

Circular N. 6<sup>th</sup> ed WEATHER BUREAU ADDENDUM

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# National Oceanic and Atmospheric Administration

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March 21, 2005

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WEAN MANUAL OF SURFACE OBSERVATIONS  
CIRCULAR N, 6TH EDITION  
WEATHER BUREAU ADDENDUM

CHAPTER A-1. CEILING AND CLOUD HEIGHT

A1300. DETERMINATION OF DIRECTION

A1311. NEPHOSCOPE\*. Find the image of the cloud in the mirror of the nephoscope. Move the eyepiece about, at the same time shifting the horizontal arm until the cloud image seen through the eyepiece is at the center of the mirror. Rotate the mirror until the cloud movement is along one of the radial lines. The azimuth corresponding to this line is the cloud direction. Convert the azimuth to one of 8 compass points by use of the following table:

Table A1 Direction equivalents

Letters	Degrees	Letters	Degrees
N	338° - 22°	S	158° - 202°
NE	23° - 67°	SW	203° - 247°
E	68° - 112°	W	248° - 292°
SE	113° - 157°	NW	293° - 337°

\* These instructions apply to the mirror-type nephoscope, which is used in the Weather Bureau almost exclusively at this time.

A1440. METHODS OF DETERMINING CLOUD HEIGHT AND VERTICAL VISIBILITY

A1448. CEILOMETER. The ceilometer will be placed and continued in operation whenever clouds cover 0.1 or more of the sky. If the sky is clear and clouds are forecast for the station, the equipment will be placed in operation at least one hour before the expected time of the appearance of clouds. The recorder gain should be set at 9, and reduced as necessary after clouds are detected by the equipment. If clouds are neither present nor forecast, the recorder, scanning, and projector switches will not be turned on, but the ceilometer amplifier will remain on continuously to keep the ceilometer ready for immediate use. The scanning drum will be stopped at an angular elevation that most nearly eliminates possibility of damage either from a strong baseline reaction or from rays of the sun entering the drum.

(1-1-49)

A1448.1. PREPARATORY OPERATIONS. The following procedure will be followed in placing the ceilometer in operation:

1. Projector — Turn the projector switch on.
2. Detector —
  - a. Adjust the amplifier gain control to insure optimum performance in accordance with technical instructions. (See Figure A1-a).
  - b. Place recorder-meter switch in the "recorder" position.
3. Recorder —
  - a. Turn the recorder switch and the selsyn and scanning switch on.
  - b. Adjust the recorder gain control to provide a maximum stylus oscillation of 5/32 inch in width.
  - c. Adjust the recorder paper so that the position of the stylus with respect to the heavy horizontal time-lines corresponds to the number of minutes after the hour at the time of adjustment.
  - d. Record the time (IST) and date of adjustment on the extreme right side of the record.

A1448.2. INTERPRETATION OF CEILOMETER RECORD. The height corresponding to the lowest angle at which maximum width of the stylus trace occurs will be ascribed to the cloud base. (See Figure A1-a). This height may be computed in accordance with paragraph 1441(5)-(7) or read from the scale attached to the recorder.

A1448.3. CEILOMETER DETERMINATION OF VARIABLE CLOUD HEIGHTS. The height ascribed to a variable ceiling will be the average height indicated during several successive sweeps of the scanning drum. A variable cloud height may be classified as measured, indefinite, or otherwise in accordance with paragraph 1430-6.

A1448.4. INDICATIONS OF VERTICAL VISIBILITY. Under the conditions indicated in paragraph 1441.2, the reaction of the ceilometer is in general characterized by a strong signal at low angles. The signal slowly falls to zero as the angle increases. The height corresponding to the angle at which the reaction becomes zero will be used only as a guide in evaluating the vertical visibility which may be several times greater than this height (See Figure A1-b).

(1-1-49)

A1448.5. MANUAL OPERATION OF THE CEILOMETER. When the recorder record cannot be interpreted with certainty during the daytime, the detector will be operated manually during the period of the observation, as follows:

1. Turn off the recorder switch labeled "selsyn and scanning". Record the time (IST) and the date on the extreme right side of the chart.
2. Turn the switch on the discriminator chassis to the position labeled "meter".
3. Turn on the detector meter switch.
4. Note the elevation angle of the scanner to the nearest 0.1°.
5. Elevate the scanning drum by means of the crank, more slowly as the critical angle is approached.
6. Determine the lowest point of maximum deflection of the output meter as follows:
  - a. Elevate the drum beyond the lowest point of maximum deflection.
  - b. Lower the drum again to the lowest angle at which a signal is indicated.
  - c. Elevate the drum to the lowest point of maximum deflection.
7. Read the angle determined in 6c and obtain the corresponding height in accordance with paragraph 1441 (6) and (7).

