4 43
4	6 39	5 02	6 41	5 00	6 43	4 58	6 46	4 55	6 48	4 53	6 50	4 51	6 52	4 48	6 55	4 45	6 58	4 43
8	6 42	5 03	6 44	5 00	6 46	4 58	6 49	4 56	6 51	4 53	6 54	4 51	6 56	4 48	6 59	4 45	7 01	4 43
12	6 44	5 03	6 47	5 01	6 49	4 59	6 51	4 56	6 54	4 54	6 56	4 52	6 59	4 49	7 02	4 46	7 04	4 43
16	6 47	5 05	6 49	5 03	6 51	5 00	6 54	4 58	6 56	4 55	6 59	4 53	7 01	4 50	7 04	4 47	7 07	4 44
20	6 49	5 07	6 51	5 04	6 54	5 02	6 56	4 59	6 59	4 57	7 01	4 54	7 04	4 52	7 07	4 49	7 10	4 46
24	6 51	5 09	6 53	5 07	6 56	5 04	6 58	5 02	7 01	4 59	7 03	4 57	7 06	4 54	7 09	4 51	7 12	4 48
28	6 52	5 11	6 55	5 09	6 57	5 06	7 00	5 04	7 02	5 01	7 05	4 59	7 07	4 56	7 10	4 53	7 13	4 50

Date	Lat. 38° N.		Lat. 39° N.		Lat. 40° N.		Lat. 41° N.		Lat. 42° N.		Lat. 43° N.		Lat. 44° N.		Lat. 45° N.		Lat. 46° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Jan. 1	7 17	4 51	7 20	4 48	7 22	4 46	7 25	4 42	7 28	4 40	7 32	4 36	7 35	4 33	7 39	4 29	7 42	4 26
4	7 17	4 54	7 20	4 51	7 22	4 48	7 25	4 45	7 28	4 42	7 32	4 39	7 35	4 36	7 39	4 32	7 42	4 28
8	7 17	4 57	7 19	4 55	7 22	4 52	4 25	4 49	7 28	4 46	7 31	4 43	7 34	4 40	7 38	4 36	7 41	4 33
12	7 16	5 01	7 19	4 58	7 21	4 56	7 24	4 53	7 27	4 50	7 30	4 47	7 33	4 44	7 37	4 41	7 40	4 38
16	7 15	5 05	7 17	5 03	7 20	5 00	7 23	4 58	7 25	4 55	7 28	4 52	7 31	4 49	7 34	4 46	7 38	4 42
20	7 13	5 09	7 15	5 07	7 18	5 05	7 20	5 02	7 23	5 00	7 26	4 57	7 28	4 54	7 32	4 51	7 34	4 48
24	7 11	5 14	7 13	5 12	7 15	5 10	7 18	5 07	7 20	5 05	7 23	5 02	7 25	4 59	7 28	4 56	7 31	4 54
28	7 08	5 18	7 10	5 16	7 12	5 14	7 14	5 12	7 17	5 10	7 19	5 07	7 22	5 05	7 24	5 02	7 27	4 59
Feb. 1	7 05	5 23	7 07	5 21	7 09	5 19	7 11	5 17	7 13	5 15	7 15	5 12	7 17	5 10	7 20	5 08	7 22	5 05
4	7 02	5 26	7 04	5 25	7 06	5 23	7 08	5 21	7 10	5 18	7 12	5 16	7 14	5 14	7 17	5 12	7 19	5 10
8	6 58	5 31	7 00	5 29	7 01	5 27	7 03	5 26	7 05	5 24	7 07	5 22	7 09	5 20	7 11	5 18	7 13	5 15
12	6 54	5 35	6 55	5 34	6 57	5 32	6 58	5 31	7 00	5 29	7 02	5 27	7 03	5 25	7 06	5 23	7 08	5 21
16	6 49	5 40	6 50	5 38	6 52	5 37	6 53	5 35	6 55	5 34	6 56	5 32	6 58	5 31	6 59	5 29	7 01	5 27
20	6 44	5 44	6 45	5 43	6 46	5 42	6 48	5 40	6 49	5 39	6 50	5 38	6 52	5 36	6 53	5 35	6 54	5 33
24	6 39	5 48	6 40	5 47	6 40	5 46	6 42	5 45	6 43	5 44	6 44	5 43	6 45	5 42	6 46	5 40	6 47	5 39
28	6 33	5 52	6 34	5 51	6 35	5 50	6 36	5 50	6 37	5 49	6 38	5 48	6 38	5 47	6 40	5 46	6 41	5 45
Mar. 1	6 32	5 53	6 33	5 52	6 33	5 52	6 34	5 51	6 35	5 50	6 36	5 49	6 37	5 48	6 38	5 47	6 39	5 46
4	6 28	5 56	6 28	5 56	6 29	5 55	6 29	5 54	6 30	5 54	6 31	5 53	6 32	5 52	6 33	5 51	6 33	5 50
8	6 22	6 00	6 22	6 00	6 22	5 59	6 23	5 59	6 23	5 58	6 24	5 58	6 25	5 57	6 25	5 56	6 26	5 56
12	6 16	6 04	6 16	6 04	6 16	6 04	6 16	6 03	6 17	6 03	6 17	6 03	6 18	6 02	6 18	6 02	6 18	6 01
16	6 10	6 08	6 10	6 08	6 10	6 08	6 10	6 07	6 10	6 07	6 10	6 07	6 10	6 07	6 11	6 07	6 11	6 07
20	6 04	6 12	6 03	6 12	6 03	6 12	6 03	6 12	6 03	6 12	6 03	6 12	6 03	6 12	6 03	6 12	6 03	6 12
24	5 57	6 15	5 57	6 15	5 57	6 16	5 57	6 16	5 56	6 16	5 56	6 17	5 56	6 17	5 55	6 17	5 55	6 17
28	5 51	6 19	5 51	6 20	5 50	6 20	5 50	6 20	5 50	6 21	5 49	6 21	5 48	6 22	5 48	6 22	5 47	6 23
Apr. 1	5 45	6 23	5 44	6 23	5 44	6 24	5 43	6 25	5 42	6 25	5 42	6 26	5 41	6 27	5 40	6 28	5 40	6 28
4	5 40	6 26	5 40	6 26	5 39	6 27	5 38	6 28	5 38	6 28	5 37	6 29	5 36	6 30	5 35	6 31	5 34	6 32
8	5 34	6 29	5 33	6 30	5 33	6 31	5 32	6 32	5 31	6 33	5 30	6 34	5 29	6 35	5 28	6 36	5 26	6 37
12	5 29	6 33	5 27	6 34	5 26	6 35	5 25	6 36	5 24	6 37	5 23	6 39	5 22	6 40	5 20	6 41	5 19	6 43
16	5 23	6 37	5 22	6 38	5 20	6 39	5 19	6 40	5 18	6 42	5 16	6 43	5 15	6 45	5 13	6 46	5 12	6 48
20	5 18	6 40	5 16	6 42	5 15	6 43	5 13	6 45	5 12	6 46	5 10	6 48	5 08	6 49	5 06	6 51	5 05	6 53
24	5 12	6 44	5 11	6 46	5 09	6 47	5 07	6 49	5 05	6 51	5 04	6 52	5 02	6 54	5 00	6 56	4 58	6 58
28	5 07	6 48	5 05	6 49	5 04	6 51	5 02	6 53	5 00	6 55	4 58	6 57	4 56	6 59	4 54	7 01	4 51	7 03
May 1	5 03	6 51	5 02	6 52	5 00	6 54	4 58	6 56	4 56	6 58	4 54	7 00	4 51	7 03	4 49	7 05	4 47	7 07
4	5 00	6 53	4 58	6 55	4 56	6 57	4 54	6 59	4 52	7 02	4 49	7 04	4 47	7 06	4 44	7 09	4 42	7 11
8	4 56	6 58	4 54	7 00	4 52	7 01	4 49	7 03	4 47	7 06	4 44	7 08	4 42	7 11	4 39	7 14	4 36	7 16
12	4 52	7 01	4 50	7 03	4 47	7 05	4 45	7 08	4 42	7 10	4 40	7 13	4 37	7 16	4 34	7 18	4 31	7 21
16	4 48	7 04	4 46	7 06	4 44	7 09	4 41	7 11	4 38	7 14	4 35	7 17	4 32	7 20	4 29	7 23	4 26	7 26
20	4 45	7 08	4 43	7 10	4 40	7 13	4 37	7 15	4 35	7 18	4 32	7 21	4 29	7 24	4 25	7 27	4 22	7 31
24	4 43	7 11	4 40	7 13	4 37	7 16	4 34	7 19	4 31	7 22	4 28	7 25	4 25	7 28	4 22	7 32	4 18	7 35
28	4 40	7 14	4 37	7 17	4 35	7 19	4 32	7 22	4 29	7 25	4 26	7 29	4 22	7 32	4 19	7 35	4 15	7 39
June 1	4 38	7 17	4 35	7 20	4 33	7 23	4 30	7 26	4 27	7 29	4 23	7 32	4 20	7 35	4 16	7 39	4 12	7 43
4	4 38	7 19	4 35	7 22	4 32	7 24	4 29	7 28	4 26	7 31	4 22	7 34	4 18	7 38	4 15	7 42	4 11	7 45
8	4 37	7 21	4 34	7 24	4 31	7 27	4 28	7 30	4 24	7 33	4 21	7 37	4 17	7 41	4 13	7 44	4 09	7 48
12	4 36	7 23	4 33	7 26	4 30	7 29	4 27	7 32	4 24	7 35	4 20	7 39	4 16	7 43	4 12	7 47	4 09	7 51
16	4 36	7 25	4 33	7 28	4 30	7 31	4 27	7 34	4 24	7 37	4 20	7 41	4 16	7 45	4 12	7 49	4 08	7 53
20	4 37	7 26	4 34	7 29	4 31	7 32	4 28	7 35	4 24	7 38	4 21	7 42	4 17	7 46	4 13	7 50	4 08	7 54
24	4 38	7 27	4 35	7 30	4 32	7 33	4 29	7 36	4 25	7 39	4 22	7 43	4 18	7 47	4 14	7 51	4 10	7 55
28	4 39	7 27	4 36	7 30	4 33	7 33	4 30	7 36	4 27	7 39	4 23	7 43	4 19	7 47	4 15	7 51	4 11	7 55
July 1	4 40	7 27	4 38	7 30	4 35	7 33	4 31	7 36	4 28	7 39	4 24	7 43	4 21	7 47	4 17	7 50	4 13	7 54
4	4 42	7 26	4 39	7 29	4 36	7 32	4 33	7 35	4 30	7 39	4 26	7 42	4 22	7 46	4 18	7 50	4 15	7 54
8	4 44	7 25	4 41	7 28	4 38	7 31	4 35	7 34	4 32	7 37	4 29	7 41	4 25	7 45	4 21	7 48	4 18	7 52
12	4 47	7 24	4 44	7 27	4 41	7 30	4 38	7 33	4 35	7 36	4 32	7 39	4 29	7 42	4 25	7 46	4 21	7 50
16	4 50	7 22	4 47	7 25	4 44	7 27	4 41	7 30	4 38	7 33	4 35	7 37	4 32	7 40	4 28	7 43	4 25	7 47
20	4 53	7 20	4 50	7 22	4 48	7 25	4 45	7 28	4 42	7 30	4 39	7 34	4 36	7 37	4 32	7 40	4 29	7 43
24	4 56	7 17	4 53	7 19	4 51	7 22	4 48	7 24	4 46	7 27	4 43	7 30	4 40	7 33	4 36	7 36	4 33	7 39
28	4 59	7 13	4 57	7 16	4 54	7 18	4 52	7 21	4 49	7 23	4 46	7 26	4 44	7 29	4 41	7 32	4 38	7 35
Aug. 1	5 03	7 10	5 00	7 12	4 58	7 14	4 56	7 16	4 53	7 19	4 50	7 22	4 48	7 24	4 45	7 27	4 42	7 30
4	5 05	7 07	5 03	7 09	5 01	7 11	4 59	7 13	4 57	7 15	4 54	7 18	4 51	7 21	4 49	7 23	4 46	7 26
8	5 09	7 02	5 07	7 04	5 05	7 06	5 03	7 08	5 00	7 11	4 58	7 13	4 56	7 15	4 53	7 18	4 51	7 20
12	5 12	6 58	5 10	6 59	5 09	7 01	5 07	7 03	5 05	7 05	5 02	7 07	5 00	7 09	4 58	7 12	4 56	7 14
16	5 16	6 53	5 14	6 54	5 12	6 56	5 11	6 58	5 09	6 59	5 07	7 01	5 05	7 03	5 03	7 05	5 01	7 08
20	5 19	6 47	5 18	6 49	5 16	6 50	5 15	6 52	5 13	6 54	5 11	6 55	5 10	6 57	5 08	6 59	5 06	7 01
24	5 23	6 42	5 21	6 43	5 20	6 44	5 19	6 46	5 17	6 47	5 16	6 49	5 14	6 50	5 12	6 52	5 11	6 54
28	5 26	6 36	5 25	6 37	5 24	6 38	5 23	6 40	5 21	6 41	5 20	6 42	5 19	6 44	5 17	6 45	5 16	6 46
Sept. 1	5 30	6 30	5 29	6 31	5 28	6 32	5 27	6 33	5 25	6 34	5 24	6 35	5 23	6 36	5 22	6 38	5 20	6 39
4	5 32	6 26	5 31	6 26	5 30	6 27	5 30	6 28	5 28	6 29	5 28	6 30	5 27	6 31	5 26	6 32	5 24	6 33
8	5 36	6 19	5 35	6 20	5 34	6 21	5 33	6 22	5 33	6 22	5 32	6 23	5 31	6 24	5 30	6 25	5 30	6 26
12	5 39	6 13	5 39	6 14	5 38	6 14	5 38	6 15	5 37	6 15	5 36	6 16	5 36	6 17	5 35	6 17	5 34	6 18
16	5 42	6 07	5 42	6 07	5 42	6 08	5 41	6 08	5 41	6 08	5 41	6 09	5 40	6 09	5 40	6 10	5 39	6 10

TABLE 1.—*Sunrise and sunset (mean solar time)*—Continued

Date	Lat. 38° N.		Lat. 39° N.		Lat. 40° N.		Lat. 41° N.		Lat. 42° N.		Lat. 43° N.		Lat. 44° N.		Lat. 45° N.		Lat. 46° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Sept. 20	5 46	6 01	5 46	6 01	5 46	6 01	5 46	6 01	5 45	6 02	5 45	6 02	5 45	6 02	5 45	6 02	5 45	6 02
24	5 49	5 54	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 55	5 49	5 54	5 50	5 54
28	5 53	5 48	5 53	5 48	5 53	5 48	5 54	5 48	5 54	5 47	5 54	5 47	5 54	5 47	5 55	5 47	5 55	5 46
Oct. 1	5 56	5 43	5 56	5 43	5 56	5 43	5 57	5 42	5 57	5 42	5 57	5 42	5 58	5 41	5 58	5 41	5 58	5 41
4	5 58	5 39	5 59	5 39	5 59	5 38	6 00	5 38	5 00	5 37	6 01	5 37	6 01	5 36	6 02	5 36	6 02	5 35
8	6 02	5 33	6 03	5 32	6 03	5 32	6 04	5 31	6 05	5 30	6 05	5 30	6 06	5 29	6 07	5 28	6 08	5 28
12	6 06	5 27	6 07	5 26	6 08	5 25	6 08	5 25	6 09	5 24	6 10	5 23	6 11	5 22	6 12	5 21	6 13	5 20
16	6 10	5 21	6 11	5 20	6 12	5 19	6 13	5 18	6 14	5 17	6 15	5 16	6 16	5 15	6 17	5 14	6 18	5 13
20	6 14	5 16	6 15	5 15	6 16	5 14	6 17	5 12	5 18	5 11	6 20	5 10	6 21	5 09	6 22	5 07	6 24	5 06
24	6 18	5 11	6 19	5 10	6 20	5 08	6 22	5 07	5 23	5 05	6 25	5 04	6 26	5 02	6 28	5 01	6 30	4 59
28	6 22	5 06	6 23	5 04	6 25	5 03	6 26	5 01	6 28	5 00	6 30	4 58	6 32	4 56	6 33	4 54	6 35	4 52
Nov. 1	6 26	5 01	6 28	5 00	6 29	4 58	6 31	4 56	6 33	4 54	6 35	4 53	6 37	4 51	6 39	4 49	6 41	4 46
4	6 29	4 58	6 31	4 56	6 33	4 54	6 35	4 53	6 37	4 51	6 39	4 49	6 41	4 47	6 43	4 44	6 45	4 42
8	6 34	4 54	6 35	4 52	6 37	4 50	6 40	4 48	6 42	4 46	6 44	4 44	6 46	4 42	6 48	4 39	6 51	4 37
12	6 38	4 51	6 40	4 49	6 42	4 47	6 44	4 44	6 47	4 42	6 49	4 40	6 51	4 37	6 54	4 35	6 56	4 32
16	6 42	4 48	6 44	4 45	6 47	4 43	6 49	4 41	6 51	4 38	6 54	4 36	6 57	4 33	6 59	4 30	7 02	4 28
20	6 47	4 45	6 49	4 43	6 51	4 40	6 54	4 38	6 56	4 35	6 59	4 33	7 02	4 30	7 05	4 27	7 08	4 24
24	6 51	4 43	6 53	4 41	6 56	4 38	6 58	4 35	7 01	4 33	7 04	4 30	7 07	4 27	7 10	4 24	7 13	4 21
28	6 55	4 42	6 57	4 39	7 00	4 36	7 03	4 34	7 05	4 31	7 09	4 28	7 12	4 25	7 15	4 21	7 18	4 18
Dec. 1	6 58	4 41	7 00	4 38	7 03	4 35	7 06	4 33	7 09	4 30	7 12	4 27	7 15	4 23	7 18	4 20	7 22	4 16
4	7 00	4 40	7 03	4 38	7 06	4 35	7 09	4 32	7 12	4 29	7 15	4 26	7 18	4 23	7 22	4 19	7 25	4 16
8	7 04	4 40	7 07	4 38	7 10	4 35	7 13	4 32	7 16	4 29	7 19	4 26	7 22	4 22	7 26	4 18	7 30	4 15
12	7 07	4 41	7 10	4 38	7 13	4 35	7 16	4 32	7 19	4 29	7 22	4 26	7 26	4 22	7 29	4 19	7 33	4 15
16	7 10	4 42	7 13	4 39	7 16	4 36	7 19	4 33	7 22	4 30	7 25	4 26	7 29	4 23	7 33	4 19	7 36	4 15
20	7 13	4 43	7 16	4 40	7 18	4 37	7 21	4 34	7 24	4 31	7 28	4 28	7 31	4 24	7 35	4 21	7 39	4 17
24	7 14	4 46	7 17	4 43	7 20	4 40	7 23	4 37	7 26	4 34	7 30	4 30	7 33	4 27	7 37	4 23	7 41	4 19
28	7 16	4 48	7 19	4 45	7 22	4 42	7 25	4 39	7 28	4 36	7 31	4 33	7 34	4 29	7 38	4 25	7 42	4 22

Date	Lat. 47° N.		Lat. 48° N.		Lat. 49° N.		Lat. 50° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Jan. 1	7 46	4 22	7 50	4 18	7 54	4 14	7 59	4 09
4	7 46	4 24	7 50	4 21	7 54	4 16	7 58	4 12
8	7 45	4 29	7 49	4 25	7 53	4 21	7 57	4 17
12	7 44	4 34	7 47	4 30	7 51	4 26	7 55	4 22
16	7 41	4 39	7 45	4 36	7 48	4 32	7 52	4 28
20	7 38	4 45	7 41	4 41	7 45	4 38	7 49	4 34
24	7 34	4 50	7 38	4 47	7 41	4 44	7 44	4 41
28	7 30	4 57	7 33	4 54	7 36	4 51	7 39	4 47
Feb. 1	7 25	5 02	7 28	5 00	7 31	4 57	7 33	4 54
4	7 21	5 07	7 24	5 05	7 26	5 02	7 29	4 59
8	7 16	5 13	7 18	5 11	7 20	5 09	7 23	5 06
12	7 10	5 19	7 12	5 17	7 14	5 15	7 16	5 13
16	7 03	5 26	7 05	5 24	7 07	5 22	7 09	5 20
20	6 56	5 32	6 58	5 30	6 59	5 28	7 01	5 27
24	6 49	5 38	6 50	5 36	6 52	5 35	6 53	5 34
28	6 42	5 44	6 43	5 42	6 44	5 41	6 45	5 40
Mar. 1	6 40	5 45	6 41	5 44	6 42	5 43	6 43	5 42
4	6 34	5 49	6 35	5 48	6 36	5 48	6 37	5 47
8	6 27	5 55	6 27	5 54	6 28	5 54	6 28	5 53
12	6 19	6 01	6 19	6 00	6 20	6 00	6 20	6 00
16	6 11	6 06	6 11	6 06	6 11	6 06	6 11	6 06
20	6 03	6 12	6 03	6 12	6 03	6 13	6 03	6 13
24	5 55	6 18	5 54	6 18	5 54	6 18	5 54	6 19
28	5 47	6 23	5 46	6 24	5 46	6 25	5 45	6 25
Apr. 1	5 39	6 29	5 38	6 30	5 37	6 31	5 36	6 31
4	5 33	6 33	5 32	6 34	5 31	6 35	5 30	6 36
8	5 25	6 38	5 24	6 40	5 23	6 41	5 21	6 42
12	5 18	6 44	5 16	6 45	5 15	6 47	5 13	6 49
16	5 10	6 50	5 08	6 51	5 06	6 53	5 05	6 55
20	5 03	6 55	5 01	6 57	4 59	6 59	4 57	7 01
24	4 56	7 00	4 54	7 03	4 51	7 05	4 49	7 07
28	4 49	7 06	4 47	7 08	4 44	7 11	4 41	7 13
May 1	4 44	7 10	4 42	7 12	4 39	7 15	4 36	7 18
4	4 39	7 14	4 37	7 17	4 34	7 20	4 31	7 23
8	4 32	7 19	4 31	7 22	4 27	7 25	4 24	7 29
12	4 27	7 24	4 25	7 28	4 21	7 31	4 18	7 34
16	4 22	7 29	4 20	7 33	4 16	7 36	4 12	7 40
20	4 18	7 34	4 15	7 38	4 11	7 42	4 07	7 46
24	4 13	7 39	4 11	7 43	4 07	7 47	4 03	7 51
28	4 11	7 43	4 07	7 47	4 03	7 51	3 58	7 56
June 1	4 08	7 47	4 04	7 51	4 00	7 55	3 56	8 00
4	4 07	7 49	4 03	7 53	3 58	7 58	3 54	8 03
8	4 05	7 52	4 01	7 57	3 56	8 01	3 52	8 06
12	4 04	7 55	4 00	7 59	3 55	8 04	3 50	8 09
16	4 04	7 57	4 00	8 01	3 55	8 06	3 50	8 11
20	4 04	7 58	4 00	8 03	3 55	8 08	3 50	8 13
24	4 05	7 59	4 01	8 03	3 56	8 08	3 51	8 13
28	4 07	7 59	4 03	8 03	3 58	8 08	3 53	8 13