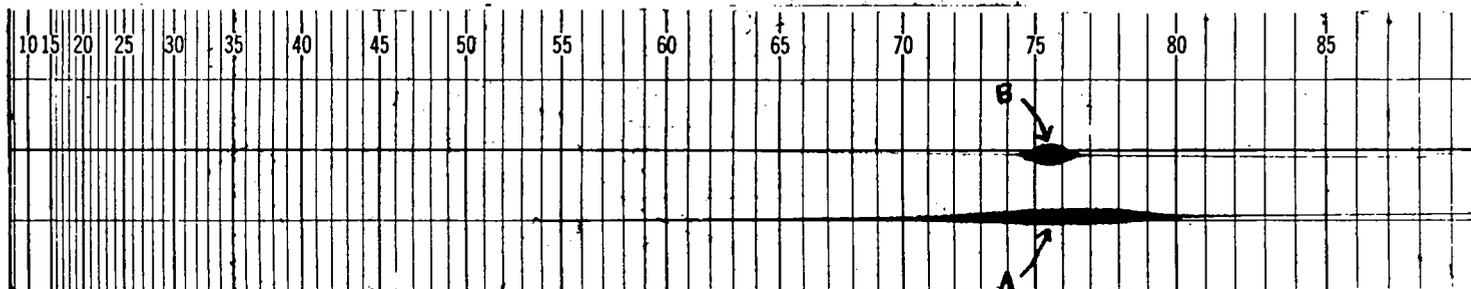
Note: Values pertaining to variable ceilings and to vertical visibility will be selected similarly to those described in paragraphs A1448.3 and 1441.2, except that the deflection of the meter will be observed, rather than the width of the stylus trace; e.g., the point of first full-scale deflection of the meter will correspond to the lowest point of maximum oscillation of the stylus, and the point at which the meter returns to zero will correspond to the point at which oscillation of the stylus ceases.

(1-1-49)

A1448.51. When the cloud height observation has been completed, return the ceilometer to automatic operation as follows:

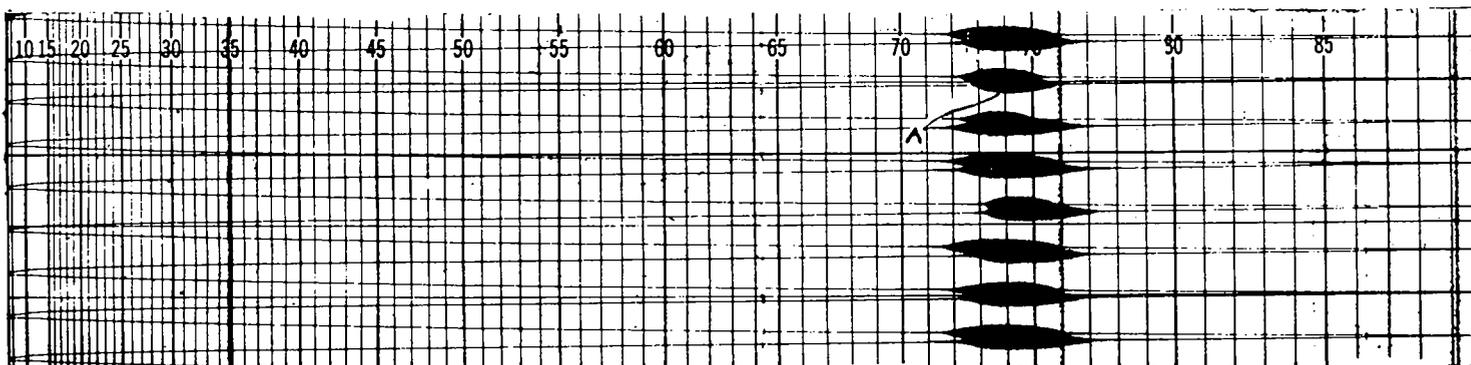
1. Reset the scanning drum to the angle noted in paragraph A1448.5(4). (Note: If the drum is not reset, the scanner will be out of phase with the stylus until the stylus has returned either to the extreme left or to the extreme right of the recorder paper, when correct phasing will usually occur automatically, but may require manual re-setting. If the accuracy of a transit or of a complete cycle is doubtful, cross out the trace at the left edge of the transit.)
2. Turn off the detector meter switch.
3. Turn the switch on the discriminator chassis to the position labeled "recorder".
4. Turn on the recorder switch labeled "selsyn and scanning". Record the time (IST) and the date on the extreme right side of the chart.

A1448.6. USE OF CEILOMETER PROJECTOR AS A CEILING LIGHT. When the recorder record cannot be interpreted with certainty during the night-time, the projector will be used as a ceiling light in accordance with paragraphs 1441-1441.4.



Adjustment of Gain Controls

These traces were made as nearly simultaneously as possible with a detector gain setting of 7 and a recorder gain of 5 at A, and a detector gain of 4 and a recorder gain of 8 at B. The lower detector gain makes more apparent the lowest point of maximum reaction. Note, however, that in both instances this point occurs at approximately the same angular elevation.



Selection of Lowest Point of Maximum Reading

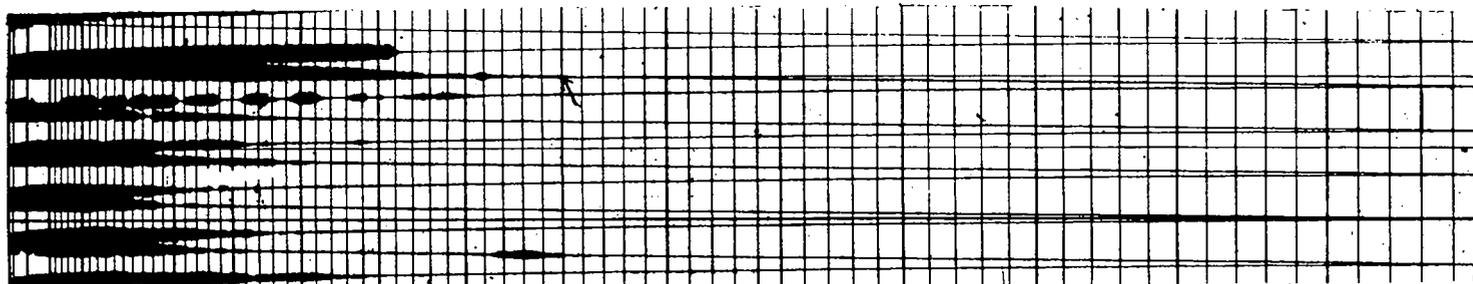
The lowest point of maximum reading during one of the transits is indicated at A. Slight variation in lowest point of maximum reaction probably due to roll structure of cloud base. Several transits must be examined and careful visual observation of the sky made in order to select representative value. In this example, an angular reading of  $73.5^\circ$  is representative of the entire period.

FIGURE A1-2



Correlation of Recorder Record with Visual Observation

Owing to broken clouds the traces at A and B are non-representative, and must be disregarded. At A the reaction is apparently from the side of a cloud; at B no clouds were overhead at the time of the transits. This example illustrates the importance of a careful visual observation of the sky and of an examination of the preceding transits to avoid ascribing erroneous height values to cloud bases.



Indication of Vertical Visibility

A light snow that was falling obscured the clouds above. The point at which reaction ceased, indicated on one of the transits by a small arrow, may be used as a guide in estimating the vertical visibility. However, this point represents a minimum ceiling value and the actual vertical visibility may frequently be much greater. Every effort must be made under these circumstances to obtain ceiling observations from aircraft. If pilot reports cannot be obtained, the observer will qualify the ceilometer indications as necessary on the basis of visual observations and past experience.

## CHAPTER A-2. VISIBILITY

A2010. All distances referred to in this manual are in statute miles.



CHAPTER A-3. ATMOSPHERIC PHENOMENA

A3442.3. ICE-ACCRETION INDICATORS. Ice-accretion indicators are furnished selected stations (See Par. 3510). The indicators consist of a wooden bracket on the ends of which clamps are mounted to hold a strip of aluminum. Each station is supplied with several strips. Any location that will insure exposure of the indicator to precipitation, regardless of the wind speed and direction, will be satisfactory.