Date	Lat. 47° N.		L. 48° N.		Lat. 49° N.		Lat. 50° N.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
July 1	4 09	7 58	4 04	8 03	4 00	8 08	3 55	8 12
4	4 11	7 58	4 06	8 02	4 02	8 07	3 57	8 11
8	4 14	7 56	4 10	8 00	4 05	8 05	4 00	8 09
12	4 17	7 54	4 13	7 58	4 09	8 02	4 04	8 07
16	4 21	7 51	4 17	7 55	4 13	7 59	4 08	8 03
20	4 25	7 47	4 21	7 51	4 17	7 55	4 13	7 59
24	4 30	7 43	4 26	7 47	4 22	7 50	4 18	7 54
28	4 34	7 38	4 31	7 42	4 27	7 45	4 24	7 49
Aug. 1	4 39	7 33	4 36	7 36	4 33	7 40	4 29	7 43
4	4 43	7 29	4 40	7 32	4 37	7 35	4 33	7 38
8	4 48	7 23	4 45	7 26	4 42	7 29	4 39	7 32
12	4 53	7 17	4 51	7 19	4 48	7 22	4 45	7 25
16	4 58	7 10	4 56	7 12	4 54	7 14	4 51	7 17
20	5 04	7 03	5 02	7 05	4 59	7 07	4 57	7 09
24	5 09	6 56	5 07	6 57	5 05	6 59	5 03	7 01
28	5 14	6 48	5 12	6 50	5 11	6 51	5 09	6 53
Sept. 1	5 19	6 40	5 18	6 42	5 16	6 43	5 15	6 45
4	5 23	6 35	5 22	6 36	5 21	6 37	5 20	6 38
8	5 28	6 27	5 27	6 28	5 26	6 29	5 25	6 30
12	5 34	6 19	5 33	6 20	5 32	6 20	5 31	6 21
16	5 39	6 11	5 38	6 11	5 38	6 12	5 38	6 12
20	5 44	6 02	5 44	6 03	5 44	6 03	5 43	6 03
24	5 50	5 54	5 50	5 54	5 50	5 54	5 50	5 54
28	5 55	5 46	5 55	5 46	5 55	5 46	5 55	5 46
Oct. 1	5 59	5 40	5 59	5 40	6 00	5 39	6 00	5 39
4	6 03	5 34	6 04	5 34	6 04	5 33	6 05	5 33
8	6 08	5 27	6 09	5 26	6 10	5 25	6 11	5 24
12	6 14	5 19	6 15	5 18	6 16	5 17	6 17	5 16
16	6 20	5 12	6 21	5 10	6 22	5 09	6 24	5 07
20	6 25	5 04	6 27	5 03	6 29	5 01	6 30	5 00
24	6 31	4 57	6 33	4 56	6 35	4 54	6 37	4 52
28	6 37	4 50	6 39	4 48	6 41	4 46	6 43	4 44
Nov. 1	6 43	4 44	6 45	4 42	6 48	4 40	6 50	4 37
4	6 48	4 40	6 50	4 38	6 52	4 35	6 55	4 32
8	6 54	4 34	6 56	4 32	6 59	4 29	7 02	4 26
12	6 59	4 29	7 02	4 26	7 05	4 23	7 08	4 20
16	7 05	4 24	7 08	4 21	7 12	4 18	7 15	4 15
20	7 11	4 21	7 14	4 17	7 18	4 14	7 21	4 10
24	7 16	4 17	7 20	4 14	7 24	4 10	7 28	4 06
28	7 22	4 15	7 25	4 11	7 29	4 07	7 33	4 03
Dec. 1	7 26	4 13	7 29	4 09	7 33	4 05	7 37	4 01
4	7 29	4 12	7 33	4 08	7 37	4 04	7 41	4 00
8	7 33	4 11	7 37	4 07	7 41	4 03	7 46	3 59
12	7 37	4 11	7 41	4 07	7 45	4 03	7 50	3 58
16	7 40	4 11	7 44	4 07	7 49	4 03	7 53	3 58
20	7 43	4 13	7 47	4 09	7 51	4 04	7 56	4 00
24	7 45	4 15	7 49	4 11	7 53	4 06	7 58	4 02
28	7 46	4 18	7 50	4 14	7 54	4 09	7 59	4 05

TABLE 2.—*Reduction of mean solar time to local standard time*

Difference of longitude between local and standard meridian	Correction to mean solar time to obtain local standard time	Difference of longitude between local and standard meridian	Correction to mean solar time to obtain local standard time	Difference of longitude between local and standard meridian	Correction to mean solar time to obtain local standard time
° ′ ° ′	*Minutes*	° ′ ° ′	*Minutes*	° ′ ° ′	*Minutes*
0 00 to 0 07	0	5 08 to 5 22	21	10 23 to 10 37	42
0 08 to 0 22	1	5 23 to 5 37	22	10 38 to 10 52	43
0 23 to 0 37	2	5 38 to 5 52	23	10 53 to 11 07	44
0 38 to 0 52	3	5 53 to 6 07	24	11 08 to 11 22	45
0 53 to 1 07	4	6 08 to 6 22	25	11 23 to 11 37	46
1 08 to 1 22	5	6 23 to 6 37	26	11 38 to 11 52	47
1 23 to 1 37	6	6 38 to 6 52	27	11 53 to 12. 07	48
1 38 to 1 52	7	6 53 to 7 07	28	12 08 to 12 22	49
1 53 to 2 07	8	7 08 to 7 22	29	12 23 to 12 37	50
2 08 to 2 22	9	7 23 to 7 37	30	12 38 to 12 52	51
2 23 to 2 37	10	7 38 to 7 52	31	12 53 to 13 07	52
2 38 to 2 52	11	7 53 to 8 07	32	13 08 to 13 22	53
2 53 to 3 07	12	8 08 to 8 22	33	13 23 to 13 37	54
3 08 to 3 22	13	8 23 to 8 37	34	13 38 to 13 52	55
3 23 to 3 37	14	8 38 to 8 52	35	13 53 to 14 07	56
3 38 to 3 52	15	8 53 to 9 07	36	14 08 to 14 22	57
3 53 to 4 07	16	9 08 to 9 22	37	14 23 to 14 37	58
4 08 to 4 22	17	9 23 to 9 37	38	14 38 to 14 52	59
4 23 to 4 37	18	9 38 to 9 52	39	14 53 to 15 07	60
4 38 to 4 52	19	9 53 to 10 07	40		
4 53 to 5 07	20	10 08 to 10 22	41		

If local meridian is east of standard meridian, subtract the correction from value obtained from table 1 of this appendix.

If local meridian is west of standard meridian, add the correction to value obtained from table 1 of this appendix.

In order to illustrate the reduction to local standard time (75th, 90th, 105th, or 120th meridian time, as the case may be) by means of the above table, the following three examples are given for time of sunrise and sunset at Fort Worth, Tex., Phoenix. Ariz., and Bangor, Maine, on January 1:

FORT WORTH, TEX. (AIRPORT), LATITUDE 33° N. (TO NEAREST WHOLE DEGREE) LONGITUDE 97°21′ W.

Latitude 33° N. in table 1 shows the mean solar time of sunrise to be 7:04 a. m and the mean solar time of sunset to be 5:04 p. m. for January 1. Longitude 97°21′ is 7°21′ different from the standard meridian (90th in this case). From the above table we see that a difference of 7°21′ requires a correction of 29 minutes to the mean solar time values, and since the station is located west of the 90th meridian (standard in this case), the correction is to be added. Thus at Fort Worth, on January 1, the time of sunrise will be 7:33 a. m. and time of sunset 5:33 p. m., 90th meridian standard time.

PHOENIX, ARIZ., (AIRPORT), LATITUDE 33° N. (TO NEAREST WHOLE DEGREE) LONGITUDE 112°03′ W.

Again for latitude 33° N. we obtain from table 1 the mean solar time of sunrise to be 7:04 a. m. and sunset to be 5:04 p. m. for January 1. Longitude 112°3′ is 7°3′

different from the standard meridian (105th in this case). From the above table we see that a difference of 7°3′ requires a correction of 28 minutes, and since Phoenix is west of the 105th meridian (standard in this case), the correction is to be added. Thus, at Phoenix on January 1, the time of sunrise will be 7:32 a. m. and time of sunset 5:32 p. m., 105th meridian standard time.

BANGOR, MAINE (AIRPORT), LATITUDE 45° N. (TO NEAREST WHOLE DEGREE) LONGITUDE 68°49′ W.

For latitude 45° N. we obtain from table 1 the mean solar time of sunrise to be 7:39 a. m. and sunset to be 4:29 p. m. for January 1. Longitude 68°49′ is 6°11′ different from the standard meridian (75th in this case). From the above table we see that a difference of 6°11′ requires a correction of 25 minutes, and since Bangor is east of the 75th meridian (standard in this case), the correction is to be subtracted. Thus, at Bangor on January 1, the time of sunrise will be 7:14 a. m. and time of sunset 4;04 p. m., 75th meridian standard time.

(1) Stations to take snow surface temperature observations.--Raob stations located at or north of 40° north latitude will take snow surface temperature observations in accordance with the following instructions.

(2) Time of taking snow surface temperature observations.--Snow surface temperature observations will be taken within ten minutes of the time of launching the nighttime radiosonde, provided that fifty per cent of the ground is covered with snow to a depth of two inches or more and that a suitable exposure, as described in (3) below, can be found within 200 feet of the instrument shelter.

(3) Point of exposure.--A standard alcohol thermometer should be exposed at a point remote from buildings and not less than fifty feet from the edge of the snow-covered area. Preferably, the thermometer should be exposed beneath the instrument shelter, but if this is impracticable, the place selected should be such that the snow between it and the instrument shelter is level.

(4) Taking the observation.--The thermometer should be exposed in a horizontal position with the bulb covered with not less than one-eighth inch nor more than one-half inch of snow and for not less than ten minutes before reading it. The temperature reading should be taken before the thermometer is removed from the snow.

(5) Recording the data.--The following data will be recorded in "Remarks, Notes, and Miscellaneous Phenomena" on Form 1130A:

Time of observation
Snow surface temperature
Character of snow
Height of dry bulb above snow surface temperature thermometer

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290297°—41——14

U. S. DEPARTMENT OF COMMERCE
WEATHER BUREAU

EXPLANATION OF SYMBOL WEATHER REPORTS
(based on instructions contained in Weather Bureau Circular N 1941)

[To illustrate the method used in transmission and deciphering of symbol weather reports, the following example of such a report is given. Each element of the report is connected by a line with a description of all symbols and conditions which might be used in that particular phase of the report. Elements of observations are always transmitted in the same order; therefore all symbol weather reports may be deciphered by reference to this chart]

WA N SPL 1624E E30⊕15①2V TRW-BD- 152/68/60→↘22+↑1618E/996/+⊕NW OCNL LTNG IN CLDS

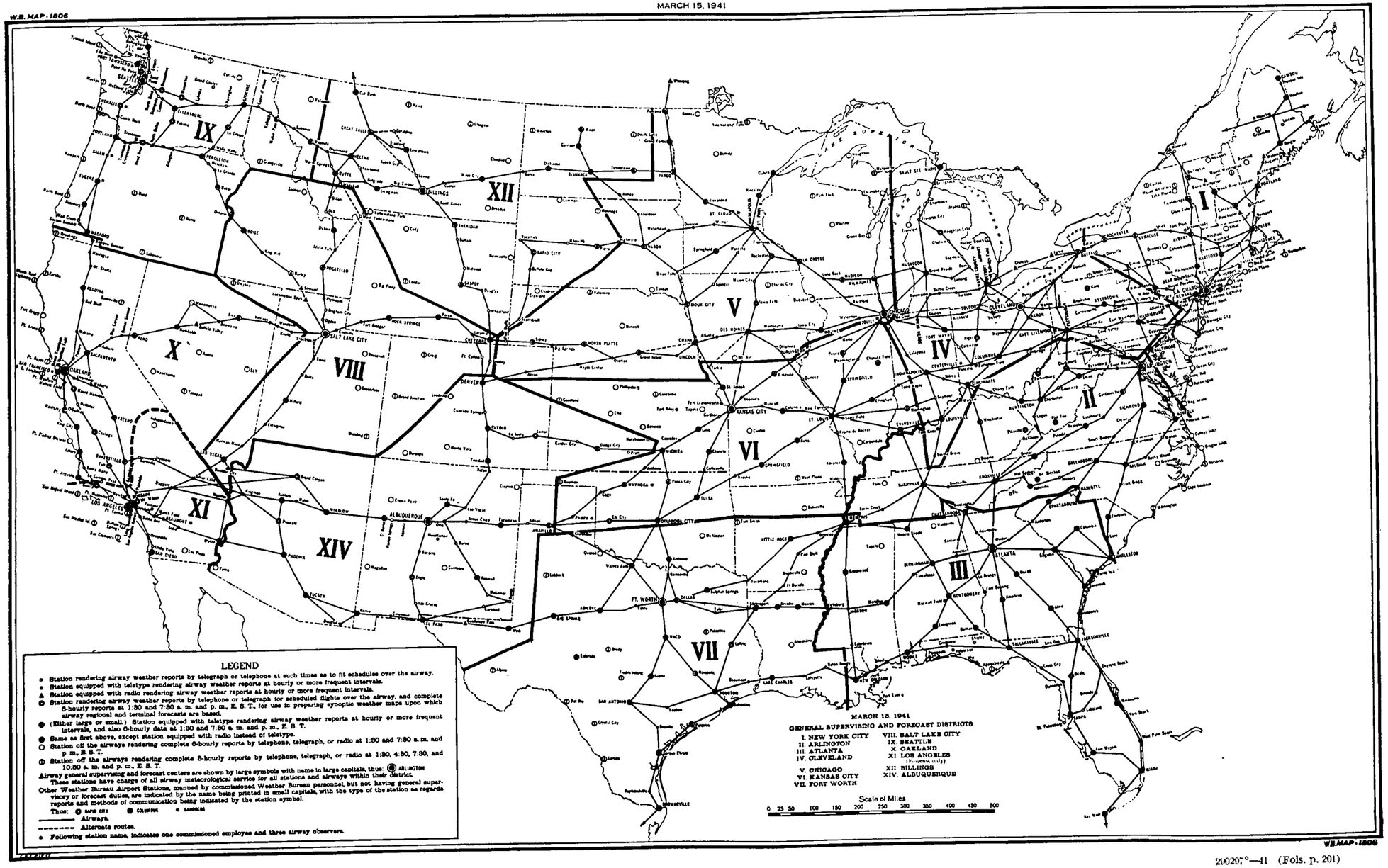
Station	Classification of report	Type of report	Time of report	Ceiling	Sky	Visibility	Weather	Obstructions to vision	Barometric pressure	Temperature	Dew point	Wind	Altimeter setting	Remarks
Lists of station names and their representative call letters are posted on Weather Bureau airport station bulletin boards for the information of all concerned.	The symbols C, N, or X are used immediately following, after 1 space, the station letters to classify weather conditions at airports specifically designated as controlled airports. If no classification letter is used the station is not located at a controlled airport. C: Satisfactory for contact flight. N: Requiring observance of instrument flight rules. X: Take-off and landing suspended.	"SPL," meaning "special report," appears when crucial changes have occurred in weather conditions since the last report. The absence of the observation-type letter group "SPL" indicates an observation where no crucial changes have occurred since the last transmitted observation. "LCL," meaning "local extra observation," appears only on reports sent over local circuits. Such reports are made every 15 minutes during periods of low ceiling and/or visibility.	Time groups are in figures based on the 24-hour clock, with following letters showing the standard of time used, e. g., "1440E" means 2:40 p. m., Eastern Standard Time; "0030C" means 12:30 a. m., Central Standard Time; "2359M" means 11:59 p. m., Mountain Standard Time; "2015P" means 8:15 p. m., Pacific Standard Time, etc. "SPL" reports which are sent alone and all "LCL" reports bear the time of observation immediately following, after 1 space, the observation-type letter group "SPL" or "LCL." "SPL" reports appearing in sequences do not show the time-of-report group and the time of observation is considered as the time of all other reports in the sequence as indicated in the sequence heading.	The absence of a "ceiling" group indicates an "unlimited" ceiling (above 9,750 feet). Figures representing the number of *hundreds* of feet which apply are used to indicate the height of the ceiling between 51 and 9,750 feet, inclusive, above the station, e.g., "35" indicates 3,500 feet, "3" indicates 300 feet, etc. The figure naught (0) is used when the ceiling is zero (below 51 feet). When the height is estimated the letter "E" precedes the ceiling figures. A plus sign (+) is used preceding the ceiling figures to indicate the ceiling balloon was blown from sight at the height represented by the figures and before reaching the clouds. The letter "V", immediately following the figure(s) for ceiling, indicates that the height of the ceiling is changeable. Between heights of 1,000 and 2,000 feet, "V" indicates a variation up to 200 feet on either side of the reported value; below 1,000 feet, "V" indicates a variation up to 100 feet on either side of the reported value.	The absence of a symbol for sky indicates that precipitation or obstructions to vision are present and reduce the ceiling to zero and/or the visibility to less than one-fifth mile and make the sky unobservable. The sky condition is indicated by the following symbols unless the condition given above is present: ○ Clear. ① Scattered clouds. ◍ Broken clouds. ⊕ Overcast. ①/ High scattered. ◍/ High broken. ⊕/ High overcast. ⊕◍ Overcast, lower broken. ⊕① Overcast, lower scattered. ◍◍ Broken, lower broken. ◍① Broken, lower scattered. ①◍ Scattered, lower broken. ①① Scattered, lower scattered. ⊕/◍ High overcast, lower broken. ⊕/① High overcast, lower scattered. ◍/◍ High broken, lower broken. ◍/① High broken, lower scattered. ①/◍ High scattered, lower broken. ①/① High scattered, lower scattered. The plus (+) or minus (−) sign *preceding* the cloudiness symbol indicates "dark" and "thin," respectively. Height of lower scattered clouds is indicated by the entry of a figure, representing the hundreds of feet applying, immediately preceding the scattered clouds symbol.	The absence of a figure for visibility indicates that the visibility is 10 miles or more. The value of the visibility below 10 miles is indicated by figures representing the number of miles and/or fractions of miles. The letter "V", immediately following the figure for visibility, indicates a fluctuating visibility which does not vary by more than ¼ mile to either side of the reported value.	The "weather" element of the report is indicated, when appropriate, by the following symbols: R− Light rain. R Moderate rain. R+ Heavy rain. S− Light snow. S Moderate snow. S+ Heavy snow. ZR− Light freezing rain. ZR Moderate freezing rain. ZR+ Heavy freezing rain. L− Light drizzle. L Moderate drizzle. L+ Heavy drizzle. ZL− Light freezing drizzle. ZL Moderate freezing drizzle. ZL+ Heavy freezing drizzle. E− Light sleet. E Moderate sleet. E+ Heavy sleet. A− Light hail. A Moderate hail. A+ Heavy hail. AP− Light small hail. AP Moderate small hail. AP+ Heavy small hail. SP− Light snow pellets. SP Moderate snow pellets. SP+ Heavy snow pellets. SQ− Mild snow squall. SQ Moderate snow squall. SQ+ Severe snow squall. RQ− Mild rain squall. RQ Moderate rain squall. RQ+ Severe rain squall. T Thunderstorm. T+ Heavy thunderstorm. SW− Light snow showers. SW Moderate snow showers. SW+ Heavy snow showers. RW− Light rain showers. RW Moderate rain showers. RW+ Heavy rain showers. TORNADO (always written out in full).	The "obstructions to vision" element of the report is indicated, when appropriate, by the following symbols: F−− Damp haze. F− Light fog. F Moderate fog. F+ Thick fog. FF Dense fog. GF− Light ground fog. GF Moderate ground fog. GF+ Thick ground fog. GFF Dense ground fog. IF− Light ice fog. IF Moderate ice fog. IF+ Thick ice fog. IFF Dense ice fog. H Hazy. K− Light smoke. K Moderate smoke. K+ Thick smoke. D− Light dust. D Moderate dust. D+ Thick dust. BS− Light blowing snow. BS Moderate blowing snow. BS+ Thick blowing snow. GS− Light drifting snow. GS Moderate drifting snow. GS+ Thick drifting snow. BD− Light blowing dust. BD Moderate blowing dust. BD+ Thick blowing dust. BN− Light blowing sand. BN Moderate blowing sand. BN+ Thick blowing sand.	The barometric pressure is indicated by a group of 3 figures; tens, units, and tenths of millibars involved. Thus a pressure of 1015.2 millibars would be written as "152"; 999.9 as "999"; 1025.7 as "257"; etc. Sent only by stations equipped with mercurial barometers.	Temperature is indicated by figures giving its value to the nearest degree Fahrenheit. Values below zero Fahrenheit are indicated by the entry of a minus sign (−) immediately preceding the figures for temperature. Zero is entered as "0."	Dew point is indicated by figures giving its value to the nearest degree Fahrenheit. Values below zero Fahrenheit are indicated by the entry of a minus sign (−) immediately preceding the figures for dew point.	The wind *direction* is indicated by arrows, as follows: ↓ North. ↓↙ North-northeast. ↙ Northeast. ←↙ East-northeast. ← East. ←↖ East-southeast. ↖ Southeast. ↑↖ South-southeast. ↑ South. ↑↗ South-southwest. ↗ Southwest. →↗ West-southwest. → West. →↘ West-northwest. ↘ Northwest. ↓↘ North-northwest. The *velocity* is indicated by figures representing its value in miles per hour, "calm" being indicated by the letter "C." If estimated, this is indicated by the entry of the letter "E" immediately following the velocity figures. The *character* of the wind is indicated, when appropriate, by entry, immediately following the velocity, of a minus sign (−) for "fresh gusts" and a plus sign (+) for "strong gusts." No indication of character means the wind is steady. *Wind shifts* which have occurred at the reporting station are indicated, immediately following the other wind data, by an arrow showing the direction (to 8 points only) from which the wind was blowing prior to the shift, followed by the local time, on the 24-hour clock, at which the shift occurred, with following letter showing the standard of time used. The intensity of the shift is indicated by the minus sign (−) for "mild," the absence of a sign for "moderate," and the plus sign (+) for "severe," the signs being entered immediately following the standard-of-time letter.	Indicated by a group of 3 figures representing the inch and hundredths of an inch of pressure involved. Thus, 30.00 would be written as "000"; 29.98 as "998"; etc. Sent only by designated stations equipped with mercurial barometers. **Special data** Special data comprising pressure change and characteristic, 5,000-foot pressure at selected stations, cloud, thunderstorm, and snow depth data, Great Lakes water temperature, etc., data from selected stations, etc., are entered in code at certain times by the stations designated to do this, as separate groups, immediately following the report proper. These data are intended primarily for the preparation of maps for forecasting. **Missing data** Elements normally sent, but for some reason missing from the transmission, will be indicated by the letter "M" entered in the report in place of the missing data.	Remarks are transmitted in authorized English abbreviations and teletype symbols. Lists of the abbreviations are available for inspection at all Weather Bureau Airport Stations. The teletype symbols used are shown on this chart.

For example, the report given above would be deciphered as follows: Washington—observance of instrument flight rules required; special report at 4:24 p. m., Eastern Standard Time; ceiling estimated at 3,000 feet; overcast, lower scattered clouds at 1,500 feet; visibility 2 miles, variable; thunderstorm; light rain shower; light blowing dust; barometric pressure 1015.2 millibars; temperature 68° F.; dew point 60° F.; wind west-northwest 22 miles per hour, strong gusts; moderate wind shift from the south at 4:18 p. m., Eastern Standard Time; altimeter setting, 29.96 inches; dark to northwest, occasional lightning in clouds.

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

WEATHER BUREAU AIRWAY METEOROLOGICAL SERVICE

MARCH 15, 1941



UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

APPENDIX II.

(CIRCULAR N, 1941)

Effective August 1, 1942
Corrected October 1, 1942

INSTRUCTIONS FOR SIX-HOURLY AND THREE-HOURLY AIRWAY SERVICE

CHAPTER I

CANCELLATION OF PREVIOUS CIRCULARS

1. The following instructions, effective with the 0430E three-hourly observation and the 0730E six-hourly observation of August 1, 1942, cancel those contained in Appendix V to the 1939 Edition of Circular N.