A3442.31. The strips will be stored in the shelter and protected from blowing rain to insure that when they are exposed they will be dry and their temperature close to that of the air. One strip of the ice-accretion indicator will be exposed whenever freezing rain is expected.

A3442.32. When freezing precipitation is occurring, a strip free of ice will be exposed ten or fifteen minutes before taking an observation. It is essential that this interval of exposure be just prior to the observation to avoid the possibility of reporting freezing precipitation as occurring at the time of observation when actually ice on the indicator might have formed some time earlier.



CHAPTER A-4. MEASUREMENT OF PRECIPITATION

A4030. TYPES OF GAGES. The gages are of three types: 4- and 8-inch standard, 12-inch tipping bucket, and 8-inch weighing. The inside diameter of the top cylindrical portion of the receiver is used to define the size of the gage. If other gages are available, the weighing gage, even though shielded, will not be used for official precipitation measurements unless it is equipped with 6-hour gears.

A4030.1. Measuring tubes, appropriate to the 8-inch standard and tipping-bucket gages, hold 2 inches and 1 inch, respectively. A special measuring stick, graduated to read directly in hundredths of an inch, may be used with either of these tubes. Measurement is facilitated by a ten to one ratio of the cubic content of the measuring tube to that of the gage. Therefore, a two-inch measurement is graduated over a twenty-inch length of the measuring stick. The 4-inch gage, which holds one inch, is made of transparent plastic. The receiver is graduated in hundredths of an inch. This construction permits of measuring the precipitation without the use of a measuring tube and stick. The weighing-bucket gage records the amount of precipitation on a chart placed on a clock-driven drum. A stick measurement is not made of the precipitation caught in this type of gage.

A4031. 4- AND 8-INCH STANDARD GAGES. These gages consist of three parts: the overflow container, the measuring tube, and the receiver assembly. Whenever freezing rain or solid forms of precipitation occur or are expected, the receiver and the measuring tube should be removed to allow representative amounts of these forms of precipitation to be caught in the overflow container.

A4032. 12-INCH TIPPING BUCKET GAGE. This gage is used to measure liquid precipitation only. The mechanism of the gage consists of a double bucket that tips back and forth on pivot bearings. When 0.01 inch of rain has fallen through the funnel into one of the buckets, the bucket tips, discharging the water into the reservoir, and bringing the other bucket under the funnel. The gage is connected to a register that records the tipping action on a chart from which amounts of precipitation to the nearest 0.01 inch, and rates of fall, can be determined.

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A4032.1. The mechanism is enclosed in a cylindrical container that includes the reservoir. A detachable cover fits on the upper part of the container. This gage is subject to damage by snow, sleet, and freezing rain; therefore, when any of these forms of precipitation is present or expected, remove the tipping bucket and cover the cylindrical container.

A4032.2. If precipitation is not occurring at the time of observation and a tipping-bucket gage is used, open the door of the tipping mechanism and tip the bucket ten times. This places a time mark on the chart and tests the mechanism for correct functioning. Tipping the bucket ten times will bring the register pen into the same position as before tipping. If precipitation is occurring, omit this operation.

A4033. 8-INCH WEIGHING GAGE. The 8-inch weighing gage consists of a collector ring with a removable funnel and a bucket mounted on a weighing mechanism that is comprised of a platform, spring, and linkage. The weight of the precipitation is converted to equivalent inches of precipitation by the gage and recorded on a chart calibrated to read in hundredths of inches.

A4033.1. The capacity of weighing gages depends on whether the pen linkage permits single, double or triple traverse of the pen over the chart. In the single traverse type the pen records on its ascent, the double traverse type on its ascent and descent, the triple traverse type again on a second ascent. The series of traverses is usually equivalent to the capacity of the weighing bucket. In summer, the weighing bucket will ordinarily be emptied when the chart is changed. In winter, during periods of freezing temperature, the gage should be charged with antifreeze by placing in the bucket one quart of commercial anhydrous calcium chloride (weight approximately 1-1/2 pounds) which is then dissolved in one quart (two pounds) of water. Do not use a more concentrated solution of calcium chloride. The solution may be covered with a small amount of light oil (SAE 10) to prevent evaporation. The calcium chloride will ordinarily be furnished by the inspector or the supervising station. The bucket will not be emptied until it is filled to 75% or 80% of capacity.

A4033.2. At each observation inspect the mechanism to determine that the clock is running and that ink is flowing from the pen. If vibration or repetition of the trace over the same ordinate causes the pen line to appear too wide for accurate evaluation of small amounts of precipitation, adjust the pen upwards 0.10 or 0.05 inch and make a notation to this effect on the chart.

A4033.3. To determine the amount of precipitation to the nearest 0.01 inch during a designated period, measure the vertical distance of the pen at the time of observation from its position at the time of the preceding observation. Convert this distance to ordinates and tenths. Some charts are graduated to read directly to 0.10 inch, and others directly to 0.05 inch; interpolation for values between these is necessary. If the pen traverse has reversed within the observational period, determine the vertical distance (a) between the trace at the beginning of the observation period and the point where the trace reverses direction, and (b) between the point where the trace reverses direction and the position of the pen at the time of observation. Add the amounts to obtain the total precipitation.



CHAPTER A-5. TEMPERATURE

A5310. SNOW SURFACE TEMPERATURE OBSERVATIONS. These observations will be taken at raob stations north of the 40th parallel.

A5410. WATER TEMPERATURE OBSERVATIONS. See paragraph A11455.

A5500. TELEPSYCHROMETER

A5510. GENERAL. The telepsychrometer is designed to measure dry-bulb temperatures and wet-bulb depressions at a meteorologically representative location and record them on a chart in an observatory. The L and N (Leeds and Northrup) type provides dry-bulb temperatures over a range of 20° to 120°F., and wet-bulb depressions from 0° to 50°F. at temperatures above 32°F. The telepsychrometer consists of two basic units: the exposure unit and the recorder.

A5520. EXPOSURE UNIT. The exposure unit contains two continuously ventilated resistance thermometers, called thermohms, which correspond to the dry- and wet-bulb thermometers of mercurial psychrometers. One of these thermohms is kept wet by a wick partially immersed in a tray of water automatically replenished from a conical reservoir. Access to the thermohms and reservoir is gained by loosening the knurled nuts on each of the three supporting legs near the bottom of the cylindrical housing. The housing should be turned slightly before it is lowered over the legs.

A5521. MAINTENANCE. Clean wicking must be kept on the wet thermohm. The replaced wick will be discarded and a new one installed at least weekly, and more often if necessary. If the wick is not clean, indicated depressions will be incorrect. For convenience in changing the wick, a spring arrangement on the wet thermohm permits of elevating it from the normal horizontal position.

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A5521.1. The conical reservoir must be supplied with distilled water. If the reservoir becomes dry, indicated depressions will gradually decrease. The reservoir is removed for filling by lifting it upwards through its upper support. The water tray must be clean and the ventilation ducts unobstructed. Routine inspection trips to the exposure unit will be regularly scheduled to insure the required maintenance. The fan motor bearings will be lubricated with SAE 20 oil once every three months. Access to the motor is gained by removing the conical cap on the exposure unit.

A5530. RECORDER. A complete description of the recorder mechanism and charts, and details of maintenance, will be found in the I&N booklets furnished with the recorder. Special attention will be given the instructions for lubricating the equipment, inking the pad, and changing the paper. These instructions are in Section 22, 18A and 16 of the I&N Booklet 1235.

A5531. CALIBRATION. Calibration of the equipment will not be made by station personnel. As a special precaution against turning the small calibration dial in the upper left corner of the recorder between calibrations, the dial will be securely fastened to the recorder chassis with scotch tape.

A5532. RECORD. The recorder prints alternately the current dry-bulb temperature and the depression of the wet-bulb on a chart whose vertical lines represent 1° intervals of dry-bulb temperature and 0.5° intervals of depression. The dry-bulb temperature trace consists of a dot and the figure "1" printed simultaneously. The wet-bulb depression trace consists of a dot and the figure "2". All readings will be estimated to tenths of degrees from the position of the extreme left edge of the dots with respect to the vertical lines.

A5532.1. Horizontal lines identify the hours by the figures 0 to 23 printed near the left margin of the chart. When a new roll of paper is first installed, or when the recording of temperatures and depressions is incorrect with respect to time, the paper will be adjusted for time by turning the upper cylinder on the recorder. Notations concerning the adjustment will be made in accordance with Chapter A-13.