CHAPTER II

PURPOSE AND SCOPE OF INSTRUCTIONS

2. The instructions contained in this appendix to Circular N will govern the transmission and entry on forms of observations taken at approximately 0130, 0430, 0730, 1030, 1330, 1630, 1930, and 2230 E.S.T., at all stations named or included in the various categories as outlined hereinafter, except where specific exceptions to this general rule are stated.

6-HOURLY SERVICE

CHAPTER III

TYPES OF REPORTS

3. In order to provide all data necessary for the preparation of complete weather maps at the 6-hourly periods upon which to base airway and district weather forecasts, a comprehensive collection and distribution of synoptic weather reports are required. To accomplish this the following major groups of reports are to be transmitted:

(a) Teletype Map Reports ("MT"): Complete synoptic meteorological surface reports, encoded in the Weather Bureau numeral code and transmitted from weather reporting stations on teletype and radio circuits authorized to do this and in the order of stations shown in Civil Aeronautics Administration "Manual of Operations," Chapter B, Part 6, Section 3. Sequences to run on individual teletype and radio circuits are then relayed to all other circuits in the country at times set by and in accordance with instructions governing this as issued by Civil Aeronautics Administration. The elements included in such reports for each individual 6-hourly period and their order and method of encoding in numeral code are those prescribed in the Weather Code (Numeral System) 1942.

(b) Map Reports ("M"): Complete synoptic meteorological surface reports to be made at designated stations at 0130, 0730, 1330 and 1930 E.S.T., (0230, 0830, 1430 and 2030 E.W.T.) which reports are encoded in the Weather Bureau numeral code, or, in the case of reports from Mexico or from ships, in the code authorized for use by that country or for ships. Their method of distribution differs from that of the teletype map reports ("MT"), in that they are collected by various methods (telegraph, radio, special message, etc.) and then transmitted in groups from a designated distributing point.

(c) Special 6-Hourly Data Added to Airway Weather Reports On Teletype Schedule "A": The numeral group "appRR" will be added to the end of the 0130, 0730, 1330, and 1930 E.S.T. (0230, 0830, 1430, 2030 E.W.T.) teletype or radio hourly airway weather reports at all hourly reporting stations equipped with pressure-measuring instruments and rain gage. Stations in this category which have not as yet been supplied with rain gages will add a group containing the pressure change and characteristic, and two slant marks as shown following:

"app//"

The two slant marks will indicate that the station does not report precipitation amounts, and as soon as the station is equipped with a rain gage, it will automatically render the "appRR" group instead.

Pressure characteristic and change, "app," will be coded by means of Code Tables 63 and 64 respectively of the 1942 Weather Code (Numeral System). The amount of precipitation, "RR," will be that occurring within the 6 hours preceding the observation and will be entered in hundredths of an inch in accordance with the provisions of the 1942 Weather Code. For example 0.09 inches would be entered "09"; 0.77 inches would be entered "77"; 0.01 inches would be entered "01"; etc. If one inch or more has occurred, ONE, TWO, THREE, etc., for the number of inches of precipitation will be placed before the "appRR" group; for example (representing pressure characteristic and change in symbolic form), 2.77 inches would be entered "TWO app77"; 1.01 inches would be entered "ONE app01"; 1.00 inch would be entered "ONE app00"; etc. If only a trace of precipitation (less than 0.005 inches) has occurred within the last six hours, the amount will be entered "99." It should be noted that amounts of 0.98 or 0.99 inches are entered as "98." If no precipitation has occurred during the six hours previous to the observation, the group will be composed of only the three figures for "app."

At hourly reporting stations adding special 6-hourly data to airway weather reports on Schedule "A," where all four 6-hourly reports are NOT made, it will be necessary to send the 12-hour amount of precipitation instead of the 6-hour amount in one or more of the 6-hourly observation reports. In order to identify such reports as 12-hour amounts of precipitation instead of 6-hour amounts, a slant (/) will always be inserted between "app" and "RR" whenever a 12-hour amount for "RR" is reported (app/RR). If no precipitation has occurred during the 12 hours previous to the observation, the group (app/RR) will be composed of only the three figures for "app."

In addition to the "appRR" group, all hourly reporting stations will, whenever at least 1 inch of snow or more has fallen within the past 6 hours, add the word contraction "SNW" immediately followed by the depth of snow on the ground to the nearest inch. For example, assuming that one inch or more of snow has fallen within the last six hours, a total of 4 inches on the ground would be transmitted as "SNW4," 10 inches, as "SNW10," 1 inch as "SNW1," etc. The depth of snow group will be the last group in the message.

Stations specifically designated by the Regional Office or by the Central Office will send one or both of the following numeral code groups in addition to the "appRR" and snow-depth groups:

$$C_L C_M C_H D_C{}^* \qquad 9P_m P_m P_m a_3$$

Additive data reporting stations whose reports are taken from Teletype Schedule "A" by designated stations, recoded into the numeral code, and placed on Schedule "C," are contained in the list of stations given in Chapter X following and are marked by an asterisk. Only additive data reports from these stations are recoded and given Schedule "C" distribution.

CHAPTER IV

GENERAL PLAN OF TELETYPE MAP REPORT TRANSMISSIONS

4. The transmission of teletype map reports will be accomplished as follows:

(a) Each station listed in Chapter IX following will prepare a teletype map report as outlined in paragraph 3(a) above and have this ready for transmission at the beginning of the 35th minute past the hours of 0100, 0700, 1300, and 1900 E.S.T., the observation on which this report is based to have been started not earlier than 10 minutes after the same hour. (Certain designated off-teletype stations whose reports are entered in the "MT" sequences are permitted to start their observations a few minutes earlier). At stations where the Weather Bureau personnel turn the reports over to Civil Aeronautics Administration station for transmission, the Weather Bureau personnel will file the report at least by 0133, 1733, 1333 and 1933, E.S.T., so that it may be punched up on the perforator prior to transmission on the circuits.

(b) The reports will then be entered on the individual circuits beginning at approximately 0135, 0735, 1335, and 1935, E.S.T., in the order of stations as given in Civil Aeronautics Administration "Manual of Operations," Chapter B, Part 6, Section 3.

(c) After this original transmission, relays of these reports will be made during such periods and times as are prescribed by the National Communication Schedule and the "Manual of Operations" of Civil Aeronautics Administration until the teletype map reports have been transmitted to all circuits in the country in addition to the one on which they originated.

* If no clouds are present this cloud group will be omitted; also please note that "h" has been dropped from this cloud group. The order of additive data groups where all are sent will be:

$$\text{"appRR} \quad C_L C_M C_H D_c \quad 9P_m P_m P_m a_3 \quad \text{SNW---"}$$

CHAPTER V

USE OF TELETYPE MAP REPORT DATA IN AIRWAY RECORD OBSERVATIONS

5. Since at some airport stations the teletype map report will be filed only a few minutes after the record airway observation for that hour, it will not be necessary for the observer to take a new observation for the latter report unless conditions have changed to such a degree as to require the filing of a "special" as outlined in Section II, Chapter V, Page 15, of Circular N, 1941. However, a check will be made on the visual elements just prior to filing the record airway observation in order to make certain that values for these data are strictly up-to-date. (Please note that the "Additive Data" groups required by subparagraph 3(c) above for Schedule "A" differ slightly from the standard "MT" code groups.)

CHAPTER VI

FORMS TO BE USED IN TAKING AND RECORDING MAP AND TELETYPE MAP REPORTS

6. Since the making of proper map and teletype map reports involves the taking of complete meteorological observations, including reductions of the mercurial barometer readings, such observations will be recorded on WB Form 1083. At hourly-reporting stations making "MT" reports, necessary data for the regular airway sequence report (checked by the observer as required in Chapter V above) will then be extracted from this and entered on WB Form 1130 for transmission. Entries on WB Form 1083 are to conform with instructions for preparing that form, and these should be studied carefully so that the proper entries, permitting the taking of data therefrom for entry in proper form on WB Form 1130, are made in all cases.

CHAPTER VII

FORMS TO BE USED IN TAKING AND RECORDING SPECIAL 6-HOURLY DATA TO BE ADDED TO AIRWAY RECORD OBSERVATIONS

7. Stations now preparing WB Form 1083 will continue to do so as heretofore. However, stations which do not send "MT" reports but which send only additive data on Schedule "A" need not use the coding blocks at the bottom of WB Form 1083 but may enter the additive data groups directly in the "Remarks" column of WB Form 1130. Stations sending both the "MT" report on Schedule "C" and the additive data on Schedule "A" should note that the groups for the latter data differ slightly from the standard groups of the "MT" reports.

Stations not preparing WB Form 1083 will add the special six-hourly data group (see subparagraph 3(c) above) directly in the "Remarks" column of WB Form 1130. In this case, stations including the 5,000-foot pressure group will make computations for such pressure on WB Form 1135, and the 6-hour amount of precipitation measured at the observation will be placed

in "Precipitation" column of WB Form 1130 on the line of that particular observation; if no precipitation occurs during the six-hour period "0" will be entered; if only a trace occurs, that is, less than 0.005 inches, "T" will be entered on the line.

The special six-hourly additive data group(s) will be placed in the "Remarks" column following any remarks and will be separated from the regular airway report by a slant mark (/) and one space. (This slant mark will be added to the last figure group, symbol group, or word, according to which occurs last, of the regular airway report).

CHAPTER VIII

AUTHORITY FOR CHANGES

8. No change in the procedure or in the lists of teletype map reports should be made without authority from the Central Office. Recommendations for changes should carry the endorsements of all Regional Offices concerned. Changes should be anticipated and arrangements made for approval of such changes fifteen to thirty days in advance of their effective dates.

CHAPTER IX

STATIONS WHICH RENDER TELETYPE MAP REPORTS

9. The following stations shall take teletype map observations and enter these reports on Schedule "C" in the order shown in Civil Aeronautics Administration "Manual of Operations," Chapter B, Part 6, Section 3, "Distribution of Meteorological Information - United States." Copies of this Manual are furnished to all concerned.

"MT" REPORTS ARRANGED NUMERICALLY

*047	Guantanamo Bay, Cuba	214	Tallahassee
201	Key West	217	Macon
202	Miami #	218	Augusta
206	Jacksonville	219	Atlanta
207	Savannah #	*220	Apalachicola
208	Charleston, S. C. #	222	Pensacola
211	Tampa	223	Mobile

* Report originates from off-teletype station.

\# Added group at 0730 /T_nT_nTT and at 1930 /T_xT_xTT city office extreme temperatures.

"MT" REPORTS ARRANGED NUMERICALLY (CONTINUED)

226	Montgomery	288	Burbank
228	Birmingham	290	San Diego
231	New Orleans	3/0	Cherry Point, N. C.
*232	Burrwood	301	Wilmington, N. C.
234	Meridian	*304	Hatteras
235	Jackson, Miss.	306	Raleigh
236	Vicksburg	308	Norfolk
240	Lake Charles	310	Columbia, S. C.
241	Port Arthur	313	Spartanburg
242	Galveston	314	Charlotte, N. C.
243	Houston	315	Asheville
247	Palestine	317	Greensboro
248	Shreveport	324	Chattanooga
250	Brownsville	326	Knoxville
251	Corpus Christi	327	Nashville
253	San Antonio	334	Memphis
254	Austin	340	Little Rock
256	Waco	344	Fort Smith
259	Fort Worth	353	Oklahoma City
265	Big Spring	356	Tulsa
266	Abilene	363	Amarillo
268	Roswell	365	Albuquerque
270	El Paso	374	Winslow
274	Tucson	384	Bakersfield
278	Phoenix	386	Las Vegas, Nevada

* Report originates from off-teletype station.

"MT" REPORTS ARRANGED NUMERICALLY (CONTINUED)

389	Fresno	449	St. Joseph
394	Santa Maria, Calif.	450	Wichita
401	Richmond	451	Dodge City
403	Cape May, N. J.	456	Topeka
405	Washington, D. C.	458	Concordia
406	Baltimore	464	Pueblo
407	Atlantic City	469	Denver
408	Philadelphia	*472	Blanding
4/1	Quantico, Va.	476	Grand Junction
410	Lynchburg, Va.	483	Sacramento
417	Elkins	488	Reno
423	Louisville	494	San Francisco
425	Huntington	501	Trenton
426	Cincinnati	503	New York
427	Parkersburg	504	New Haven
428	Columbus, Ohio	*505	Block Island
429	Dayton	*506	Nantucket
432	Evansville	507	Providence
434	St. Louis	508	Hartford
437	Terre Haute	509	Boston
438	Indianapolis	511	Harrisburg
439	Springfield, Ill.	515	Binghamton
440	Springfield, Mo.	518	Albany
445	Columbia, Mo.	519	Syracuse
446	Kansas City	520	Pittsburgh
		521	Akron

* Report originates from off-teletype station.

"MT" REPORTS ARRANGED NUMERICALLY (CONTINUED)

524	Cleveland	578	Pocatello
526	Erie	583	Winnemucca
528	Buffalo	*587	Owyhee, Nevada
529	Rochester, N. Y.	*589	Lakeview, Ore.
532	Peoria	592	Redding
533	Fort Wayne	597	Medford
534	Chicago	*598	Brookings, Ore.
535	South Bend	605	Concord, N. H.
536	Toledo	606	Portland, Me.
537	Detroit	*608	Eastport, Me.
539	Lansing	*613	Mt. Washington, N. H.
543	Iowa City	*615	White Face Mountain, N. Y.
544	Moline	617	Burlington, Vt.
546	Des Moines	*619	Greenville, Me.
547	Dubuque	635	Grand Rapids
551	Lincoln	636	Muskegon
553	Omaha	639	Alpena
557	Sioux City, Ia.	640	Milwaukee
562	North Platte	641	Madison
564	Cheynne	642	Charles City
567	Valentine	643	LaCrosse, Wis.
569	Casper	645	Green Bay
*570	Roosevelt, Utah	648	Escanaba
572	Salt Lake City	654	Huron
574	Rock Springs	658	Minneapolis

* Report originates from off-teletype station.

"MT" REPORTS ARRANGED NUMERICALLY (CONTINUED)

662	Rapid City	*746	Grand Marais, Minn.
666	Sheridan	753	Fargo
677	Billings	764	Bismarck
679	Butte	767	Williston
681	Boise	772	Helena
*683	Burns, Oregon	773	Missoula
*687	Grangeville, Idaho	775	Great Falls
688	Pendleton	777	Havre
690	Roseburg	*780	LaCrosse, Wash.
*691	North Bend, Ore.	781	Yakima
*692	Bend, Oregon	782	Ellensburg
*695	Newport, Oregon	785	Spokane
698	Portland, Oregon	*786	Bonner's Ferry, Idaho
699	Tongue Point, Ore.	*787	Colville, Wash.
712	Caribou	*788	Oroville, Wash.
734	Sault Ste. Marie	*791	North Head
743	Marquette	793	Seattle
*744	Houghton, Mich.	*794	Moclips, Wash.
745	Duluth	*798	Tatoosh Island

* Report originates from off-teletype station.

18-6290

"MT" REPORTS ARRANGED ALPHABETICALLY

266	Abilene, Texas	250	Brownsville, Texas
518	Albany, N. Y.	528	Buffalo, N. Y.
365	Albuquerque, N. Mex.	288	Burbank, Calif.
639	Alpena, Michigan	*683	Burns, Oregon
521	Akron, Ohio	617	Burlington, Vt.
363	Amarillo, Texas	*232	Burrwood, La.
*220	Apalachicola	679	Butte, Montana
315	Asheville, N. C.	403	Cape May, N. J.
219	Atlanta, Ga.	712	Caribou, Me.
407	Atlantic City, N. J.	569	Casper, Wyo.
218	Augusta, Georgia	314	Charlotte, N. C.
254	Austin, Texas	642	Charles City, Ia.
384	Bakersfield, Calif.	208	Charleston, S. C.#
406	Baltimore, Md.	324	Chattanooga, Tenn.
*692	Bend, Oregon	*3/0	Cherry Point, N. C.
265	Big Spring, Texas	564	Cheyenne, Wyoming
677	Billings, Montana	534	Chicago, Ill.
515	Binghamton, N. Y.	426	Cincinnati, Ohio
228	Birmingham, Ala.	524	Cleveland
764	Bismarck, N. D.	445	Columbia, Mo.
*472	Blanding, Utah	310	Columbia, S. C.
*505	Block Island, R. I.	428	Columbus, Ohio
681	Boise, Idaho	*787	Colville, Wash.
*786	Bonner's Ferry, Idaho	605	Concord, N. H.
509	Boston, Mass.	458	Concordia, Kansas
*598	Brookings, Ore.	251	Corpus Christi, Texas

* Report originates from off-teletype station.
\# Added group at 0730 /T_nT_nTT and at 1930 /T_xT_xTT city office extreme temperatures.

"MT" REPORTS ARRANGED ALPHABETICALLY (CONTINUED)

429 Dayton, Ohio
469 Denver, Colo.
546 Des Moines, Ia.
537 Detroit, Mich.
451 Dodge City, Kansas
547 Dubuque, Ia.
745 Duluth, Minnesota
*608 Eastport, Me.
417 Elkins, W. Va.
782 Ellensburg, Wash.
270 El Paso, Texas

526 Erie, Pa.
648 Escanaba, Mich.
432 Evansville, Ind.
753 Fargo, N. D.
344 Fort Smith, Ark.
533 Fort Wayne, Ind.
259 Fort Worth, Texas
389 Fresno, Calif.
242 Galveston, Texas
476 Grand Junction, Colo.
*746 Grand Marais, Minn.
635 Grand Rapids, Mich.
*687 Grangeville, Idaho
775 Great Falls, Mont.

645 Green Bay, Wis.
317 Greensboro, N. C.
*619 Greenville, Maine
*047 Guantanamo Bay, Cuba
511 Harrisburg, Pa.
508 Hartford, Conn.
*304 Hatteras, N. C.
777 Havre, Montana
772 Helena, Montana
*744 Houghton, Mich.
243 Houston, Texas

425 Huntington, W. Va.
654 Huron, S. D.
438 Indianapolis, Ind.
543 Iowa City, Ia.
235 Jackson, Miss.
206 Jacksonville, Fla.
446 Kansas City, Mo.
201 Key West, Fla.
326 Knoxville, Tenn.
*780 LaCrosse, Wash.
643 LaCrosse, Wis.
240 Lake Charles, La.
*589 Lakeview, Oregon
539 Lansing, Mich.

* Report originates from off-teletype station.

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"MT" REPORTS ARRANGED ALPHABETICALLY (CONTINUED)

386	Las Vegas, Nevada	503	New York, N. Y.
551	Lincoln, Nebraska	308	Norfolk, Va.
340	Little Rock, Arkansas	*691	North Bend, Oregon
423	Louisville, Kentucky	*791	North Head, Wash.
410	Lynchburg, Virginia	562	North Platte, Nebraska
217	Macon, Georgia	353	Oklahoma City, Okla.
641	Madison, Wisconsin	553	Omaha, Nebraska
743	Marquette, Michigan	*788	Oroville, Wash.
597	Medford, Oregon	*587	Owyhee, Nevada
334	Memphis, Tenn.	247	Palestine, Texas
234	Meridian, Miss.	427	Parkersburg, W. Va.
202	Miami, Florida #	532	Peoria, Illinois
640	Milwaukee, Wis.	688	Pendleton, Oregon
658	Minneapolis, Minn.	222	Pensacola, Florida
773	Missoula, Montana	408	Philadelphia, Pa.
223	Mobile, Alabama	278	Phoenix, Arizona
*794	Moclips, Wash.	520	Pittsburgh, Pa.
544	Moline, Illinois	578	Pocatello, Idaho
226	Montgomery, Ala.	241	Port Arthur, Texas
*613	Mt. Washington, N. H.	606	Portland, Maine
636	Muskegon, Mich.	698	Portland, Oregon
*506	Nantucket, Mass.	507	Providence, R. I.
327	Nashville, Tenn.	464	Pueblo, Colorado
405	New Haven, Conn.	4/1	Quantico, Va.
231	New Orleans, La.	306	Raleigh, N. C.
*695	Newport, Oregon		

* Report originates from off-teletype station.
\# Added group at 0730 /T_nT_nTT and at 1930 /T_xT_xTT city office extreme temperatures.

"MT" REPORTS ARRANGED ALPHABETICALLY (CONTINUED)

662	Rapid City, S. D.	440	Springfield, Mo.
592	Redding, Calif.	449	St. Joseph, Mo.
488	Reno, Nevada	434	St. Louis, Mo.
401	Richmond, Virginia	519	Syracuse, N. Y.
529	Rochester, N. Y.	214	Tallahassee, Fla.
*570	Roosevelt, Utah	211	Tampa, Florida
574	Rock Springs, Wyoming	*798	Tatoosh Island, Wash.
690	Roseburg, Oregon	437	Terre Haute, Ind.
268	Roswell, New Mexico	536	Toledo, Ohio
483	Sacramento, Calif.	699	Tongue Point, Wash.
572	Salt Lake City, Utah	456	Topeka, Kansas
253	San Antonio, Texas	501	Trenton, N. J.
290	San Diego, Calif.	274	Tucson, Arizona
494	San Francisco, Calif.	356	Tulsa, Oklahoma
394	Santa Maria, Calif.	567	Valentine, Nebraska
734	Sault Ste. Marie, Mich.	236	Vicksburg, Miss.
207	Savannah, Georgia #	256	Waco, Texas
793	Seattle, Washington	405	Washington, D. C.
666	Sheridan, Wyoming	*615	Whiteface Mountain, N. Y.
248	Shreveport, La.	450	Wichita, Kansas
557	Sioux City, Iowa	767	Williston, N. D.
535	South Bend, Ind.	301	Wilmington, N. C.
313	Spartanburg, S. C.	583	Winnemucca, Nevada
785	Spokane, Washington	374	Winslow, Arizona
439	Springfield, Illinois	781	Yakima, Washington

* Report originates from off-teletype station.
\# Added group at 0730 /T_nT_nTT and at 1930 /T_xT_xTT city office extreme temperatures.

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CHAPTER X

STATIONS WHICH RENDER MAP REPORTS AND STATIONS WHOSE AIRWAY REPORTS ARE CONVERTED TO MAP REPORTS

10. The following list indicates the stations authorized to be included in the map report transmissions at teletype distribution centers in accordance with the "Manual of Operations." Proper headings as prescribed by Civil Aeronautics Administration will be entered at beginnings of transmissions.

MAP REPORTS ("M") ARRANGED NUMERICALLY

*204	Melbourne, Fla.	*264	Wink, Texas
*210	Ft. Myers, Fla.	*267	Lubbock, Texas
212	Ocala, Fla.	269	Carrizozo, N. Mexico
*215	Alma, Ga.	*272	Rodeo, N. Mexico
*216	Albany, Ga.	*275	Engle, N. Mexico
*238	Greenwood, Miss.	276	Mogollon, N. Mexico
239	Monticello, Ark.	*280	Yuma, Airzona
2/4	Arcadia, La.	*283	Blythe, Calif.
*244	Navasota, Texas	289	Mt. Wilson, Calif.
245	Lufkin, Texas	291	San Nicholas Is., Calif.
*246	Alexandria, La. (Camp Beauregard)	292	Buffalo Springs, Calif.
*249	Sulphur Springs, Texas	*300	Florence, S. C.
2/5	Fredicksburg, Texas	302	Cape Lookout, N. C.
252	Laredo, Texas	305	Greenville, N. C.
*255	Palacios, Texas	307	Cape Henry, Va.
257	Brady, Texas	316	Mt. Mitchell, N. C.
260	Crystal City, Texas	*318	Bristol, Tenn.
261	Del Rio, Texas	*322	Muscle Shoals, Ala.
262	Alpine, Texas	323	Huntsville, Ala.
263	El Dorado, Texas	328	Stearns, Kentucky

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C".

MAP REPORTS ("M") ARRANGED NUMERICALLY (CONTINUED)

330	Tupelo, Miss.	*411	Roanoke, Va.
335	Batesville, Ark.	412	Flat Top, W. Va.
337	Paris, Tenn.	413	Pikeville, Ky.
342	McAlester, Okla.	415	Clarksburg, W. Va.
348	West Plains, Mo.	*416	Gordonsville, Va.
*351	Wichita Falls, Tex.	418	Frostburg, Md.
352	Quanah, Texas	4/2	Chillicothe, Ohio
355	Elk City, Okla.	421	Winchester, Ky.
*358	Waynika, Okla.	*431	Advance, Mo.
*364	Tucumcari, N. Mexico	433	Carbondale, Ill.
367	Clayton, N. Mexico	435	Washington, Ind.
368	Guymon, Okla.	*436	Effingham, Ill.
*372	Prescott, Ariz.	592	Barnegat, N. J.
*373	El Morro, N. Mexico	443	Clinton, Mo.
376	Farmington, N. Mexico	447	Quincy, Ill.
377	Crownpoint, N. Mexico	499	Ambrose Lightship, N. Y.
378	Grand Canyon, Ariz.	454	Geneseo, Kansas
*381	Kingman, Ariz.	455	Ellis, Kansas
388	Independence, Calif.	459	Phillipsburg, Kansas
*391	Santa Barbara, Calif.	*460	Trinidad, Colorado
392	Pt. Arguello, Calif.	461	Monte Vista, Colorado
396	Pt. Piedras Blancas, Calif.	463	Lamar, Colorado
397	Coalinga, Calif.	465	Goodland, Kansas
400	Urbanna, Virginia	467	Leadville, Colorado
402	Snow Hill, Md.	471	Durango, Colorado
		*475	Milford, Utah

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C."

MAP REPORTS ("M") ARRANGED NUMERICALLY (CONTINUED)

477	Green River, Utah	*552	Grand Island, Nebraska
484	Hawthorne, Nevada	555	Burwell, Nebraska
485	Tonopah, Nevada	558	Tyndall, S. D.
486	Ely, Nevada	*563	Sidney, Nebraska
487	Austin, Nevada	*565	Parco, Wyoming
490	Mt. Hamilton, Calif.	*568	Chadron, Nebraska
491	Monterey, Calif.	571	Craig, Colo.
495	S.E. Farallon Is., Calif.	576	Lander, Wyoming
499	Point Arena, Calif.	577	Big Piney, Wyoming
496	Fire Island, L.I., N. Y.	*579	Burley, Idaho
500	Sandy Hook, N. J.	*580	Humboldt, Nevada
5/1	Oneonta, N. Y.	*582	Elko, Nevada
495	Tiana, L.I., N. Y.	584	Susanville, Calif.
*512	Kylertown, Pa.	590	Fort Bragg, Calif.
*513	Wilkes Barre, Pa.	594	Eureka, Calif.
5/2	Kane, Pa.	*607	Bangor, Maine
494	Ditch Plains, L.I., N.Y.	612	Newport, Vermont
527	Knapp Creek, N. Y.	616	Lake Placid, N. Y.
*540	Kirksville, Mo.	618	Rumford, Me.
*542	Lamoni, Iowa	*622	Canton, N. Y.

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C."

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MAP REPORTS ("M") ARRANGED NUMERICALLY (CONTINUED)

*6/3	Traverse City, Mich.	741	Park Falls, Wisconsin
634	Harbor Beach, Mich	742	Hinckley, Minnesota
646	Wausau, Wisconsin	747	International Falls, Minn.
650	Spencer, Iowa	*751	Alexandria, Minnesota
653	Springfield, Minnesota	*754	Jamestown, N. D.
661	Newcastle, Wyoming	755	Bemidji, Minnesota
*664	Pierre, S. D.	*756	Grand Forks, N. D.
667	Broadus, Montana	757	Devil's Lake, N. D.
668	Mobridge, S. D.	*758	Pembina, N. D.
669	Lemmon, S. D.	759	Roseau, Minnesota
*673	Dubois, Idaho	*761	Miles City, Montana
674	Cody, Wyoming	*763	Dickinson, N. D.
676	West Yellowstone, Mont.	765	Garrison, N. D.
*678	Livingston, Montana	*766	Minot, N. D.
686	Salmon, Idaho	768	Glasgow, Montana
*693	Eugene, Oregon	*771	Lewistown, Montana
*697	Northdalles, Wash.	778	Cutbank, Montana
*703	Houlton, Maine	779	Kalispell, Montana
740	Land O'Lakes, Wisconsin	*784	Mullan Pass, Idaho

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C."

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"M" REPORTS ARRANGED ALPHABETICALLY

*431 Advance, Mo.
*216 Albany, Ga.
*246 Alexandria, La.(Camp Beauregard)
*751 Alexandria, Minn.
*215 Alma, Georgia
262 Alpine, Texas
499 Ambrose Lightship, N. Y.
2/4 Arcadia, Louisiana
487 Austin, Nevada
*607 Bangor, Maine
592 Barnegat, N. J.
335 Batesville, Ark.
755 Bemidji, Minnesota
577 Big Piney, Wyoming
*283 Blythe, Calif.
257 Brady, Texas
*318 Bristol, Tenn.
667 Broadus, Montana
292 Buffalo Springs, Calif.
*579 Burley, Idaho
555 Burwell, Nebraska
*622 Canton, N. Y.
307 Cape Henry, Va.
302 Cape Lookout, N. C.
433 Carbondale, Ill.
269 Carrizozo, N. Mexico
*568 Chadron, Nebraska
4/2 Chillicothe, Ohio
415 Clarksburg, W. Va.
367 Clayton, N. Mexico
443 Clinton, Mo.
397 Coalinga, Calif.
674 Cody, Wyoming
377 Crownpoint, N. Mexico
571 Craig, Colo.
260 Crystal City, Texas
778 Cutbank, Montana
261 Del Rio, Texas
757 Devil's Lake, N. D.
*763 Dickinson, N. D.
494 Ditch Plains, L.I., N. Y.
*673 Dubois, Idaho
471 Durango, Colorado
263 El Dorado, Texas
*436 Effingham, Ill.

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C."

"M" REPORTS ARRANGED ALPHABETICALLY (CONTINUED)

355	Elk City, Oklahoma	477	Green River, Utah
*582	Elko, Nevada	305	Greenville, N. C.
486	Ely, Nevada	*238	Greenwood, Miss.
455	Ellis, Kansas	368	Guymon, Oklahoma
*373	El Morro, N. Mexico	634	Harbor Beach, Michigan
*275	Engle, N. Mexico	484	Hawthorne, Nevada
*693	Eugene, Oregon	742	Hinckley, Minnesota
594	Eureka, Calif.	*703	Houlton, Maine
376	Farmington, N. Mexico	*580	Humboldt, Nevada
412	Flat Top, W. Va.	323	Huntsville, Alabama
496	Fire Island, L.I., N. Y.	388	Independence, Calif.
*300	Florence, S. C.	747	International Falls, Minn.
590	Fort Bragg, Calif.	*754	Jamestown, N. D.
*210	Ft. Myers, Fla.	779	Kalispell, Montana
2/5	Fredericksburg, Texas	5/2	Kane, Pa.
418	Frostburg, Md.	*381	Kingman, Ariz.
765	Garrison, N. D.	*540	Kirksville, Mo.
454	Geneseo, Kansas	527	Knapp Creek, N. Y.
768	Glasgow, Montana	*512	Kylertown, Pa.
465	Goodland, Kansas	616	Lake Placid, N. Y.
*416	Gordonsville, Va.	463	Lamar, Colorado
378	Grand Canyon, Airz.	*542	Lamoni, Iowa
*756	Grand Forks, N. D.	576	Lander, Wyoming
*552	Grand Island, Nebraska	740	Land O'Lakes, Wisconsin

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C."

"M" REPORTS ARRANGED ALPHABETICALLY (CONTINUED)

252	Laredo, Texas	661	Newcastle, Wyoming
467	Leadville, Colorado	612	Newport, Vermont
669	Lemmon, S. D.	*697	Northdalles, Wash.
*771	Lewistown, Montana	212	Ocala, Florida
*678	Livingston, Montana	5/1	Oneonta, N. Y.
*267	Lubbock, Texas	*565	Parco, Wyoming
245	Lufkin, Texas	337	Paris, Tenn.
342	McAlester, Oklahoma	741	Park Falls, Wis.
*204	Melbourne, Florida	*255	Palacios, Texas
*761	Miles City, Montana	459	Phillipsburg, Kansas
*475	Milford, Utah	*758	Pembina, N. D.
*766	Minot, N. D.	*664	Pierre, S. D.
668	Mobridge, S. D.	413	Pikeville, Ky.
276	Mogollon, N. Mexico	499	Point Arena, Calif.
461	Monte Vista, Colorado	392	Point Arguello, Calif.
491	Monterey, California	396	Pt. Piedras Blancas, Calif.
239	Monticello, Arkansas	*372	Prescott, Ariz.
490	Mt. Hamilton, Calif.	352	Quanah, Texas
316	Mt. Mitchell, N. C.	447	Quincy, Ill.
289	Mt. Wilson, Calif.	*411	Roanoke, Va.
*784	Mullan Pass, Idaho	*272	Rodeo, N. Mexico
*322	Muscle Shoals, Ala.	759	Roseau, Minnesota
*244	Navasota, Texas	618	Rumford, Maine

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C."

"M" REPORTS ARRANGED ALPHABETICALLY (CONTINUED)

686	Salmon, Idaho	*364	Tucumcari, N. Mexico
500	Sandy Hook, N. J.	330	Tupelo, Miss.
291	San Nicholas Is., Calif.	*6/3	Traverse City, Mich.
*391	Santa Barbara, Calif.	558	Tyndall, S. D.
*563	Sidney, Nebraska	400	Urbanna, Virginia
402	Snow Hill, Md.	435	Washington, Ind.
495	S.E. Farallon Is., Calif.	646	Wausau, Wis.
650	Spencer, Iowa	*358	Waynoka, Oklahoma
653	Springfield, Minnesota	348	West Plains, Mo.
328	Stearns, Ky.	676	West Yellowstone, Mont.
*249	Sulphur Springs, Texas	*351	Wichita Falls, Texas
584	Susanville, Calif.	*513	Wilkes Barre, Pa.
495	Tiana, L.I., N. Y.	421	Winchester, Ky.
485	Tonopah, Nevada	*264	Wink, Texas
*460	Trinidad, Colorado	*280	Yuma, Arizona

* Report originates on Schedule "A" as record airway observation with special data added.
Airway report then converted to numeral code by designated station and entered on Schedule "C."

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ALASKAN "M" REPORTS ARRANGED ALPHABETICALLY

983	Akulurak	( )	Homer
#( )	Alitak	97/	Illiamna
973	Anchorage (Elmendorf)	962	Juneau
( )	Aniak	( )	Kanaga
991	Atka	( )	Kanakanak
997	Attu	981	Kanatak
989	Barrow	952	Ketchikan (Annette)
984	Bethel	996	Kiska
( )	Bettles	970	Kodiak
9/5	Cape Decision	988	Kotzebue
( )	Cape Spencer	( )	Lake Minchumina
( )	Cape St. Elias	( )	McCarthy
( )	Circle	985	McGrath
9/7	Copper Center	( )	Moses Point
971	Cordova	982	Naknek
951	Craig	( )	Nikolski
990	Dutch Harbor	987	Nome
( )	Eagle	( )	Northway
974	Fairbanks (Ladd)	994	Nunivak
978	Fort Yukon	( )	Perryville
( )	Fort Glenn	960	Petersburg
( )	Fort Randall	( )	Platinum
995	Gambell	/98	Pt. Hope
955	Haines	( )	Pt. Lay

#( ) International index Nos. not yet assigned.

ALASKAN "M" REPORTS ARRANGED ALPHABETICALLY

986	Ruby	( )	Storey River Island
980	Sand Point	( )	Summit
#( )	Scotch Cap	( )	Talkeetna
972	Seward	976	Tanana
( )	Shishmaref	967	Tanacross
98/	Shungnak	9/8	Unalakleet
9/6	Sitka (Biorka)	979	Wiseman
993	St. Paul Island	( )	Yatataga
( )	Stoney River	963	Yakutat

ALASKAN "M" REPORTS ARRANGED NUMERICALLY

9/5	Cape Decision	973	Anchorage (Elmendorf)
951	Craig	974	Fairbanks (Ladd)
952	Ketchikan	976	Tanana
955	Haines	978	Fort Yukon
9/6	Sitka (Biorka)	979	Wiseman
960	Petersburg	98/	Shungnak
962	Juneau	/98	Pt. Hope
963	Yakutat	9/8	Unalakleet
967	Tanacross	980	Sand Point
97/	Illiamna	981	Kanatak
9/7	Copper Center	982	Naknek
970	Kodiak	983	Akulurak
971	Cordova	984	Bethel
972	Seward	985	McGrath

#( ) International index Nos. not yet assigned.

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ALASKAN "M" REPORTS ARRANGED NUMERICALLY

986 Ruby
987 Nome
988 Kotzebue
989 Barrow
990 Dutch Harbor
991 Atka
993 St. Paul Island
994 Nunivak
995 Gambell
996 Kiska

997 Attu
#( ) Alitak
( ) Aniak
( ) Bettles
( ) Platinum
( ) Point Lay
( ) Shishmaref
( ) Storey River Island
( ) Talkeetna

( ) Cape Spencer
( ) Cape St. Elias
( ) Circle
( ) Eagle
( ) Fort Glenn
( ) Fort Randall
( ) Homer
( ) Kanaga
( ) Kanakanak
( ) Lake Minchumina

( ) McCarthy
( ) Moses Point
( ) Nikolski
( ) Northway
( ) Perryville
( ) Scotch Cap
( ) Stoney River
( ) Summit
( ) Yatataga

#( ) International index Nos. not yet assigned.

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CANADIAN MAP REPORTS ARRANGED NUMERICALLY

623 London, Ont.
624 Malton, Ont.
625 Sterling, Ont.
627 St. Hubert, Quebec
628 Ottawa, Ont.
629 Killaloe, Ont.
630 Muskoka, Ont.
731 North Bay, Ont.
735 Earlton, Ont.
738 White River, Ont.
739 Porquis Junction, Ont.
749 Port Arthur, Ont.
799 Victoria, B. C.
831 Kapuskasing, Ont.
833 Pagwa, Ont.
841 Armstrong, Ont.
842 Sioux Lookout, Ont.
845 Pickle Lake, Ont.
850 Kenora, Ont.
852 Winnipeg, Manitoba
854 Red Lake, Ont.
858 Norway House, Manitoba
859 God's Lake, Manitoba
860 Rivers, Manitoba
861 Broadview, Sask.
863 Regina, Sask.
867 The Pas, Manitoba
869 Prince Albert, Sask.
870 Swift Current, Sask.
872 Medicine Hat, Alberta
874 Lethbridge, Alberta
875 Cowley, Alberta
876 Battleford, Sask.
877 Calgary, Alberta
878 Penhold, Alberta
879 Edmonton, Alberta
881 Cranbrook, B. C.
883 Penticton, B. C.
884 Crescent Valley, B. C.
885 Carmi, B. C.
886 Princeton, B. C.
887 Kamloops, B. C.
888 Jasper, Alberta
890 Hope, B. C.
892 Vancouver, B. C.
894 Estevan, B. C.
895 Bull Harbor, B. C.
896 Prince George, B. C.

CANADIAN MAP REPORTS ARRANGED NUMERICALLY (CONT'D)

897 Williams Lake, B. C.
898 Prince Rupert, B. C.
899 Langara, B. C.
922 Stanley, Sask.
932 McMurray, Alberta
933 Keg River, Alberta
934 Ft. Smith, Alberta
936 Yellow Knife, D. of Mack.
941 Beaver Lodge, Alberta
942 Fairview, Alberta
944 Hudson Hope, B. C.
945 Ft. Nelson, B. C.
946 Ft. Simpson, D. of Mack.
949 Holman Island, N. W. T.
953 Watson Lake, B. C.
954 Atlin, B. C.
956 Ft. Norman, D. of Mack.
964 Whitehorse, Yukon
965 Mayo, Yukon
966 Dawson, Yukon

CANADIAN MAP REPORTS ARRANGED ALPHABETICALLY

841 Armstrong, Ont.
954 Atlin, B. C.
876 Battleford, Sask.
941 Beaver Lodge, Alberta
861 Broadview, Sask.
895 Bull Harbor, B. C.
877 Calgary, Alberta
885 Carmi, B. C.
875 Cowley, Alberta
881 Cranbrook, B. C.
884 Crescent Valley, B. C.
966 Dawson, Yukon
735 Earlton, Ont.
879 Edmonton, Alberta
894 Estevan, B. C.
942 Fairview, Alberta
956 Ft. Norman, D. of Mack.
946 Ft. Simpson, D. of Mack.
934 Ft. Smith, Alberta
859 God's Lake, Manitoba
949 Holman Island, N. W. T.
890 Hope, B. C.
944 Hudson Hope, B. C.
888 Jasper, Alberta

CANADIAN MAP REPORTS ARRANGED ALPHABETICALLY (CONT'D).

887 Kamloops, B. C.
831 Kapuskasing, Ont.
933 Keg River, Alberta
850 Kenora, Ont.
629 Killaloe, Ont.
899 Langara, B. C.
874 Lethbridge, Alberta
623 London, Ont.
624 Malton, Ont.
965 Mayo, Yukon
932 McMurray, Alberta
872 Medicine Hat, Alberta
630 Muskoka, Ont.
945 Nelson, B. C.
731 North Bay, Ont.
858 Norway House, Manitoba
628 Ottawa, Ont.
833 Pagwa, Ont.
878 Penhold, Alberta
883 Penticton, B. C.
845 Pickle Lake, Ont.
739 Porquis Junction, Ont.
749 Port Arthur, Ont.
869 Prince Albert, Sask.
896 Prince George, B. C.
898 Prince Rupert, B. C.
886 Princeton, B. C.
854 Red Lake, Ont.
863 Regina, Sask.
860 Rivers, Manitoba
842 Sioux Lookout, Ont.
922 Stanley, Sask.
625 Sterling, Ont.
627 St. Hubert, Quebec
870 Swift Current, Sask.
867 The Pas, Manitoba
892 Vancouver, B. C.
799 Victoria, B. C.
953 Watson Lake, B. C.
964 Whitehorse, Yukon
738 White River, Ont.
897 Williams Lake, B. C.
852 Winnipeg, Manitoba
936 Yellow Knife, D. of Mack

HAWAIIAN MAP REPORTS

999 Honolulu, T.H.

MEXICAN MAP REPORTS ARRANGED NUMERICALLY

100 Chetumal, Q. R.
101 Cozumel, Q. R.
105 Campeche, Camp.
106 Merida, Yuc.
107 Progreso, Yuc.
108 Tapachula, Chis.
115 Villahermosa, Tab.
116 Ciudad Obregon, Tab.
118 Salina Cruz, Oax.
119 Coatzacoalcos, Ver.
120 Oaxaca, Oax.
121 Veracruz, Ver.
136 Tacubaya, D. F.
138 Acapulco, Gro.
144 Morelia, Mich.
148 Tampico, Tamp.
151 Quanajuato, Gto.
159 Matmoros, Tam.
160 Manzanillo, Col.
161 Guadalajara, Val.
162 Zacatecas, Zac.
164 Monterrey, N. L.
170 Ciudad Lerdo, Dgs.
175 Islas Marias, Nay.
178 Chihuahua, Chih.
180 Mazatlan, Sin.
185 Culiacan, Sin.
190 La Paz, B. C.
194 Guaymas, Son.
195 Hermosillo, Son.

3-HOURLY SERVICE

CHAPTER XI

11. Hourly airway weather reporting stations on teletype or radio circuits which are equipped with pressure measuring instruments shall add to the 0430, 1030, 1630, and 2230 E.S.T. (0530, 1130, 1730, and 2330 E.W.T.) record airway observations, the code group "app" for data representing three-hourly pressure characteristic and change. Such of these stations as have been specifically instructed to do so shall also add to these reports, when clouds are present, a four-figure code group "$C_LC_MC_HD_c$," representing cloud data. These groups shall be added immediately following any remarks and shall be separated from the regular sequence report by a slant mark (/) and one space. This slant mark will be added to the last figure group, symbol group, or word (according to which occurs last) of the regular report.

12. Stations which do not make hourly airway weather reports and which have been so designated and instructed and are listed in the last paragraph of this chapter shall render reports (3M) at 0430, 1030, 1630 and 2230 E.S.T. # (0530, 1130, 1730 and 2230 E.W.T.) composed of data for the first five code groups indicated in the Weather Code (Numeral System) 1942, and in addition a three-figure group composed of "$T_sT_sD_c$," that is, dew point and cloud direction. WB Form 1082 will be used for these observations, and blocks for entry of the coded data are provided at the bottom of the form.

13. Distribution of "3M" reports will be made over teletype Schedule "C" in accordance with istructions contained in C.A.A. Manual of Operation, Chapter B, Part 6, Section 3. Stations which will enter their reports directly on Schedule "C" are marked with an asterisk on the list given in the last paragraph of this chapter. Other stations listed will telegraph or radio their reports to reach collection centers before 0430, 1030, 1630, and 2230 E.S.T. where they will be entered on Schedule "C."

14. The following is a list of stations which render three-hourly (3M) reports:

047	Guantanamo Bay, Cuba	257	Brady, Texas
2/5	Fredericksburg, Texas	260	Crystal City, Texas
220	Apalachicola, Florida	261	Del Rio, Texas
246	Alexandria, Louisiana	262	Alpine, Texas
*247	Palestine, Texas	263	Eldorado, Texas
252	Laredo, Texas	*268	Roswell, N. M.

Stations not designated to make all four of the three-hourly observations will make only those authorized.
* Station enters report directly on Schedule "C."

276	Mogollon, N. M.	485	Tonopah, Nevada
289	Mt. Wilson, Calif.	486	Ely, Nevada
291	San Nicholas Island, Calif.	492	Pt. Montara, Calif.
292	Buffalo Springs, Calif.	495	S.E. Farallon Island, Calif.
294	Pt. Firmin, Calif.	496	Point Reyes, Calif.
299	San Miguel Island, Calif.	499	Point Arena, Calif.
*301	Wilmington, N. C.	506	Nantucket, Mass.
304	Hatteras, N. C.	527	Knapp Creek, N. Y.
*315	Asheville, N. C.	*567	Valentine, Nebraska
*344	Ft. Smith, Arkansas	571	Craig, Colorado
348	West Plains, Mo.	576	Lander, Wyoming
368	Guymon, Oklahoma	584	Susanville, Calif.
390	Pt. Hueneme, Calif.	587	Owyhee, Nevada
392	Point Arguello, Calif.	589	Lakeview, Oregon
*401	Richmond, Va.	593	Blunts Reef Lightship, Calif.
402	Snow Hill, Md.	594	Eureka, Calif.
*403	Cape May, N. J.	598	Brookings, Ore.
4/1	Quantico, Va.	613	Mt. Washington, N. H.
4/2	Chillicothe, Ohio	615	Whiteface Mt., N. Y.
421	Winchester, Ky.	619	Greenville, Me.
*427	Parkersburg, W. Va.	622	Canton, N. Y.
*458	Concordia, Kansas	634	Harbor Beach, Mich.
465	Goodland, Kansas	*639	Alpena, Mich.
472	Blanding, Utah	*642	Charles City, Iowa
*476	Grand Junction, Colo.		

* Station enters report directly on Schedule "C."

*645	Green Bay, Wisconsin	*743	Marquette, Mich.
*648	Escanaba, Michigan	747	International Falls, Minn.
653	Springfield, Minn.	757	Devils Lake, N. D.
668	Mobridge, S. D.	766	Minot, N. D.
683	Burns, Oregon	*767	Williston, N. D.
687	Grangeville, Idaho	768	Glasgow, Montana
691	North Bend, Oregon	*777	Havre, Montana
692	Bend, Oregon	778	Cut Bank, Montana
695	Newport, Oregon	779	Kalispell, Montana
*699	Tongue Point, Oregon	788	Oroville, Washington
*712	Caribou, Maine	791	North Head, Washington
740	Land O'Lakes, Wis.	794	Moclips, Washington
741	Park Falls, Wisconsin	798	Tatoosh Island, Wash.

ALASKAN 3-HOURLY REPORTS

973	Anchorage (Elmendorf)	( )	Eagle
989	Barrow	974	Fairbanks (Ladd)
984	Bethel	978	Fort Yukon
9/5	Cape Decision	( )	Fort Glenn
#( )	Cape Spencer	( )	Fort Randall
( )	Cape St. Elias	955	Haines
( )	Circle	( )	Homer
9/7	Copper Center	97/	Illiamna
971	Cordova	962	Juneau
951	Craig	( )	Kanakanak

* Station enters report directly on Schedule "C."

( ) International index Nos. not yet assigned.

18-5290

ALASKAN 3-HOURLY REPORTS (CONTINUED)

952	Ketchikan (Annette)	972	Seward
970	Kodiak	( )	Sheep Mountain
988	Kotzebue	98/	Shungnak
#( )	McCarthy	9/6	Sitka (Biorka)
985	McGrath	( )	Stoney River
( )	Moses Point	( )	Storey Island
982	Naknek	( )	Summit
987	Nome	( )	Talkeetna
( )	Northway	976	Tanana
960	Petersburg	967	Tanacross
( )	Platinum	9/8	Unalakleet
986	Ruby	979	Wiseman
980	Sand Point	( )	Yatataga
( )	Scotch Cap	963	Yakutat

CANADIAN STATIONS RENDERING 3-HOURLY REPORTS

799	Victoria, B. C.	LBB	Bella Bella, B. C.
894	Estevan, B. C.	LCL	Cape Lazo, B. C.
895	Bull Harbor, B. C.	LDT	Dead Tree Point, B. C.
898	Prince Rupert, B. C.	LPC	Pachena, B. C.
899	Langara, B. C.	LTI	Triple Island, B. C.
LAB	Alert Bay, B. C.	LTQ	Kain's Island, B. C.

#( ) International index Nos. not yet assigned.

18-4268

UNITED STATES DEPARTMENT OF COMMERCE
Jesse H. Jones, Secretary

Supplement

WEATHER BUREAU
F. W. Reichelderfer, Chief

MANUAL OF INSTRUCTIONS FOR CODING ADDITIVE DATA GROUPS FOR HOURLY OBSERVATIONS

(APPENDIX II TO 1941 EDITION OF CIRCULAR N.)

DIVISION OF SYNOPTIC REPORTS AND FORECASTS

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Pages 10 and 11	SECTION III (3-hourly observations)

WASHINGTON: DECEMBER 1944
(Effective February 1, 1945)

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington 25, D. C.

SR&F Div/Syn-Mo

Effective February 1, 1945

MANUAL OF INSTRUCTIONS FOR CODING ADDITIVE DATA GROUPS FOR HOURLY OBSERVATIONS

(Appendix II to 1941 edition of Circular N.)

INTRODUCTION

The purpose of this manual is to provide a complete list of additive data that are included in hourly airways observations taken at the 6-hourly synoptic periods and at the 3-hourly intermediate synoptic periods. Necessary instructions and references for the coding of these data are included herein.

The term "all stations" as used in this manual includes all stations having transmitting drops on Schedule "A" teletype circuits and those stations that send hourly reports by means of telephone, radio or telegraph to a collecting station for inclusion in Schedule "A" sequence collections.

An additive group is a group of code figures (never less than two or more than six digits) which are used to code various meteorological phenomena and which is transmitted at the END of the regular hourly observation. If the hourly observation contains "weather remarks", the end of these "weather remarks" is considered to be the end of the regular hourly observation. Code figures for the values of the elements coded are taken from the appropriate code tables in the 1942 Weather Code.

A selected group of "additive data" reports are taken from Schedule "A" teletype circuits at designated stations (Washington and Denver) and recoded into the 1942 Numeral Code for transmission on Schedule "C" teletype circuits. These recoded reports are known as "converted reports" and follow the code form of the 1942 Weather Code insofar as available hourly and additive data permit. In general, the coded form of these reports is as follows:

$$IIIC_LC_M \quad wwVhN_h \quad DDF/N \quad PPPTT \quad /C_Happ \quad T_sT_sD_CT_{n/x}T_{n/x} \quad 7h_ch_cVV$$

$$8R_sR_tRR \quad 9P_mP_mP_ma_3 \quad 0S_pS_pS_pS_p$$

SECTION I

EFFECTIVE DATE OF THIS MANUAL

The instructions in this manual become effective with 0130 EST (0230 EWT) synoptic observation (6-hourly) February 1, 1945.

Coincident with the effective time of this manual, the October 1, 1942 edition of Appendix II, to the 1941 edition of Circular N and its amending circular letters are canceled, (Cir. Let. No. 31-44, 134-43, 110-43, 17-43, 155-42, 152-42, 108-42, 102-42 and 86-42).

SECTION II

6-HOURLY OBSERVATION PERIODS

All stations taking hourly observations at the 0130, 0730, 1330 and 1930 EST (0230, 0830, 1430 and 2030 EWT) periods will include as many of the additive data groups listed below as their instrumentation permits, ~~unless otherwise instructed by the Regional Office~~. The addi-

Section II, Page 2, 1st Paragraph: (Circular Letter No. 24-45) (Effective April 1, 1945)

(hourly report) / appRR (99ppp and/or 000R'R') $C_LC_MC_HD_Ch_+M_+$

(or $C_LC_MC_HD_C$) $9P_mP_mP_ma_3$ $T_n/_xT_n/_x$ $0S_pS_pS_pS_p$.

~~Explanation of the symbols and instructions for coding these elements~~ are as follows:

First group - "appRR"

a = Characteristic of barometric tendency of last three hours (Paragraphs 108, 109 and 112 of Part I and Code Table 63 of Part II, 1942 Weather Code; Instructions for Characterizing Barometric Tendencies, August 1, 1942).

If the station has not been supplied with a barograph or if the barograph should be inoperative for any reason, a slant (/) will be coded for "a".

pp = Amount (net change) of barometric tendency in last 3 hours. (Paragraphs 109, 110 and 112 of Part I and Code Table 64 of Part II, 1942 Weather Code; Instructions Characterizing Barometric Tendencies, dated August 1, 1942).

Values for "pp" are coded in FIFTHS of millibars (Code Table 64).

"When the amount of pressure change is 20 millibars (0.590 inch of mercury) or more, "99" is coded for "pp" and an additional five-figure group (99ppp) is inserted in the report immediately FOLLOWING the "appRR" group. In group "99ppp", "99" is the group identifier and "ppp" is the 3-hour net change in FIFTHS of millibars. Examples: (a) for a 3-hour net change of 3.4 millibars (0.100 inch) "17" is coded for "pp" (i.e., 17 FIFTHS of millibars); (b) for a 3-hour net change of 23.4 millibars (0.690 inch) "99" is coded for "pp" and "117" is coded for "ppp" (i.e., 0.690 inch equals 100 FIFTHS of millibars, 0.690 inch minus 0.590 inch leaves 0.100 inch or 17 FIFTHS of millibars, therefore, the value coded for "ppp" is the sum of 100 and 17 FIFTHS of millibars or "117").

Coincident with the effective time of this manual, the October 1, 1942 edition of Appendix II, to the 1941 edition of Circular N and its amending circular letters are canceled, (Cir. Let. No. 31-44, 134-43, 110-43, 17-43, 155-42, 152-42, 108-42, 102-42 and 86-42).

SECTION II

6-HOURLY OBSERVATION PERIODS

All stations taking hourly observations at the 0130, 0730, 1330 and 1930 EST (0230, 0830, 1430 and 2030 EWT) periods will include as many of the additive data groups listed below as their instrumentation permits, ~~unless otherwise instructed by the Regional Office.~~ The additive data groups are added at the end of the regular hourly observation and will be separated from it by a slant (/). A space will be used to separate the slant (/) and the "appRR" group. The order of the additive data groups to be included is shown by the following symbolic form:

(99ppp and/or 000R'R') $9P_mP_mP_ma_3$

(hourly report) / appRR$_n$ $C_LC_MC_HD_Ch_+M_+$(or $C_LC_MC_HD_C$) ~~$h_+M_+9P_mP_mP_ma_3$~~

$T_{n/x}T_{n/x}$ $0S_pS_ps_ps_p$

Explanation of the symbols and instructions for coding these elements are as follows:

First group - "appRR"

a = Characteristic of barometric tendency of last three hours (Paragraphs 108, 109 and 112 of Part I and Code Table 63 of Part II, 1942 Weather Code; Instructions for Characterizing Barometric Tendencies, August 1, 1942).

If the station has not been supplied with a barograph or if the barograph should be inoperative for any reason, a slant (/) will be coded for "a".

pp = Amount (net change) of barometric tendency in last 3 hours. (Paragraphs 109, 110 and 112 of Part I and Code Table 64 of Part II, 1942 Weather Code; Instructions Characterizing Barometric Tendencies, dated August 1, 1942).

Values for "pp" are coded in FIFTHS of millibars (Code Table 64).

If the amount of pressure change is 0.585 inch or less, (i.e., 99 fifths of mb. or less), the code figure is taken directly from Code Table 64. If the change is more than 0.585 inch the combination of a word (TWENTY) and code figure is used for codi "pp"; e.g., if the amount of change is 0.615 inches, 0.590 (20 millibars) is subtracted from this amount (0.615-0.590 = 0.025) and the code figure 04 for the remainder, 0.025 inch, is taken directly from Code Table 64. The value for "pp" (0.615 inch) is coded in the message as "TWENTY a04RR". When the word "TWENTY" is included in the report it immediately follows the

~~slant (/) at the end of~~ the regular hourly observation.

If for any reason the value for "pp" cannot be obtained, from either the barograph, or a mercurial or aneroid reading taken three hours previously, slants (///) will be coded for it. Examples of coding "pp" values are as follows:

"pp" value of 0.000 inch is coded as 00
"pp" value of 0.045 inch is coded as 08
"pp" value of 0.585 inch is coded as 99
"pp" value of 0.590 inch is coded as "~~TWENTY a00RR~~" "a99RR-99100"
"pp" value of 0.595 inch is coded as "~~TWENTY a01RR~~" "a99RR-99101"

If the values for "a" and "pp" are missing this group will be coded "///RR", ("hourly report / ///RR").

For coding both "a" and "pp" the preceding 3 hours are interpreted to mean the full 3 hours preceding the actual time of observation (e.g., 0415 to 0715 EST, if appropriate).

RR = Amount of precipitation which has occurred in the past 6 hours (Paragraphs 11, 12, 13, 134, 136, 137, 138, 139 of Part I and Code Table 70 of Part II, 1942 Weather Code).

When the total precipitation to be reported is from 0.01 to 0.99 inch, inclusive, RR will be coded as follows: 0.01 inch, RR=01; 0.57 inch, RR=57; 0.98 inch, RR=98; 0.99 inch, RR=98, etc. When 0.99 inch of precipitation is recorded, code figure 98 is ALWAYS coded for symbol "RR".

When the total precipitation to be reported is a "TRACE", code figure "99" is ALWAYS coded for symbol "RR". A "TRACE" of precipitation is an amount generally considered too small to measure; actually it is 0.005 inch or less. The standard Weather Bureau rule for disposal of decimals is used when measuring precipitation.

"When the amount of precipitation is one inch or more, five-figure group (000R'R') is inserted in the report FOLLOWING the "appRR" or the "99ppp" group (if the latter group is reported) to indicate the number of "whole inches" of precipitation. In the group "000R'R'", "000" is the group identifier and the "whole inches" of precipitation are coded for "R'R'". The "hundredths" of an inch of precipitation are coded for "RR" in the "appRR" group. Examples: (a) 0.77 inches is coded "app77", (b) 2.77 inches is coded "app77 00002" or "app77 99ppp 00002" if the "99ppp" group is also included.

Additive Data Groups for Hourly Observations"
(Appendix II to 1941 Edition of Circular N)

Page 2, Section II, 1st Paragraph, 1st Sentence:

Delete last 7 words of 1st sentence: "unless otherwise instructed the Regional Office."

Page 2, Section II, 1st Paragraph:

~~slant (/) at the end of~~ the regular hourly observation.

If for any reason the value for "pp" cannot be obtained, from either the barograph, or a mercurial or aneroid reading taken three hours previously, slants (//) will be coded for it. Examples of coding "pp" values are as follows:

"pp" value of 0.000 inch is coded as 00
"pp" value of 0.045 inch is coded as 08
"pp" value of 0.585 inch is coded as 99
"pp" value of 0.590 inch is coded as "~~TWENTY a00RR~~" "a99RR-99100."
"pp" value of 0.595 inch is coded as "~~TWENTY a01RR~~" "a99RR-99101."

If the values for "a" and "pp" are missing this group will be coded "///RR", ("hourly report / ///RR").

For coding both "a" and "pp" the preceding 3 hours are interpreted to mean the full 3 hours preceding the actual time of observation (e.g., 0415 to 0715 EST, if appropriate).

RR = Amount of precipitation which has occurred in the past 6 hours (Paragraphs 11, 12, 13, 134, 136, 137, 138, 139 of Part I and Code Table 70 of Part II, 1942 Weather Code).

When the total precipitation to be reported is from 0.01 to 0.99 inch, inclusive, RR will be coded as follows: 0.01 inch, RR=01; 0.57 inch, RR=57; 0.98 inch, RR=98; 0.99 inch, RR=98, etc. When 0.99 inch of precipitation is recorded, code figure 98 is ALWAYS coded for symbol "RR".

When the total precipitation to be reported is a "TRACE", code figure "99" is ALWAYS coded for symbol "RR". A "TRACE" of precipitation is an amount generally considered too small to measure; actually it is 0.005 inch or less. The standard Weather Bureau rule for disposal of decimals is used when measuring precipitation.

When the total precipitation to be reported is one inch, or more, a plain language word (ONE, TWO, THREE, etc., as appropriate) representing whole inches is inserted in the message immediately preceding the "appRR" group and the remaining hundredths of an inch are coded for "RR". For example, 2.77 inches would be coded as, "TWO app77".

Symbol "RR" is always represented by either a code figure or slants (//). Accordingly, if no precipitation has occurred during the reporting period "RR" will always be coded "00", or if precipitation has occurred and for any reason the actual amount is unknown, slants (//) will be used in coding "RR".

12-hour amounts of precipitation

In this appendix there is only one exception to the fixed rule of using 6-hour amounts of precipitation for coding symbol "RR" and this occurs when the following condition is met.

Stations which do not take observations at all 4 of the 6-hourly periods and which are not equipped with automatic recording rain gages will include the 12-hour amount in the next regular 6-hourly observation. The above instructions for coding "RR" apply equally to 6 and 12-hourly amounts EXCEPT that in the case of 12-hourly amounts the symbolic form of this group is changed to "app/RR".

Page 4, Section II, Examples:

(Circular Letter No. 24-45)
(Effective April 1, 1945)

OBSERVED VALUES:		CODE FIGURES:			TIME PERIOD	CODED AS:
pp (in.)	RR (in.)	a	pp	RR		
.005	zero	1	01	00	6 hours	10100
.045	trace	3	08	99	6 hours	30899
.590	0.63	4	99,99100	63	6 hours	49963 99100
.030	2.31	8	05	31,00002	6 hours	80531 00002
.675	3.57	9	99,99114	57,00003	6 hours	99957 99114 00003
.010	0.43	2	02	43	12 hours	202/43
.015	trace	1	03	99	12 hours	103/99
.015	missing	1	03	//	6 hours	103//

are reported and six code figures if 12-hour amounts are reported.

(Note: In general, the amount of precipitation reported in the 6-hourly coded synoptic observation ($8R_sR_tRR$) will agree with that coded in the "RR" element of the additive data group, "appRR". However, there is one case in which these two codings may not agree and this occurs when the only precipitation for the 6-hour period falls between the filing times of the coded 6-hourly synoptic and the hourly observation. When precipitation under these conditions occurs during this interval (between filing times) it will always be coded as a Trace for the additive data group regardless of the amount of precipitation that falls. In accordance with instructions in the 1942 Weather Code, the $8R_sR_tRR$ group will not be included in the coded 6-hourly synoptic report; however, "99" (Trace) will be coded for "RR" in the additive data precipitation group (appRR).

coded in the hourly report. Under these conditions the hourly report will be filed as "Special" and the reason for the differing amounts of precipitation reported in the coded synoptic report and the hourly report should be apparent to the recipients of both reports.)

12-hour amounts of precipitation

In this appendix there is only one exception to the fixed rule of using 6-hour amounts of precipitation for coding symbol "RR" and this occurs when the following condition is met.

Stations which do not take observations at all 4 of the 6-hourly periods and which are not equipped with automatic recording rain gages will include the 12-hour amount in the next regular 6-hourly observation. The above instructions for coding "RR" apply equally to 6 and 12-hourly amounts EXCEPT that in the case of 12-hourly amounts the symbolic form of this group is changed to "app/RR". The slant (/) will always be inserted between "app" and "RR" as 12-hour amount identification.

Examples of coding group "appRR":

Observed Values:		Code Figures:			Time Period	Coded as:
pp (in.)	RR (in.)	a	pp	RR		
.005	zero	1	01	00	6 hrs.	10100
.045	Trace	3	08	99	6 hrs.	30899
.590	0.63	4	99,99100	63	6 hrs.	49963 99100
.030	2.31	8	05	84,00002	6 hrs.	80531 00002
.675	3.57	9	99,99114	57,00003	6 hrs.	99957 99114 00003
.010	0.43	2	02	43	12 hrs.	202/43
.015	Trace	1	03	99	12 hrs.	103/99
.015	Missing	1	03	//	6 hrs.	103//

The "appRR" group will always be included in the report and will consist of five code figures if 6-hour amounts of precipitation are reported and six code figures if 12-hour amounts are reported.

(Note: In general, the amount of precipitation reported in the 6-hourly coded synoptic observation ($8R_sR_tRR$) will agree with that coded in the "RR" element of the additive data group, "appRR". However, there is one case in which these two codings may not agree and this occurs when the only precipitation for the 6-hour period falls between the filing times of the coded 6-hourly synoptic and the hourly observation. When precipitation under these conditions occurs during this interval (between filing times) it will always be coded as a Trace in the additive data group regardless of the amount of precipitation that falls. ~~Accordingly, "RR" will be coded as "00" in the 6-hour synoptic message and as "99" (Trace) in the additive data group "appRR".~~ In the latter case it is necessary to code "RR" as a Trace so that it will agree with the weather coded in the hourly report. Under these conditions the hourly report will be filed as "Special" and the reason for the differing amounts of precipitation reported in the coded synoptic report and the hourly report should be apparent to the recipients of both reports.)

<u>Second Group</u> - "$C_L C_M C_H D_C h_+ M_+$ or $C_L C_M C_H D_C$"

C_L = Form of low cloud (paragraphs 45 to 51 of Part I and Code Table 50 of Part II, 1942 Weather Code).

Code figure "0" is used for C_L when no low clouds are present and when the sky is obscured.

C_M = Form of middle cloud (paragraphs 45 to 51 of Part I and Code Table 51 of Part II, 1942 Weather Code).

Code figure "0" is used for C_M when no middle clouds are present, when middle clouds cannot be observed because of low clouds, and when the sky is obscured.

C_H = Form of high cloud (paragraphs 45 to 51 of Part I and Code Table 62 of Part II, 1942 Weather Code).

Code figure "0" is used for C_H when no high clouds are present, when high clouds cannot be observed because of low and middle clouds, and when the sky is obscured.

D_C = Direction from which clouds are moving, coded to 8 points of the compass (paragraphs 45 to 51 of Part I and Code Table 65 of Part II, 1942 Weather Code).

The code figure for "D_C" may be used for direction of either low, middle or high clouds under the following conditions:

(a) of middle cloud whenever middle cloud is observed,
(b) of high cloud, whenever middle cloud is not observed and high cloud is observed,
(c) of low cloud whenever low cloud is the only form observed.

Code figure "0" is used for D_C when (d) no clouds observed, (e) clouds are not moving, (f) sky obscured by fog, dust-storm, etc. Code figure "9" is used for D_C if the direction of the appropriate cloud layer is unknown or variable.

If the direction of the appropriate cloud layer (C_M, C_H or C_L) <u>cannot</u> be determined at the time of observation, but has been determined during the preceding hour, the latter direction will be used.

h_+ = The height above surface of the base of that cloud layer which is predominant in amount of those between 10,000 and 20,000 feet above surface. (Circular Letter No. 67-44).

M_+ = Method by which h_+ is determined (Circular Letter No. 67-44).

Instructions for coding h_+ and M_+ are as follows:

(i) If only one cloud layer is present between 10,000 and 20,000 feet, the height reported by h_+ will be the height of the base of that layer.

(ii) If two or more cloud layers are present between 10,000 and 20,000 feet the height of the base of the layer which is predominant in amount (number of tenths) will be reported by h_+.

(iii) If high clouds are reported by a high cloud symbol but none are present between 10,000 and 20,000 feet, h_+ will be reported as "/" to indicate that the base of the cloud layer is 20,000 feet or more. M_+ will be coded in the usual manner.

(iv) If high clouds are not reported because of lower broken, lower overcast, or obscured sky, code figures for h_+ and M_+ will be omitted, unless current information from a pilot's report (taken within the last hour) indicates the height of bases of cloud layers above 9750 feet, in which case h_+ will report the height of the base of that cloud layer which is predominant in amount of those reported above 9750 and below 20,000 feet, and M_+ will be coded as "3".

(v) For the purpose of coding h_+ and M_+ high clouds are interpreted to mean any clouds whose bases are above 9750 feet regardless how the cloud is coded (C_L, C_M or C_H).

CODE TABLES

h_+	M_+
0 - None, or 10,000 feet 1 - 11,000 feet 2 - 12,000 feet 3 - 13,000 feet 4 - 14,000 feet 5 - 15,000 feet 6 - 16,000 feet 7 - 17,000 feet 8 - 18,000 feet 9 - 19,000 feet / - 20,000 feet or more	0 - Missing 1 - Measured by balloon or ceiling light 2 - Estimated 3 - Obtained from Pilot's Report

Only those stations authorized to take cloud observations will include this group in the additive data portion of the message.

When NO clouds are present the cloud group is omitted from the report. When there are clouds present and the elevation of all observable cloud bases is at or below 9750 feet, the cloud group will ALWAYS contain 4 figures ($C_LC_MC_HD_C$).

When there are clouds present whose bases are above 9750 feet, the cloud group will ALWAYS contain 6 figures ($C_LC_MC_HD_Ch_+M_+$).

Obscured Sky - when the sky is obscured by fog, dust-storm, rain, snow, smoke, or other phenomena, the cloud group will be included and "0" will be the code figure used for the four categories ($C_LC_MC_HD_C$).

Note: It is not desired to have the observer determine the appropriate cloud types by deduction. Therefore, when the sky is obscured by precipitation or other phenomena to the extent that the observer cannot accurately observe the cloud types present, they will be reported as obscured.

Third Group - "$9P_mP_mP_ma_3$"

9 = Group identification figure ("group nine" of 1942 Weather Code).

$P_mP_mP_m$ = Atmospheric pressure reduced to 5,000 feet above sea level, in "tens", "units" and "tenths" of millibars, the initial figure for "hundreds" is omitted. (Paragraphs 105 and 106 of Part I and Code Table 71 of Part II, 1942 Weather Code).

a_3 = Characteristic of barometric tendency during the 3-hour period ending 3 hours ago (paragraphs 107, 108, 109 and 112 of Part I and Code Table 63 of Part II, 1942 Weather Code; Instructions for Characterizing Barometric Tendencies, August 1, 1942).

If the value for "a_3" is missing a slant (/) is coded for this element.

The "a_3" refers to the actual time of observation (0115 EST to 0415 EST, if appropriate).

The 5,000-foot pressure will be sent by all stations whose elevation is higher than 3,000 feet above sea level and who have been authorized to compute this datum. When this group is included it will ALWAYS contain 5 figures. Stations not authorized to transmit these data will omit this group from the report.

Fourth Group - "$T_{n/x}T_{n/x}$"

T_nT_n = Minimum temperature of air in whole degrees Fahrenheit, during 12 or 24-hour period preceding the observation (paragraphs 113 to 119 of Part I and Code Table 60 of Part II, 1942 Weather Code).

At 0730 EST the minimum temperature, which occurred in the 12-hour period preceding the observation, will be used in coding T_nT_n.

At 1330 EST the minimum temperature, which occurred in the 24-hour period preceding the observation, will be used in coding T_nT_n.

T_xT_x = Maximum temperature of air in whole degrees Fahrenheit, during the 12 or 24-hour period preceding the observation (paragraphs 113 to 119 of Part I and Code Table 60 of Part II, 1942 Weather Code).

At 1930 EST the maximum temperature, which occurred in the 12-hour period preceding the observation, will be used in coding T_xT_x.

At 0130 EST the maximum temperature, which occurred in the preceding 24-hour period, will be used in coding T_xT_x.

For temperatures below zero degrees Fahrenheit the number 100 is added ALGEBRAICALLY and the numerical sum is used. Examples: -15° is coded 85; -1° is coded 99; 0° is coded 00.

For temperatures of 100 degrees or higher the number 100 is subtracted from the actual temperature and the numerical result is used. Examples: 107° is coded 07; 114° is coded 14; 100° is coded 00.

When the minimum or maximum temperatures are missing, slants (//) will be coded for T_nT_n or T_xT_x.

All stations equipped with maximum and minimum thermometers, or automatic recording devices will include these data as an additive group.

Stations that are not suitably equipped to regularly report minimum and maximum temperatures will omit the $T_{n/x}T_{n/x}$ values from reports. (This paragraph applies only to stations not properly equipped to determine minimum and maximum temperatures and DOES NOT apply to missing data).

Group Five - "$0S_pS_ps_ps_p$"

0 = Group identification figure ("group ten" of 1942 Weather Code).

S_pS_p = Special Phenomena, "general description". The phenomena reported "in general" by the code figure used for "capital S_pS_p" is amplified "in detail" by the code figure used for "small s_ps_p" (paragraphs 141 to 165 of Part I and Code Table 72 of Part II, 1942 Weather Code).

At the present time the "depth of snow on ground" is the only datum coded in the "Special Phenomena" group that is included as an additive data group. Therefore, code figure 85 (Depth of snow on ground, in whole inches) will always be substituted for symbol S_pS_p in these reports; i.e., the first three code figures of this group will always be 085.

s_ps_p = Special Phenomena, "detailed description". The "detailed description" given by the code figure used for "small s_ps_p" refers to the phenomena described "in general" by the code figure used for "capital S_pS_p". (Paragraphs 141 to 165 of Part I and Code Table 73b of Part II, 1942 Weather Code).

The code figures used for "s_ps_p" in this case are "whole inches"; in other words, the observer substitutes the actual depth of snow on ground, measured in inches, for symbol "s_ps_p". One inch of snow on ground is the smallest amount reported in the Special Phenomena group. Accordingly, code figures 08500 will never be used to report this phenomenon.

This group is always the last of the additive data groups and always consists of five figures.

All stations will report the "depth of snow on ground" in accordance with the following instructions:

1. At 0730 EST:
   When there is more than a trace of snow on the ground, the depth will always be coded in the Special Phenomena group regardless as to whether or not precipitation has occurred during the preceding 6 hours.

2. At 1330, 1930 and 0130 EST:
   When precipitation has occurred in the past 6 hours and there is more than a trace of snow on ground, the depth will be coded in the Special Phenomena group. For example, 2 inches of snow cover would be coded as 08502, 13 inches as 08513, etc.

Interpretations on "depth of snow on ground"

The following interpretations on coding "depth of snow on ground" are offered for general guidance to all observers in coding this

element. Traces of snow are not included in the additive-data groups; however, they are included in "group 8" of the 6-hourly synoptic reports, ($8R_sR_tRR$).

"A trace of snow on the ground" means that there is some snow on the ground in exposed places, but the depth is too small to measure for practical purposes (actually this depth is arbitrarily set at "0.5 inch or less").

The accurate and uniform determination of a "trace of snow on ground" is a difficult procedure. In general, the observer should be guided by the average conditions throughout the area surrounding the station. If a "trace of snow on the ground" is observed in fairly exposed places and this appears to be the general condition of the surrounding country, a "trace" will be reported even though there is no snow remaining in exposed places immediately adjacent to the station. In general, a trace will not be reported when it is quite evident that the remaining snow is due to localized conditions such as; snow on distant mountain sides and tops, etc. This also applies to snow whose presence has been prolonged by artificial conditions arising from its sheltered position, such as; under trees, north side of buildings and ridges, or in drifts (natural or man made) whose surfaces have melted and frozen resulting in a hard ice crusted mound that may linger on for weeks.

The term "depth of snow on ground" as written above includes new snow, old snow, ice, and any ice-like formation which may be present on the ground.

Coding instructions require that depth of snow be reported to the nearest whole inch, and when the depth is exactly halfway between two whole inch measurements the 5 tenths is dropped or added in accordance with standard Weather Bureau rule for the disposal of decimals. For example: up to 0.5 inch, inclusive, is coded a "Trace"; 0.6 to 1.4 inches inclusive, is coded 1 inch; 1.5 to 2.5 inches, inclusive, is coded as 2 inches; etc.

It is generally preferred that the term "snow cover" be used instead of "snow" in referring to the total depth of accumulated snow and ice present on the ground. It is also desirable to avoid terms like "10 inches of snow", "snow 4 inches", etc., when referring to the accumulated depth of both the new and old snow. The terms "snow cover 10 inches", or "4 inches of snow cover" or "7 inch snow cover" are more explicit, and may serve to avoid giving the impression that the depth of snow which fell during the past 6 hours was 10, 4 or 7 inches, respectively.

SECTION III

3-HOURLY OBSERVATIONS

All stations filing observations on Schedule "A" teletype circuits at the intermediate synoptic periods (0430, 1030, 1630 and 2230 EST)

will include as many of the additive data groups listed below as 24-45 3/21/45

Page 11, Section III, 2nd Paragraph: (Circular Letter No. 24-45) (Effective April 1, 1945)

(hourly report) / app(and 99ppp) $C_L C_M C_H D_C h_+ M_+$(or $C_L C_M C_H D_C$) $9P_m P_m P_m a_3$

These instructions apply equally to the 3 and 6-hourly reports.

It will be noted that only 3 additive data groups are added to the hourly observation taken at the intermediate synoptic periods and that the first, second and third group always consists of 3, 4(or 6) and 5 figures respectively.

If the "99ppp" group is inserted in the report the first, second, third and fourth groups will consist of 3, 5, 4(or 6) and 5 figures respectively.

24-45
9/21/45

will include as many of the additive data groups listed below as instrumentation permits, ~~unless specifically authorized by the Regional Office~~ <u>NOT</u> ~~to include the data~~.

These 3-hourly additive data groups are as follows:

app $C_L C_M C_H D_C h_+ M_+$ (or $C_L C_M C_H D_C$) $9P_m P_m P_m a_3$

A listing of the meanings of these symbols and specific instructions for their individual coding is listed in Section II of this appendix. These instructions apply equally to the 3 and 6-hourly reports.

It will be noted that only 3 additive data groups are added to the hourly observation taken at the intermediate synoptic periods and that the first, second and third group <u>always</u> consists of 3, 4(or 6) and 5 figures respectively.

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

Opr:Ru

Effective October 1, 1941

(To accompany CIRCULAR LETTER NO. 124-41)

Subject: Supplement -1- to Circular N, 5th Edition, "List of Stations to Take Local Extra Observations."

Reference: Page 14, Subparagraph 2-103(d) of Circular N, 5th Edition

The list of airport stations which shall render "Local Extra Observations" in accordance with the reference paragraph above is given as follows:

Abilene, Tex.
Akron, Ohio
Albany, N. Y.
Albuquerque, N.Mex.
Amarillo, Tex.
Atlanta, Ga.
Baltimore, Md.
Billings, Mont.
Birmingham, Ala.
Bismarck, N. Dak.

Boston, Mass.
Brownsville, Tex.
Buffalo, N. Y.
Burbank, Calif.
Butte, Mont.
Charleston, S.C.
Charlotte, N.C.
Cheyenne, Wyo.
Chicago, Ill.
Cincinnati, Ohio

Cleveland, Ohio
Columbus, Ohio
Dallas, Texas
Denver, Colo.
Detroit, Mich.
El Paso, Tex.
Fargo, N. Dak.
Fort Wayne, Ind.
Fort Worth, Texas
Fresno, Calif.

Great Falls, Mont.
Greensboro, N.C.

Harrisburg, Pa.
Hartford, Conn.
Helena, Mont.
Houston, Tex.
Huron, S. Dak
Indianapolis, Ind.
Jackson, Miss.
Jacksonville, Fla.
Joliet, Ill.
Kansas City, Mo.

Las Vegas, Nev.
Long Beach, Calif.
Louisville, Ky.
Medford, Oregon
Memphis, Tenn.
Miama, Fla.
Milwaukee, Wis.
Minneapolis, Minn.
Mobile, Ala.
Moline, Ill.

Montgomery, Ala.
Muskegon, Mich.
Nashville, Tenn.
Newark, N. J.
New Haven, Conn.
New Orleans, La.
New York, N. Y.
Oakland, Calif.
Oklahoma City, Okla.
Omaha, Nebr.

Pendleton, Oregon

Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Oreg.
Providence, R. I.
Pueblo, Colo.
Reno, Nev.
Richmond, Va.
Rochester, N. Y.
Sacramento, Calif.
St. Louis, Mo.

St. Paul, Minn.
Salt Lake City, Utah
San Antonio, Tex.
San Diego, Calif.
San Francisco, Calif.
Seattle, Wash.
Sioux City, Iowa
South Bend, Ind.
Spartanburg, S. C.
Spokane, Wash.

Springfield, Ill.
Syracuse, N. Y.
Tallahassee, Fla.
Tampa, Fla.
Toledo, Ohio
Tulsa, Okla.
Washington, D. C.
Wayne County Airport (Detroit Michigan)
Wichita, Kans.

Winslow, Ariz.

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

Opr:Ru

Effective October 1, 1941

(To accompany CIRCULAR LETTER NO. 124-41)

Subject: Supplement -2- to Circular N, 5th Edition "List of Weather Bureau Airport Stations Which Shall Classify Their Weather Reports".

Reference: Page 28, paragraph 2-129 of Circular N.

Control airports are designated by Civil Air Regulations, Appendix E, Part 60 and amendments thereto. Where Weather Bureau Airport Stations are located at control airports, airway weather reports originating from such stations are classified in accordance with chapter XV (A), page 27 of Circular N.

The following is a list of Weather Bureau Airport Stations which shall classify their weather reports:

Akron, Ohio
Albany, N. Y.
Albuquerque, N. Mex.
Amarillo, Tex.
Atlanta, Ga.
Baltimore, Md.
Billings, Mont.
Birmingham, Ala.
Bismarck, N.Dak.
Boston, Mass.

Buffalo, N. Y.
Burbank, Calif.
Butte, Mont.
Charleston, S.C.
Cheyenne, Wyo.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Columbus, Ohio
Dallas, Texas

Denver, Colo.
Detroit, Mich.
El Paso, Tex.
Fargo, N.Dak.
Fort Wayne, Ind.
Fort Worth, Texas
Harrisburg, Pa.
Hartford, Conn.
Helena, Mont.
Houston, Texas
Indianapolis, Ind.
Jackson, Miss.
Jacksonville, Fla.
Kansas City, Mo.
Long Beach, Calif

Louisville, Ky.
Medford, Oregon
Memphis, Tenn.
Miami, Fla.
Milwaukee, Wis.
Minneapolis, Minn.
Montgomery, Ala.
Nashville, Tenn.
Newark, N. J.
New York, N. Y.

New Orleans, La.
Oakland, Calif.
Oklahoma City, Okla.
Omaha, Nebr.
Pendleton, Oregon

Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Oreg.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.
St. Louis, Mo.
St. Paul, Minn.
Sacramento, Calif.
Salt Lake City, Utah
San Antonio, Texas
San Diego, Calif.
San Francisco, Calif.
Seattle, Wash.
South Bend, Ind.
Spokane, Wash.
Toledo, Ohio
Tulsa, Okla.
Washington, D.C.
Wayne County Airport, Detroit
Wichita, Kansas

All of the above listed stations are now classifying their weather reports and when this list is changed, stations concerned will be advised accordingly.

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

Opr:Ru

Effective October 1, 1941

(To accompany CIRCULAR LETTER No. 124-41)

Subject: Supplement -3- to Circular N, 5th Edition "Filing of Special and Local Extra Observations by Interphone to ATC."

Reference: Page 17, Subparagraph 2-106(a), Circular N, 5th Edition.

The time of a special or local extra observation at stations having interphone communication facilities with the Airway Traffic Control Center will be that of filing the report by interphone to the ATC providing this can be accomplished within a few seconds of the time in which it is filed with the CAA communication station. If the interphone is in use at the time of completion of the special or local extra observation, the report will be filed immediately with the communication station and later transmitted to the ATC when the interphone or other means of communication become available. The time of observation in such cases will be that of filing with the communication station. A record observation which is also a special will, of course, bear the time of the radio or teletype sequence in which it is first used.

When observations are transmitted by interphone to Airway Traffic Control Centers, only the following elements will be given unless others are specifically requested by the controller:

1. Station
2. Type of Report
3. Time of Report
4. Classification
5. Ceiling
6. Sky Condition
7. Visibility
8. Weather and/or Obstructions to Vision
9. Wind
10. Remarks

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

Opr:Ru

Effective October 1,1941

(To accompany CIRCULAR LETTER NO. 124-41)

Subject: Supplement -4- to Circular N, 5th Edition "Identification of Wet Snow."

Reference: Page 72, Paragraph 2-403 of Circular N, 5th Edition.

The occurrence of "wet snow" has a very important bearing on aircraft operation, and the following discussion is given to aid weather reporting personnel in determining correctly if falling snow is wet:

"Wet snow" is snow which is moist to such an extent that the snow crystals have largely lost their sharply pointed structure and the flakes are soggy or in a semi-melted condition when falling at the surface on a dry, poorly-heat-conducting object, having the same temperature as the surrounding air.

The classification of snow as "wet" or otherwise should not be made to depend upon the surface temperature, but rather wholly upon the physical characteristics of the snow in regard to wetness. Wet snow often falls as large flakes possibly formed by the clinging together of two or more smaller flakes which have collided in the free air. Wet snow may fall with air temperatures at the surface ranging possibly from several degrees below 32°F. to a number of degrees above 32°F. Dry snow may possibly fall with surface temperatures slightly above 32° so that temperature alone is not a sufficient criterion for distinguishing between wet and dry snow. (When rain and snow are occurring together, it is more important to report the phenomenon as "rain and snow mixed" than to indicate that the snow is wet.) In deciding on whether snow is wet or otherwise, certain properties of the snow may be taken into consideration. Examples of this are as follows:

(1.) Wet snow tends to cling more readily to objects at or below 32°F., than dry snow.

(2.) Wet snow immediately after falling does not form a crisp layer on the surface like really dry snow, but rather may tend to lose its crystalline character and melt readily. It would produce a slush if the fall were sufficiently deep.

(3.) When falling snow continues to have a uniform character in regard to dryness or wetness for some time, the drifting or blowing of the fresh snow thus fallen indicates ordinarily that the snow is dry. Therefore, when freshly fallen snow drifts or blows under the circumstances outlined, it should almost never be classed as "wet". The non-drifting of snow, however, is not conclusive evidence that the falling snow is "wet", as shown by the following considerations: (a) it may be dry snow not drifted due to light wind; or (b) dry snow falling on a layer of already wet snow on the surface which hinders drifting; or (c) dry snow falling at a ground or surface temperature which is sufficiently high to cause some melting and hinder drifting; or (d) dry snow falling on a surface with such physical characteristics as to prevent drifting.

A good scheme for assisting in the observation of falling snow to determine whether it is wet or otherwise is to keep a clean, dry, unpainted board in the instrument shelter so as to have it at the temperature of the surrounding air. When making the observation, the board should be taken from the shelter and some of the flakes of falling snow should be caught on it in the horizontal position. If the snow is dry, it will generally be observed that the flakes thus caught are crisp and possibly fine, with the crystalline structure well marked. If the snow is wet, the flakes will not be crispy and will usually occur in ill-formed aggregates that are readily flattened with inappreciable sound, and will almost immediately show evidences of wetting the board.

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

Opr:Ru
(File No. 740.5)

October 9, 1941

Circular Letter No. 130-41
(To all airport stations)

Subject: Supplement -2a- to Circular N, 5th Edition, effective November 1, 1941. "List of CAA, Coast Guard, and Second-order Airway Weather Reporting Stations Which Classify Their Weather Reports".

Reference: Page 28, Paragraph 2-129 of Circular N.

When airway weather reports originate from control airports (designated by CAR 60), the reports are classified, in accordance with Chapter XV(A), page 27 of Circular N, if they are to be entered on CAA radio or teletype circuits for distribution.

The following is a list of CAA, Coast Guard, and second-order airway weather reporting stations which shall classify their weather reports:

Dayton, Ohio	Lansing, Michigan
Galveston, Texas	Los Angeles, Calif. (LA)
Glendale, Calif.	New York, N.Y. (Floyd Bennett Field)
Grand Rapids, Mich.	Youngstown, Ohio

All the above listed stations have previously been designated to classify their weather reports, and when this list is changed from time to time, stations concerned will be advised through their Regional Headquarters.

Weather Bureau Airport stations which classify their weather reports were listed in Supplement -2-, accompanying Circular Letter No. 124-41.

Respectfully,

F. W. Reichelderfer,

F. W. Reichelderfer,
Chief of Bureau.

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

Opr/An
File No. 740.5

December 5, 1941.

CIRCULAR LETTER NO. 166-41.
(To all stations)

Subject: Additions to Supplements 1, 2 and 2a of Circular N, 5th Edition.

Reference: Circular Letters Nos. 124-41 and 130-41.

Additional stations have been designated to take local extra observations and to classify their airway weather reports since the above supplements were issued. The newly designated stations are given below in order that the lists contained in the supplements may be brought up to date.

SUPPLEMENT -1-

Big Spring, Texas
Knoxville, Tenn.
Phoenix, Ariz.
Tucson, Ariz.

SUPPLEMENT -2-

Boise, Idaho
Charlotte, N. C.
Des Moines, Iowa
Fresno, Calif.
Lake Charles, La.
Las Vegas, Nev.
Little Rock, Ark.
Tallahassee, Fla.
Tucson, Ariz.

SUPPLEMENT -2a-

Augusta, Ga.
Bangor, Maine
Baton Rouge, La.
Everett, Wash.
Houlton, Maine
Manchester, N. H.
Meridian, Miss.
Midland, Tex.
Orlando, Fla.
Presque Isle, Maine
Salinas, Calif.
Savannah, Ga.
West Palm Beach, Fla.
Wichita Falls, Tex.

F. W. Reichelderfer

F. W. Reichelderfer
Chief of Bureau

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington

Opr/An
File No. 740.5
(C.R. 603.9)

December 19, 1941

CIRCULAR LETTER NO. 174-41
(For all stations)

SUBJECT: Supplement -5- to Circular N , 5th Edition, effective 12:01 a.m., E.S.T., December 26, 1941.
REFERENCE: Pages 61, 62 and 63 of Circular N.

1. To provide more rapid dissemination from hourly airway weather reporting stations of individual pilots' reports of (1) icing conditions, (2) aircraft experiencing electrical discharge or lightning stroke, (3) turbulence, (4) upper air winds of over 60 miles per hour, and (5) tops of overcast, such information when received more than 10 minutes prior to the next record observation will be filed as a special observation containing only the PIREPS*. If reports of any of these phenomena are received within 10 minutes prior to the next record observation, this information will be included in remarks (in the ordinary manner) of this next record observation and a "SPL PIREPS" will not be filed. Also, if changes in local weather conditions necessitate the filing of a special weather report before a pilot's report of the above phenomena can be handled as a separate "SPL PIREPS", this data will be included in the remarks of the special weather report and the SPL PIREPS will not be filed.

2. A SPL PIREPS will be filed in the same manner and given the same distribution as a special weather report and will contain the following:

a. Station designator of originating station.
b. SPL
c. Four figure time group and E, C, M, or P to indicate time zone.
d. PIREPS
e. Information on icing conditions, turbulence, upper air winds of over 60 MPH, aircraft experiencing electrical discharge or lightning stroke (see paragraph 4 below for coding instructions), or tops of overcasts.

*Such reports will be referred to as "SPL PIREPS" in these instructions.

3. The following are examples of "SPL PIREPS" as transmitted:

FV SPL 1711C PIREPS +ICE 15-75 N FV 80-55

AZ SPL 1638E PIREPS DISCHARGE 10 N AZ 35

BU SPL 1313P PIREPS MDT TURBC OVR MTNS N

BI SPL 1458M PIREPS WND 315 95 W RK 65

NT SPL 0441C PIREPS TOVC 85

4. When a pilot reports that his aircraft has experienced an electrical discharge or lightning stroke, such information will be indicated in a SPL PIREPS or the remarks of the next record or special observation by the word "DISCHARGE". This word will be followed by the distance and direction of aircraft from the reporting station and the altitude to nearest hundred feet mean sea level at which the electrical discharge was experienced. For example, a pilot flying between Richmond and Washington reports to Washington at 4:38 p.m. that his aircraft experienced an electrical discharge 20 miles south of Washington at an elevation of 5000 feet MSL. This would be sent as a SPL PIREPS from Washington as follows:

WA SPL 1640E PIREPS DISCHARGE 20 S WA 50

If this report had been received at 4:25 p.m., for example, a SPL PIREPS would not have been sent but the remark "PIREPS DISCHARGE 20 S WA 50" added to Washington's 1630E record observation. Please note that the phrases "experienced electrical" or "lightning stroke", in connection with an aircraft, are <u>not</u> to be transmitted either in remarks of a record or special observation or in a SPL PIREPS.

5. A SPL PIREPS will be recorded on WB Form 1130 (following the last observation or SPL PIREPS) in the following manner:

a. Enter "S" in the column for type of report.

b. Enter filing time (24-hour clock) in column for time.

c. Enter "PIREPS- - - - -" in remarks column.

d. Enter initials of observer in proper column.

e. Excepting the date column, no entries will be made in columns other than those indicated above.

6. Please note that no change in instructions has been made for including other data received from pilots in remarks of special or record observations and that the instructions in this circular are issued primarily to provide for special handling of the phenomena listed in the first paragraph.

7. As stated previously, SPL PIREPS will be treated in the same manner as a special surface observation except that unless local conditions have changed sufficiently to warrant a "special", the report will contain only the PIREPS. If both a special observation and a SPL PIREPS (filed at different times) are on hand for teletype transmission in the special sequence collection beginning on the hour, the teletype operator should be requested to include the complete SPL PIREPS as a remark in the special surface observation.

8. Pages 61, 62 and 63 of Circular N, 5th Edition, are being revised to incorporate the above instructions. This system however, is considered too important to delay its being placed into operation until the revised pages are completed, and in order to conserve paper, this supplement will be supplied to all weather reporting and communication stations, and only limited distribution will be given otherwise. As soon as the revised pages are completed, these instructions will be issued as an amendment to Circular N, cancelling this supplement, and the pages will be furnished to the several thousand recipients of Circular N amendments.

F. W. Reichelderfer.

F. W. Reichelderfer
Chief of Bureau

Enclosure for
Circular Letter 32.

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

Condensed Table of Critical Values For Airway Weather Reports

Effective June 15, 1946

(See Circular N, 1941, for complete instructions)

HYDROMETEOR AND LITHOMETEOR INTENSITY TABLE WHERE CRITERION IS VISIBILITY

(Obstructions to vision limited to 6 miles or less)

HEAVY													
					0	1/16	1/8	3/16	1/4				
F+	GF+	IF+	K+	D+	BD+	BN+	S+	SP+	SW+	BS+	GS+	L+	ZL+
MODERATE													
						5/16	3/8	1/2					
F	GF	IF	K	D	BD	BN	S	SP	SW	BS	GS	L	ZL
LIGHT													
	5/8	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	3	4	5	6
F−	GF−	IF−	K−	D−	BD−	BN−	S−	SP−	SW−	BS−	GS−	L−	ZL−

SUMMARY OF CONDITIONS UNDER WHICH SPECIAL OBSERVATIONS ARE TAKEN

1. Period of precipitation begins or ends.
2. A change in type of precipitation occurs.
3. Hail begins or ends.
4. Thunderstorm begins or ends, or shows marked increase in intensity.
5. Tornado, duststorm, or sandstorm begins or ends.
6. Windshift passes the station.
7. Wind velocity doubles or more and exceeds 30 mph.
8. Altimeter setting changes (as shown by a change in station pressure) at the rate of 0.08 inch or more per hour.
9. Sky condition:
   a. Cloudiness below 10,000 feet changes from clear to broken, or scattered to overcast, or vice versa.
   b. Cloudiness below 1,500 feet changes from scattered to broken, or vice versa.
   c. Cloudiness at or below the airline operating minimum for the particular airport changes from scattered to broken, or vice versa.
10. Ceiling:
   a. Decreases to less than 1,000 feet, or increases to 1,000 feet or more.
   b. Decreases to less than 500 feet, or increases to 500 feet or more.
   c Decreases by 1/2 or more; doubles or more.
11. Visibility:
   a. Decreases to less than three miles, or increases to three miles or more.
   b. Decreases to less than one mile, or increases to one mile or more.
   c. Decreases by 1/2 or more, becoming five miles or less.
   d. Five miles or less, doubles or more.
12. Any type of fog begins or ends.
13. Type of fog changes.
14. ANY CHANGE AFFECTING THE SAFETY OR EXPEDITIOUS CONTROL OF AIRCRAFT.

LOCAL EXTRA OBSERVATIONS

Local extra observations are taken:

1. At designated stations, at fifteen-minute intervals, whenever ceiling or visibility decreases to a value equal to or less than the highest aircraft minimum applying to the airport, or whenever the ceiling decreases to 500 feet or less, or the visibility to one mile or less. They will be discontinued when values above these minimums have been reported.
2. At any station when requested for aircraft arrivals or departures.
3. At stations equipped with projectors, whenever a pilot's report differs from a "measured" ceiling.
4. At any station after an aircraft accident within two miles of the boundary of the airport.

AIRCRAFT CEILING REPORTS

When it is impossible to secure a "measured" ceiling, pilots' reports will be used in airway weather observations if the observer believes they are representative of conditions and were obtained within one and one-half miles of the boundary of the airport.

INTENSITY CRITERIA FOR RAINFALL

Light: Rate of accumulation 0.10 inch per hour or less.
Moderate: Rate of accumulation 0.11–0.30 inch per hour.
Heavy: Rate of accumulation 0.31 inch per hour or more.

INTENSITY CRITERIA FOR THUNDERSTORMS

Thunderstorm: Intensity less than heavy.
Heavy Thunderstorm: Nearly incessant sharp thunder and lighting; moderate to heavy rain, and possibly moderate to heavy hail; high winds, exceeding 40 mph, at peak of gusts, and a sharp drop in temperature.

INTENSITY CRITERIA FOR WIND SHIFTS

1. Precipitation and lowering of ceiling do not occur:
   Light: When gusts do not exceed 34 mph.
   Moderate: When gusts do not exceed 49 mph.
   Heavy: When gusts exceed 49 mph.
2. Precipitation occurs and ceiling lowers:
   Light: When gusts do not exceed 24 mph.
   Moderate: When gusts do not exceed 39 mph.
   Heavy: When gusts exceed 39 mph.

INTENSITY CRITERIA FOR SQUALLS

Wind velocities equivalent to those under Wind Shifts (2).

EXAMPLES OF "ABBREVIATED SPECIALS"

SL S12 2118M P8×1TRW →↘35+ ↑ 2112M+/T OVHD MOVG EWD FQT LTNG CLD TO CLD
OL S1 0259C ○ C

(WB—528—46—12,500) 271

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington 25, D. C.

Opr:Ho
(File No. 740.5)

November 15, 1946

CIRCULAR LETTER NO. 91-46
(To All Stations)

Subject: 11th Amendment to Circular N

The 11th Amendment to Circular N, which will be effective as of January 1, 1947, has been delayed in printing owing to a shortage of paper. Chapter 40 of the amendment is being issued as a separate to be effective 0000 EST, January 1, 1947. Instructions in this chapter, which relate to the coding of airway observations, require adoption of procedures that differ principally as follows from those required by present instructions:

(1) Use, on a summation principle, of "X" alone and in combination with high and low clouds. (The observations section of Amendment 11 will establish the convention that ground fog obscures less than 0.6 of the sky, that is, the sky condition above an angle of 36° is observable. When the value of 0.6 is equaled or exceeded, the obscuration is classified as fog.)

(2) Consistent application of summation principle to sky condition.

(3) Discontinuance use of intensity symbols with obstructionsto vision.

(4) Discontinuance requirement that ceiling be reported zero when visibility is less than 1/4 mile.

(5) Discontinuance classification of pireps as special observations.

Chapter 40 will be bound with Circular N at each station until Amendment 11 in its entirety and instructions for disposing of the separate are received.

F. W. Reichelderfer

F. W. Reichelderfer,
Chief of Bureau.

CHAPTER 40. AIRWAY WEATHER CODE

40000. GENERAL

40010. The airway weather code consists of symbols and numerals arranged in groups with relatively fixed positions. Word and phrase contractions or complete words may supplement the coded data.

40020. The elements of the observation are placed in groups as specified below. Spaces separate Groups I to V; and oblique lines (slants), used as mechanical devices, separate numerical data that might otherwise be misinterpreted. Further instructions on use of slants are to be found in paragraph 40030. Reference to specific instructions for coding are listed beside each item below.

GROUP NUMBER	ELEMENT NUMBER	ELEMENT	INSTRUCTIONS PARAGRAPH NUMBER
I	I	Station Identification	40120
II	2	Type of Report	40121
III	3	Time of Report	40122
IV	4	Ceiling and Cloud Height	40123
	5	Sky Condition	40124
	6	Visibility	40125
	7	Weather	40126
	8	Obstructions to Vision	40127
V	9	Sea-level Pressure	40128
	10	Temperature	40129
	11	Dew Point	40130
	12	Wind	40131
	a.	Direction	40131
	b.	Speed	40132.1
	c.	Character	40132.2
	d.	Shifts	40132.3
	13	Altimeter Setting	40132
VI	14	Remarks	40133

40021. The letter symbol "M" is used to indicate missing data pertaining to an element normally included in a report. Elements regularly omitted are indicative of data not observed at a particular station.

40030. HOURLY REPORTS. Data pertaining to record observations are coded in Groups I, IV, V, and VI. Slants rather than spaces are used to separate Group V from VI. Slants are also used within Group V between sea-level pressure and temperature, temperature and dew point, wind data and altimeter setting. Additive data are separated by a slant and a space from the last element of the record observation with

which they are transmitted.

Example:

WA E38012 271/74/58-x8/032/CIG VRBL 36
TO 40 HND/ 90400 2002 56

40040. SPECIAL REPORTS. Special reports invariably include Groups I through III, and remarks, if required. In addition they contain either one element only (Group IV, 7; V, 12 or V, 13), or Group IV plus V, 12, according as the instructions for special observations (Chapter 20) apply. When a significant change, as defined in Chapter 20, occurs in altimeter setting, Group V, 13 is included in the special report. When a check report coincides with a special, all the elements of a check report, as stated in paragraph 40060, below, are included in the special report.

40050. CHECK REPORTS. Check reports are composed of Groups I, II, III, IV, V 12, V 13, and VI.

40060. LOCAL EXTRA REPORTS. Local extra reports are composed of Groups I, II, III, IV, and VI.

40070. CORRECTED REPORTS. A report correcting a previously transmitted observation will be identified by the letters "CQN" immediately preceding the station identification. The report will include Groups I and III; if the observation to be corrected is a special, record-special, or local extra, the correcting report will also include Group II.

40100. CODING FOR TELETYPE TRANSMISSION

40110. Instructions in paragraphs 40120 to 40133 will be observed in coding individual elements of observations for teletype and radio distribution, and instructions in paragraphs 40200 in coding observations for telegraphic distribution.

40120. STATION IDENTIFICATION. The station identifier is a two or three letter symbol assigned to the station for use in teletype transmissions. These symbols are listed in Federal Airways Manuals of Operations of the Civil Aeronautics Administration.

40121. TYPE. Record-type reports prepared at hourly intervals for scheduled sequence teletype transmission are not identified by any symbol in teletype transmission. Special and record-special reports are identified by the letter "S" followed by a serial number. Serial numbers are assigned consecutively for each day. Number 1 is the first special or record-special report filed for transmission on or after 0000, local standard time, of a given day. Local extra reports are

identified by the contraction "LCL" on local teletype circuits.

40122. TIME. The time of record and record-special observations is not included in the report, since the time of the sequence in which the reports are included appears at the heading of the sequence collection. The time of the sequence collection may therefore be used as a reference time. However, a corrected report of a record observation will include the reference time of the record observation immediately following the station identifier. In special and local extra reports, the time is that of the last entry on WB Form 1130A. The time of special and local extra observations is given in four figures (to the nearest minute on the basis of the 24-hour clock) followed by a time zone indicator.

Table 26

Time - 24-hour clock	Time Zone	Indicator
0000 - Beginning of day.	Eastern	E
	Central	C
	Mountain	M
2359 - Last minute of day.	Pacific	P
	Alaskan	A
	Bering	B
	Yukon	Y

40123. CEILING AND CLOUD HEIGHTS. In this manual all heights pertaining to symbols for sky condition (see par. 40124), except those that may be reported in "Remarks" as a part of a Pireps, are with reference to heights above ground and not above sea level. The heights pertaining to the sky-condition symbols are reported in hundreds of feet in accordance with the following table:

Table 27

0 to 5,050 feet	5,051-9,750	Above 9750
To nearest 100 feet	To nearest 500 feet	Numerical value omitted; a slant mark, denoting "high" follows sky condition symbol.

40123.1. When clouds or an obscuration at and below 9750 feet cover 0.6 or more of the sky, the ceiling is expressed as a numerical value corresponding to the lowest level at which this occurs and is placed before all sky-condition symbols. (see Chapter 2) Under all other conditions the ceiling is termed unlimited. Whenever the ceiling is below 2000 feet and rapidly variable the letter "V" follows the ceiling value and the range of variability is reported in "Remarks." (See

"Remarks"). When the ceiling is 2000 feet or more the range of variability is given in remarks, and the letter "V" is not used in the ceiling group.

40123.2. The height of scattered clouds is reported immediately preceding the sky-condition symbol to which it applies whenever (1) the symbol appears alone, e.g., 20⦶ , or (2) the symbol is the second in a combination of sky-condition symbols, e.g., ⦶20⦶.

40123.3. When any one of the symbols corresponding to low scattered, broken, or overcast clouds is first in a combination of sky-condition symbols, the height corresponding to it is reported in "Remarks." (See "Remarks.") An appropriate ceiling classification symbol is prefixed to the heights ascribed to ⦶, ⊕ and X at and below 9750 feet. The classification symbol is taken from the following list:

Table 28

Aircraft	A	Indefinite	W
Balloon	B	Measured	M
Estimated	E	Precipitation	P

40124. SKY CONDITION. Sky condition with respect to clouds and obscuration is coded in the symbols listed in Table 29. The symbols ⦶, ⦶ and ⊕ may be modified by the prefixes plus (+) or minus (-) for dark or thin clouds, respectively. The terms "scattered clouds," "broken clouds," and "overcast" refer to specified amounts, which may be represented by symbols as listed in Table 29. These symbols will be used in accordance with a principle of summation as follows:

(1) Lowest Cloud Layer: The symbol corresponding to the lowest layer of clouds reported will indicate the sky covered by the layer. If a few clouds (less than 0.1) are present below this layer, they will be reported in "Remarks."

(2) High or Multiple Cloud Layers: Symbols corresponding to higher cloud layers will indicate the amount of sky covered not only by their respective layers, but by all layers below them.

Table 29

Sky-Condition Symbols	
X	0.6 or more of the sky obscured by precipitation or obstructions to vision either alone or in combination with lower clouds, and irrespective of higher clouds.
O	Clear: Less than 0.1 total cloud cover.*
⦶	Scattered clouds: 0.1 - 0.5 cloud cover.
⦷	Broken clouds: 0.6 - 0.9 cloud cover.
⊕	Overcast: More than 0.9 cloud cover.

40124.1. Not more than two sky condition symbols will be used in the sky condition group; the symbol for clear will not be used in combination. When a combination of symbols is used, the first symbol will be that whose corresponding value of height or vertical visibility is greater. In this coding chapter the term "high," as applied to clouds, denotes clouds in any amount whose base is above 9750 feet; "low" denotes clouds whose base is at or below 9750 feet. The sky condition above 9750 feet will always be coded in a single symbol that corresponds to the total amount of clouds or obscuration present. When two or more layers of clouds are observed and an obscuration is not present, the layers will be coded in the sky condition group or reported in "Remarks" in accordance with the following:

(1) High clouds only: All layers of high clouds will be grouped together and coded in a single symbol that corresponds to the total amount of all clouds.

(2) Low clouds only: If only a single layer is present, code it as a single symbol in the sky condition group. If two layers are present, code both in the sky condition group. If three or more layers are present, proceed as follows:

(a) Code the highest layer in the sky condition group.

(b) Code the lowest layer covering 0.6 or more of the sky in the sky condition group and report all other layers, whether intermediate or lower, in remarks.

(c) If a broken layer is not present below the layer referred to in (a), report the first layer below it in the sky condition group, and report all other layers in remarks.

*See paragraph 40124.2 for use of this symbol when sky is partially obscured.

(3) High and Low Clouds:

(a) All layers of high clouds will be grouped together and coded in a single symbol that conforms with the principle of summation stated in paragraph 40124 above.

(b) The lowest layer of clouds covering 0.6 or more of the sky will be coded in the sky condition group and all others in "Remarks." (See "Remarks.")

(c) If scattered layers only are present below clouds coded in accordance with (a), the highest of scattered layers will be coded in the sky condition group and all others reported in "Remarks."

40124.2. Under certain conditions of obscuration specified below, the symbol X will be used to indicate that the sky cannot be sufficiently well observed to code it accurately by cloud symbols only. These conditions of obscuration require the presence of one or more of the following:

(1) Fog.
(2) Lithometeors (dust, smoke, etc.).
(3) Precipitation.

Provided:

(1) When cloud layers are not present, 0.6 or more of the sky is obscured.

(2) When cloud layers are present above the phenomena listed above, the phenomena alone obscure 0.6 or more of the sky.

(3) When cloud layers are present below the phenomena listed above, the tenths of sky covered by the clouds plus the tenths obscured by the phenomena equals 0.6 or more.

40124.21. If less than the critical value of 0.6 is present, selection of the sky symbol will be based solely on the cloud layers observed, and the obscuration present will be reported in "Remarks." (See "Remarks.")

Examples:

X/25Ⓓ	Vertical visibility is more than 9750 feet.
W25ⒹX	The obscuration (reported as 2500 feet) is lower than the broken clouds reported.
E25X20Ⓓ	The obscuration (reported as 2500 feet) is above the scattered clouds reported as 2000 feet.

40125. VISIBILITY. Visibility will be coded in miles or fractions of miles, in accordance with Table 30 When the prevailing visibility is exactly half-way between one of the values in the table, select the lower value for the prevailing visibility.

40125.1. A plus sign following a value of 15 miles will be used when the visibility is estimated to be more than 15 miles and a suitable visibility marker beyond that distance is not available.

40125.2. Variable visibility will be indicated by a "V" immediately following the visibility value when prevailing visibility is less than 2 miles. The range of variability will be reported in "Remarks." Variable visibility with a prevailing visibility of 2 miles or more will be reported only in "Remarks." (See "Remarks.")

40125.3. Visibility differing in various quadrants will be reported in "Remarks." (See "Remarks.")

40125.4. At stations participating in the control tower visibility program, visibility values less than 3 miles at the usual point of observation will be reported in "Remarks," and visibility values at control tower level in Group IV.

Table 30. Visibility Values to be Used in Airway Reports

Increments, Miles and Fractions		
0	1	One-mile increments when visibility is 3 to 15 miles, inclusive.
1/16	1 1/4	
1/8	1 1/2	
3/16	1 3/4	Five-mile increments when the visibility is more than 15 miles.
1/4	2	
5/16	2 1/4	
3/8	2 1/2	
1/2		
5/8		
3/4		

40126. WEATHER. The weather phenomena listed in Table 31 will be coded in the symbols listed beside them. Phenomena will be coded in the following order: tornado, thunderstorm, liquid precipitation, freezing precipitation, frozen precipitation. Symbols for squalls will follow symbols for precipitation, if precipitation is occurring. Direction of a tornado from the station will immediately follow the term "TORNADO."

Table 31. Weather Symbols

Weather	Symbol	Weather	Symbol
Tornado	Written in full	Small hail	AP
Heavy thunderstorm	T+	Snow	S
Thunderstorm	T	Snow showers	SW
Rain	R	Snow grains	SG
Rain showers	RW	Snow pellets	SP
Drizzle	L	Ice crystals	IC
Freezing rain	ZR	Sleet	E
Freezing drizzle	ZL	Rain squalls	RQ
Hail	A	Snow squalls	SQ

40126.1. Intensities of precipitation and squalls will be indicated by the plus (+) sign for heavy and minus (-) sign for light intensity; absence of either sign will indicate moderate intensity. Note that a thunderstorm of light or moderate intensity is coded in the airway code without intensity symbol.

40126.2. Additional information concerning weather will be reported when available in "Remarks." (See "Remarks.") Typical examples of general classes follow:

(1) Direction of movement of a tornado.

(2) Direction of a thunderstorm with respect to the station, direction of movement, occurrence of lightning, frequency and character of lightning, or frequency of thunder when lightning is not readily observable.

(3) Size of stones in a hail storm.

(4) Intermittent character of precipitation, regardless of whether precipitation is reported in Group IV of the same report. Precipitation will be coded in Group IV of the first observation reporting the beginning of a period of precipitation. Note that a new period of precipitation is regarded as beginning when precipitation has not occurred for 15 minutes or more. Precipitation will be coded in Group IV if it is actually occurring at the time of observation. Otherwise it will be reported in "Remarks;" provided the observation is taken within 15 minutes of the actual occurrence of precipitation and it appears probable that the period of precipitation has not ended.

40126.3. Precipitation of a showery or intermittent character will not be reported for a period exceeding 15 minutes after cessation of active precipitation. Thunderstorms will not be omitted from a succeeding observation unless 15 minutes or more have elapsed since thunder was last heard. Squalls observed at the station within fifteen minutes of the

actual time of observation will be coded in the symbols RQ and SQ, according as the type of precipitation accompanying the squall is rain or snow. Precipitation occurring at the time of observation will be coded immediately preceding the squall symbol, in the symbol appropriate to the character and form of the precipitation, e.g., R+RQ, RWRQ, S-SQ, etc.

40127. OBSTRUCTIONS TO VISION. The obstructions to vision listed in Table 32 will be coded in the symbols listed in the adjacent column:

Table 32. Obstructions to Vision

Obstructions to Vision	Symbol	Obstructions to Vision	Symbol
Fog	F	Dust	D
Ground fog	GF	Blowing dust	BD
Ice fog	IF	Blowing sand	BN
Haze	H	Blowing snow	BS
Smoke	K	Drifting snow	GS

40127.1. If the visibility is 6 miles or less any obstruction to vision present will be coded. If the prevailing visibility is more than 6 miles, obstructions to vision will not be coded.

40127.2. Patches of ground fog not obscuring vision at a level 6 feet above the ground will be reported in "Remarks" only. (See "Remarks.") Drifting snow not obscuring vision at this level will be reported in "remarks" only.

40128. SEA-LEVEL PRESSURE. Sea-level pressure will be coded in figures representing tens, units, and tenth of millibars (mbs.). The initial 9 or 10 of the 100's or 1000's place is omitted, e.g., 1027.1 mb. would be coded as 271; 987.0 mb. as 870, etc.

40128.1. Occurrence of a rapid fall and rise of pressure will be reported in "Remarks." (See "Remarks.")

40129. TEMPERATURE. Temperature will be coded in the nearest whole degree by one, two, or three figures. The minus sign is prefixed before sub-zero temperatures. For example, 110° would be coded as 110; 8° as 8; 0° as 0; -10° as -10, etc.

40130. DEW POINT. The dew point will be coded to the nearest whole degree similarly to that of temperature.

40131. WIND. The direction from which the wind is blowing will be coded to 16 points of the compass in the symbols listed in Table 33. A calm is indicated by the absence of a direction arrow.

Table 33. Wind Directions

↓	North	↑	South
↓↙	North-northeast	↑↗	South-southwest
↙	Northeast	↗	Southwest
←↙	East-northeast	→↗	West-southwest
←	East	→	West
←↖	East-southeast	→↘	West-northwest
↖	Southeast	↘	Northwest
↑↖	South-southeast	↓↘	North-northwest

40131.1. A 1-minute average wind speed to the nearest whole mile per hour will be coded by means of one, two, or three figures. The letter E following the numeral will indicate that the speed is estimated. Zero speed will be indicated by the letter C, for calm. For example, 109 mph will be coded as 109; 6 mph as 6, etc.

40132.2. Character of the wind, gustiness and dry squalls, will be coded in the symbols minus (-) for fresh gusts and plus (+) for strong gusts. The symbols will follow the figures for speed. Peak speed of gusts will be reported in "Remarks." (See "Remarks.")

40131.3. Wind shifts will be indicated by an arrow symbol (see Table 33) showing the direction of the wind to 16 points prior to the shift, followed by the local standard time of the shift (to the nearest minute, 24-hour clock), and the time zone letter symbol. Intensity of shifts will be indicated by use of the plus sign (+) or minus sign (-) following time zone letter for heavy and light intensity, respectively. Absence of either indicates moderate intensity. For example, a moderate wind shift from the south at 1843, Mountain Standard Time, will be coded ↑1843M.

40132. ALTIMETER SETTING. The altimeter setting will be coded in three figures representing units, tenths, and hundredths of inches. The initial 2 or 3 of the tens place is omitted. For example, 30.73 would be coded as 073; 29.91 as 991, etc. When the altimeter setting is the only element reported in a special observation, it will be preceded by the authorized contraction "ALSTG" and expressed in units, tenths, and hundredths.

40133. REMARKS. Remarks, in the form of symbols and authorized word and phrase contractions, or complete words when contractions are not authorized, willbe added to the coded airway report in accordance with the examples in Table 34. When intensity of phenomena remote from the station cannot be determined the symbol "U" will be placed after the symbol for the phenomena to indicate intensity unknown. Certain conditions are not adequately reported by a symbol within limits of Groups IV and V and therefore require that explanatory remarks be added to the report whenever practicable. Instructions concerning conditions that require further explanation, or exclusive reporting, in "Remarks," together with examples of their use have been condensed in the following table. The examples are not exhaustive, and when other conditions obtain than those illustrated, the observer will amplify the report with such remarks as he judges to be pertinent to the meteorological situation and useful to the users of the data.

40134. In accordance with Circular P, raob stations will add icing and freezing level data as remarks to the first hourly (or 3-hourly) airway observation following determination of the data. These data are identified by the phrase contractions RAFRZ and RAICG.

Table 34. Remarks — Condensed Table of Instructions and Illustrations

Condition Observed	Coded in Group IV or V	Amplified in Remarks	Purpose of Remarks
CEILING AND CLOUD HEIGHT			
(1) Ceiling Variable:			To report the range of variability.
Below 2,000 feet	M4V	CIG VRBL 2 TO 6 HND	
2,000 feet or more	M28	CIG VRBL 25 TO 30 HND	
(2) Height which cannot be reported for layers reported in sky condition group	M17①①	E31①	To report height of low clouds described by the first symbol in a combination term. Repeat symbol.
	①27①	55①	
	M45⊕①	E80⊕	
(3) Height of layers not reported in sky condition group	M41⊕/①	E85①	To report height of intermediate layer(s) between (high) overcast or broken, and lower broken layer; symbol also appears (see sky condition).
	M47①/①	A75①	
	⊕/75①	18①	To report height of scattered layer(s) below two higher layers.
	E75①55①	35①	
SKY CONDITION			
(1) Sky condition variable	M29①15①	①V①	To report clouds rapidly variable in amount from scattered to broken and vice versa, or broken to overcast and vice versa.
	M17①	①V①	
	M23⊕	⊕V①	
(2) Layers not reported in sky condition group	M47⊕/①	E70①E60①	To report intermediate layer(s) between (high) overcast or broken and lower broken layer.

Condition Observed	Coded in Group IV or V	Amplified in Remarks	Purpose of Remarks
(2) (continued)	M75⦶/⦶ M90⦶65⦶	45⦶ 37⦶	To report lower scattered layers below two layers reported in sky condition.
(3) Less than 0.6 of the sky obscured and clouds not visible.	O O	F OVER RVR K ERN HRZN	To report a phenomenon obscuring less than 0.6 of the sky.
(4) Less than 0.6 of the sky obscured and clouds visible.	⦶/ A25⦶	K LYR SW F NE QUAD	To report a phenomenon obscuring less than 0.6 of the sky.
(6) Breaks in an overcast.	M30⊕ ⊕/	BINOVC BINOVC OVHD	To report breaks in an overcast.
(7) Special cloud types.			To report cloud types of special significance to forecasters and other users of airway reports.
Towering cumulus.	35⦶	TWRG CU SE	
Cumulonimbus.	42⦶	CB E	
Cumulomammatus.	M33⊕	CM OVHD	
Altocumulus castellatus.	⦶/	ACC OVER MTNS S	
VISIBILITY			
(1) Variable prevailing visibility:			To report range of variability.
Less than 2 miles.	1V	VSBY VRBL 1/2 TO 13/4	
2 miles or more.	2	VSBY VRBL 11/4 TO 3	
(2) Differing in different quadrants:			To report visibility
Prevailing visibility less than 3 miles.	21/2 1	VSBY N2E21/2S11/4W21/2 VSBY NE1SE1/2SW1/4NW11/4	(1) in each quadrant, beginning with N or NE.

Condition Observed	Coded in Group IV or V	Amplified in Remarks	Purpose of Remarks
(2) (continued) Prevailing visibility 3 miles or more.	4 5	VSBY S11/2W10 VSBY E2	(2) in quadrants in which visibility differs by 1/2 or more or 100% or more from prevailing.
(3) Differing at level of control tower from that at level of usual observation point; prevailing visibility less than 3 miles from latter point.	5	GND VSBY 2	To report visibility at level of usual observation point.
WEATHER (1) Tornado	TORNADO W	MOVG NE	To report direction of movement. (Direction from station immediately follows tornado in Group IV.) Entire report as a special observation appears as a remark.
(2) Thunderstorm	T T+	T NW MOVG E T+ OVHD MOVG EWD	To report direction, if observable, (1) with respect to station. (2) of movement.
(3) Lightning, with or without thunder audible		OCNL LTNG CLD TO CLD LTNG CLD TO CLD AND TO GND FQT LTNG CLD TO GND NW OCNL LTNG N	To report, if observed, (1) type (cloud to cloud, etc.) (2) frequency.

Condition Observed	Coded in Group IV or V	Amplified in Remarks	Purpose of Remarks
WEATHER (continued)			
(4) Precipitation			
Hail	A+	HLSTO 11/4 INCHES	To report diameter of largest hailstones.
Intermittent			To report intermittent character of precipitation,
	—	INTMT R-	(1) not occurring at time of observation.
	R-	R- INTMT	(2) occurring at time of observation.
Showery			To report showery character of precipitation,
	—	OCNL RW-	(1) not occurring at time of observation.
	RW-	RW-	(2) occurring at time of observation.
Sparse	RW-	OCNL SPKL	To describe rain or snow showers, or steady precipitation when precipitation is very light.
	—	OCNL SPKL	
	SW-	OCNL SNW FLRY	
	R-S-	PCPN VERY LGT	
Fine	R	R VERY FINE	To describe precipitation in small drops as opposed to sparseness.
Variation of intensity	R-	R- OCNLY R+	To report rapidly variable intensity.

Condition Observed	Coded in Group IV or V	Amplified in Remarks	Purpose or Remarks
(4) (continued)			
Precipitation at a distance	— —	PCPN W INTSTY UNKN RU OVER RIDGE N	To indicate occurrence of precipitation and direction with respect to station.
(5) Obstructions to vision			
Fog	F F	F INCRG F DSIPTG	To report fog dissipating or increasing, etc.
Smoke	— K	K LYRS K DRFTG OVER FLD	To report smoke in layers, drifting, etc.
Ground fog at height less than 6 feet	—	GF 2 FT DEEP	To describe phenomena excluded from coding as obstructions to vision since they do not restrict visibility to 6 miles or less at 6 feet or more above ground.
Snow drifting but not obscuring vision at 6 feet and more above ground.	—	LOW DRFTG SNW	
Dust devils	—	DUST DEVILS NW	
Aurora	—	BRGT AURBO	To report occurrence of aurora.
PRESSURE			
(1) A sudden marked fall, then rapid rise of 0.06 inch or more in pressure, shown on the barogram as a "V."	665	LOWEST PRES 631 1745C RSG 3 MB	To report in the next record observation lowest sea-level pressure in tens, units and tenths of millibars, time of its occurrence in local standard time, with amount of rise expressed in millibars since lowest pressure.

Condition Observed	Coded in Group IV or V	Amplified in Remarks	Purpose of Remarks
PRESSURE (continued) (2) Rapidly falling or rising.	821	PRES FLG RPDLY	To report rapid rise or fall.
WIND Peak gusts.	945+	G 75 MPH	To report peak wind speed in strong gusts.

40200. CODING FOR COMMERCIAL TELEGRAPH TRANSMISSION

40210. Airway weather reports will be coded for transmission by commercial telegraph similarly to those for local CAA transmission.

40220. All symbols and intensity modifiers will be telegraphed in their word equivalents. The elements comprising the observation will be prepared for telegraphic transmission in the same order as they are prepared for dissemination by CAA local facilities. The word "slant" will not be transmitted. Its equivalent meaning in the sky group will be conveyed by the word "high," e.g., high overcast, high scattered. The complete value of ceiling and cloud height, sea-level pressure, and altimeter setting will be transmitted. Decimal points will be omitted, e.g., measured 1200 (ceiling); 2990 (altimeter setting); 10122 (sea-level pressure). The word "missing" will be used to indicate missing data pertaining to an element normally included in a report. The station identifier and the time of the report will be omitted from the coded message. When the telegraphed message is prepared for teletype distribution at the receiving station, the station identifier and time of the report when required will be supplied from the heading of the telegram and coded in accordance with paragraphs 40120 and 40122.

Example: PHO 0600P E55⊕/⦶9R- 65/63×11/20⦶

As received at San Francisco from Hollister, California:

ESTIMATED 5500 HIGH OVERCAST LOWER BROKEN
9 LIGHT RAIN 6563 NORTHEAST 11 2000 SCATTERED

40300. CODING OF PILOT REPORTS

40310. GENERAL. When pilot reports are received by weather-observing personnel, they will be coded in accordance with instructions in paragraphs 40320 to 40380.

40311. All reference to heights of phenomena encountered in flight will be expressed in hundreds of feet to the nearest hundred above mean sea level, indicated by the letters "MSL."*

40312. Authorized weather symbols, international cloud abbreviations, word and phrase contractions will be used or, if they are lacking, complete words.

40313. All phenomena having an authorized symbol (see paragraphs 40126 and 40127) will be reported in symbol form followed, if required by paragraph 40126.1, by the appropriate intensity indicator. "U" will be used for "intensity unknown." If the phenomenon has been reported in general terms by the pilot ("precipitation" without indication of rain or snow, etc.) the phenomenon will be reported in an authorized phrase contraction or lacking that, in one or more complete words. The report will be followed by the appropriate phrase contraction corresponding to the intensity symbols referred to in paragraph 40126.1.

40314. In general, the order of coding will be

(1) Station identification.
(2) Time of filing pilot report for teletype transmission.
(3) The term PIREPS, or authorized equivalent.
(4) Phenomena reported.
(5) Location of phenomena.
(6) Altitude.
(7) Time of pilot's observation, whenever known.
(8) Type of aircraft, whenever known.

40320. ICING. Code pilot reports of airfoil icing conditions as follows:

(1) Use the contraction "ICG" with indication of intensity, as illustrated in the following list:

ICG TRACE = Trace of ice
LGT ICG = Light icing condition
MDT ICG = Moderate icing condition
HVY ICG = Heavy icing condition

*Note: Pilot reports of cloud heights used as a ceiling in an airway observation will be converted to feet above the surface by the observer and coded in the intervals given in table 27 of this chapter.

(2) Express the extent of the icing area in miles, followed by the direction from the reporting station or other well-known teletype or radio station or geographic area such as specific mountain ranges. For example, with a pilot report of icing encountered 15 to 80 miles west of Cheyenne, the observer would code this portion of the Pireps as "15-80 W CX."

(3) Code the base and top of the icing area in hundreds of feet above mean sea level, whenever known. For example, code icing with base at 4,000 feet, top at 8,000 feet, as "40-80 MSL." Use slants to indicate that the base or top of the icing area is unknown. For example, "//-115 MSL."

40330. ELECTRICAL DISCHARGE OR LIGHTNING STROKE. Code a pilot report of electrical discharge or lightning stroke experienced by an aircraft as follows:

(1) Use the word "DISCHARGE."
(2) Give the direction and distance of the aircraft from the reporting station or from another well-known point at the time of the electrical discharge.
(3) Code the altitude of the aircraft in hundreds of feet above mean sea level.

40340. TURBULENCE. Code turbulence experienced by an aircraft as follows:

(1) Use the contraction "TURBC" followed by an indication of intensity as illustrated in the following list:

LGT TURBC = Light turbulence
MDT TURBC = Moderate turbulence
HVY TURBC = Heavy turbulence

(2) Express the extent of turbulence area and distance from a well-known point, if known. For example, turbulence over mountains 30 miles west of Denver would be coded "OVER MTNS 30 W DV," turbulence 20 miles west of Kansas City would be coded "20 W KC."
(3) Code altitude of turbulence in hundreds of feet above mean sea level

40350. HAIL. Code pilot reports of hail encountered in flight as follows:

(1) Use the authorized teletype symbol forhail and indicate the intensity in the same manner as in weather reports of hail. Use the symbol "U" to indicate unknown intensity.

(2) Give the extent of the hailstorm, if furnished, and the distance from a well-known point.

(3) Code the altitude of the aircraft in hundreds of feet above mean sea level.

Note: It is quite possible that a pilot report of hail will be added to a report of turbulence and electrical discharge. All these phenomena may be included in the same "Pireps."

40360. WINDS ALOFT EXCEEDING 60 MILES PER HOUR. Code winds aloft reported to exceed 60 mph as follows:

(1) Use the authorized contraction "WND."

(2) Code true direction from which the wind is blowing in figures 1, 2, and 3 representing the degrees of the compass.

(3) Code the wind speed in miles per hour in figures.

(4) Indicate the approximate location of the high winds; for example, east of Omaha would be " E OH.".

(5) Code the altitude at which the high wind speeds were encountered in hundreds of feet above mean sea level.

40370. TOPS OF OVERCAST. Code pilot reports of tops of overcast as follows:

(1) Use the authorized contraction "TOVC."

(2) Indicate the point over which the height of the overcast is determined.

(3) Code height in hundreds of feet to the nearest 100 feet above mean sea level.

Note: Intervals used in reporting ceiling heights are not applicable to pilot reports of tops of overcast.

40380. Code pilot reports of ceiling heights as follows:

(1) Use the contraction "CIG."

(2) Report the station or area over which height was determined, e.g. "OVER CG."

(3) Report the height of the ceiling in hundreds of feet above mean sea level, followed by the contraction "MSL."

(4) Indicate the time of pilot's report and the type of aircraft, if known.

40390. Examples of pilot reports coded for teletype transmission are illustrated in paragraphs 40391-40397.

40391. ICING PIREPS:

40391.1. A pilot of a DC-3 flying between Cheyenne, Wyoming, and Salt Lake City, Utah, reports to Cheyenne that at 1050 MST he encountered moderate icing conditions 15 to 80 miles west of Cheyenne, from 9,000 feet MSL to 10,500 feet MSL:

CX 1100M PIREPS MDT ICG 15-80 W CX 90-105 MSL 1050M DC3.

40391.2. The pilot of a Stinson, flying between Seattle and Oakland, reports to Medford that at 0700 PST he encountered light icing conditions 5 to 20 miles north of Eugene, Oregon, at 2,000 feet MSL; the top of the icing was not reported:

MF 0715P PIREPS LGT ICG 5-20 N EU 20-// MSL 0700P STSN.

40391.3. The pilot of a P-38, flying between Oakland and Burbank, reports that he encountered heavy icing conditions at 0925 PST over mountains north of Burbank, with the top of the icing at 11,500 feet MSL, base unknown:

BU 0931P PIREPS HVY ICG MTNS N BU //-115 MSL 0925P P38.

40392. DISCHARGE PIREPS:

40392.1. A pilot flying a PBY between Richmond, Virginia, and Washington, D. C., reports to Washington that at 1620 EST his aircraft experienced an electrical discharge 20 miles south of Washington at an altitude of 5,000 feet MSL:

WA 1629E PIREPS DISCHARGE 20 S WA 50 MSL 1620E PBY.

40392.2. The pilot of a Flying Fortress enroute from St. Louis, Missouri, to Chicago, Illinois, reports to Chicago that at 1515 CST his plane experienced an electrical discharge over the Kankakee River at an altitude of 2,500 feet MSL:

CG 1535C PIREPS DISCHARGE 15 S JO 25 MSL 1515C B17.

40393. TURBULENCE PIREPS:

40393.1. A pilot reports to Kansas City, Missouri, that his C-54 encountered heavy turbulence at 2330 CST 10 miles northeast of Knoxville, Missouri, at 6,000 feet MSL:

KC 2335C PIREPS HVY TURBC 10 NE KL 60 MSL 2330C C54.

40393.2. The pilot of a DC-3 flying at 10,000 feet MSL through Donner Summit Pass, California, reports to Reno, Nevada, that moderate turbulence is being experienced, 1050 PST:

RP 1055P PIREPS MDT TURBC OVER DS 100 MSL 1050P DC3.

40394. HAIL PIREPS:

40394.1. The pilot of a DC-4 reports to Omaha, Nebraska, at 1617 CST that he is flying through moderate hail 10 miles south at an altitude of 3,500 feet MSL:

OH 1619C PIREPS A 10 S OH 35 MSL 1617C DC4.

40394.2. At 1628 CST the same pilot reports that he is flying in light hail and heavy rain, with moderate turbulence at 3,000 feet MSL, 15 miles southwest of Omaha, and that at 5,000 feet MSL his plane had experienced a discharge:

OH 1635C PIREPS MDT TURBC R+A- 15 W OH 30 MSL DISCHARGE 50 MSL 1628C DC4.

40395. WINDS ALOFT PIREPS:

40395.1. At 0845 CST the pilot of a P-47 reports to Bismarck, North Dakota, that he is encountering a 95-mile wind west of Bismarck at 6,000 feet MSL, wind direction 315 degrees:

RK 0850C PIREPS WND 315 95 W RK 60 MSL 0845C P47.

40396. TOPS OF OVERCAST PIREPS:

40396.1. The pilot of a B-24 flying over Navasota, Texas, at 0613 CST reports to Navasota that the top of the overcast is at 8,500 feet MSL:

NT 0618C PIREPS TOVC OVER NT 85 MSL 0613C B24.

40396.2. If the plane had been 15 miles southeast of Navasota when the pilot determined the height of the top of the overcast, the coded report would have read:

NT 0618C PIREPS TOVC 15 SE NT 85 MSL 0613C B24.

40397. CEILING PIREPS:

40397.1. The pilot of a DC-3 flying over Washington, D. C., reports at 1110 EST to Washington that the ceiling is at 1,500 feet MSL:

WA 1118E PIREPS CIG OVER WA 15 HND MSL 1110E DC3.

40397.2. A pilot flying between Casper and Sheridan, Wyoming, reports to Sheridan that the ceiling over Kaycee is 1400 feet MSL. The type of aircraft was not reported, nor the time of the observation.

ZY 1850M PIREPS CIG 65 MIS S ZY 14 HND MSL.

40400. CODING CHARACTERISTIC OF BAROMETRIC TENDENCY

40410. The characteristic of barometric tendency included as additive data with the record observation at 3- and 6-hourly periods will be classified and coded in accordance with the following rules, which are exemplified by typical traces, each of which embraces a 3-hour period:

Rule 1.

a. A 3-hour trace must be coded as 3 or 8 if the trace contains no points of discontinuity.

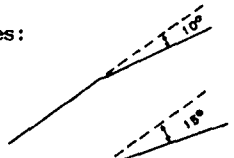
A point of discontinuity is defined as a point at which the extension of the earlier part of the trace makes an angle with the trace's continuation which is equal to or greater than 15° (1/6 of a right angle).

b. If the 3-hour trace contains one or more points of discontinuity, the trace must be coded as 0, 1, 4, 5, 6, or 9.

c. Traces to be coded as 2 or 7 are special cases, containing at least 3 points of discontinuity, and are governed by *rule 4*.

Examples:

A.



This should be coded as 3 because there is no point of discontinuity in the trace according to definition.

B.

This should *not* be coded as 3 because there is a point of discontinuity in the trace according to definition. It should be coded as 1.

Rule 2.

When the trace during the 3-hour period may apparently be represented by two or more characteristics, code the characteristic which is representative of the last portion of the trace. (Note EXCEPTION to this in rule 3.)

Examples:

A. should be coded as 4.

B. should be coded as 5.

C. should be coded as 5.

D. should be coded as 6.

E. should be coded as 0.

F. should be coded as 1.

Rule 3.

Rule 2 must be disregarded when that characteristic representative of the last portion of the 3-hour trace conflicts with the *net amount of* change in the 3 hours. When this exception occurs, choose the characteristic which is *most descriptive* of the *whole* 3-hour trace, and which is also compatible with the net 3-hour change.

Examples:

A. should be coded as 0.

(If rule 2 were followed, it would have given 6 as the characteristic, but 6 indicates that the barometric change is negative, whereas in the above example, the change is positive. Neither does code characteristic 1 represent this case, for this would ignore the fact that during the 3-hour period the barometer was at one time higher than it is at observation.)

B. should be coded as 0.

(If rule 2 were followed, it would have given 7 as the characteristic, which, as in example A, would not have been compatible with the sign of the net 3-hour change.

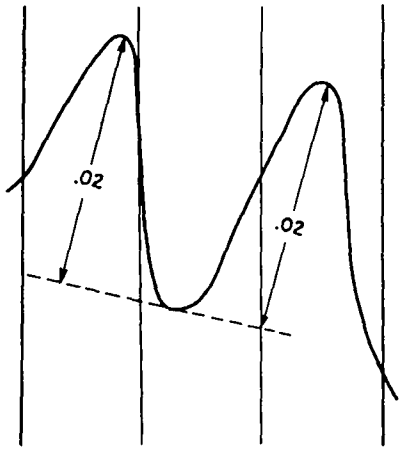
A further discussion of this type of case may be found under Miscellaneous Explanatory Examples.)

C. should be coded as 5.

(The reasoning in this case is similar to that for examples A and B.)

Rule 4.

Number 2 or number 7 characteristics may be coded only if there are *at least two crests or two troughs* contained in a 3-hour trace, *and of such an amplitude that the distance from the top of each crest to the bottom of its neighboring trough is equal to, or greater than, the distance representing .02 inch of mercury on the barograph sheet.*



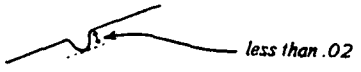
a. This eliminates the use of the "mean slope" of earlier instructions.

b. The limit of .02 inch holds for both the seven day and four day barographs.

Rule 5.

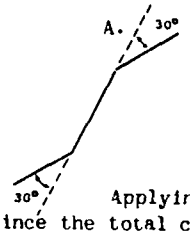
Single or multiple troughs or crests which do not equal or exceed .02 inches of mercury in amplitude must be disregarded, and the trace must be coded according to its general trend.

Example:



The trace should be coded as 3.

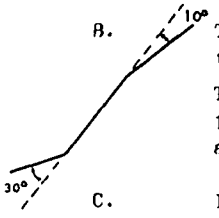
Miscellaneous Explanatory Examples:



This trace cannot be coded as 2 because it does not contain two crests or two troughs.

Applying rule 1, it can be seen that there are two points of discontinuity, and two possible characteristics assignable to the 3-hour trace.

Applying rule 2, it is evident that the trace should be coded as 1. Since the total change has been a rising one, there is no conflict in this respect with the characteristic chosen, and rule 3 is satisfied.



This trace cannot be coded as 2 because it does not contain two crests or two troughs.

There is only one point of discontinuity according to rule 1, and therefore there is only one possible characteristic assignable, which is 4.

C.

In this case (and in similar cases) it is considered more important to transmit the fact that the barometer has risen and has then fallen, than the fact that the barometer is unsteady. If the unsteady character were considered the more important, the above trace could only be coded as 2, since the total change has been a rising one. This however, does not advise the analyst of the fact that the barometer has risen but is *now falling*. Coded as 2, and thus plotted on the map, it would appear that the barometer has been rising unsteadily throughout the period.

To remove this paradox as well as possible, it is necessary to neglect the unsteady character of the last portion of this trace and code the 3-hour trace as 0.