A5532.2. Maximum and minimum dry-bulb temperatures for any period are selected by noting the dots on trace "1" farthest to the right and left respectively during the given period.

A5532.3. A short line will be directed to the right of the dry-bulb reading and the notation "6 H" entered at each 6-hourly observation.

A5540. OBTAINING PSYCHROMETRIC DATA. During the period of operation of the telepsychrometer, temperature, dew point, and relative humidity will be obtained in accordance with the following instructions.

A5541. When the wet-bulb temperature obtained from the telepsychrometer data is higher than 33°F., temperature, dew point, and relative humidity will be obtained from the telepsychrometer data.

A5542. When the wet-bulb temperature obtained from the telepsychrometer data is 33°F. or less, and the telepsychrometer dry-bulb is above 20°F.:

1. Dry-bulb temperatures, including maximum and minimum temperatures, will be taken from the telepsychrometer.
2. Wet-bulb temperature will be obtained by comparing the telepsychrometer dry-bulb temperature with the dew point derived from mercurial psychrometer data.
  - (a) If the dew point is equal to or higher than the telepsychrometer dry-bulb temperature, the wet-bulb temperature will be regarded as equal to the telepsychrometer dry-bulb temperature.
  - (b) If the dew point is lower than the telepsychrometer dry-bulb temperature, the wet-bulb temperature will be computed from the observed telepsychrometer dry-bulb temperature and the dew point computed from the observed mercurial wet- and dry-bulb temperatures. Psychrometric diagram 1-A (Form 1186-A) or 1-B (Form 1186-B) is used for this computation (See paragraph A5545).
3. Dew point will be derived from mercurial psychrometer dry- and wet-bulb temperatures.
4. Relative humidity will be derived from the telepsychrometer dry-bulb and the dew point temperature obtained from the mercurial psychrometer data.

A5543. When the telepsychrometer dry-bulb temperature is 20°F. or less, temperature, dew point, and relative humidity data will be obtained from psychrometers using standard mercurial or alcohol thermometers.

A5544. See Table A2 for a tabulation of the instructions contained in paragraph A5540-43.

TABLE A2

Methods for obtaining Dry- and Wet-Bulb, Dew Point, and Relative Humidity values using telepsychrometers.

	Wet-bulb (from telepsychrometer data) higher than 33°F.	Telepsychrometer dry-bulb higher than 20°F., wet-bulb 33°F. or higher.	Telepsychrometer dry-bulb 20°F. or less.
Dry-Bulb	From telepsychrometer.	From telepsychrometer.	From mercurial or other standard psychrometer.
Wet-Bulb	From telepsychrometer dry-bulb temperature and wet-bulb depression.	From telepsychrometer dry-bulb and standard psychrometer dew point. (Use diagram 1-A and 1-B).	From mercurial or other standard psychrometer.
Dew Point	From above dry- and wet-bulb temperatures.	From standard psychrometer dry- and wet-bulb values.	From standard psychrometer dry- and wet-bulb values.
Relative Humidity	From above dry- and wet-bulb temperatures.	From telepsychrometer dry-bulb and standard psychrometer wet-bulb.	From standard psychrometer dry- and wet-bulb values.

A5545. PSYCHROMETRIC DIAGRAM. Diagram 1-A will be used at stations whose mean pressure is 29.5 inches or less, and diagram 1-B at stations whose pressure is more than 29.5 inches. (See Figure A2 a-b). The diagram appropriate to the mean station pressure is used in the following manner:

1. Locate the intersection of the horizontal line corresponding to the dew point temperature and the slanting line corresponding to the dry-bulb temperature. Interpolate to tenths of degrees when necessary.
2. Read from the adjacent vertical lines the wet-bulb temperature to tenths of degrees Fahrenheit.

EXAMPLE

- Given:
1. Mercurial dew point temperature of 20.0°F.
  2. Telepsychrometer dry-bulb temperature of 27.7°F.
  3. Mean station pressure of 29.62 inches.

Computation: Enter diagram 1-B along the horizontal 20.0°F. line and the slanting 27.7°F. line (interpolated). The vertical temperature line of 25.5°F. (interpolated), passing through their point of intersection is the wet-bulb temperature.

PSYCHROMETRIC DIAGRAM I-A

RELATING DEW-POINT, DRY- AND WET-BULB TEMPERATURES

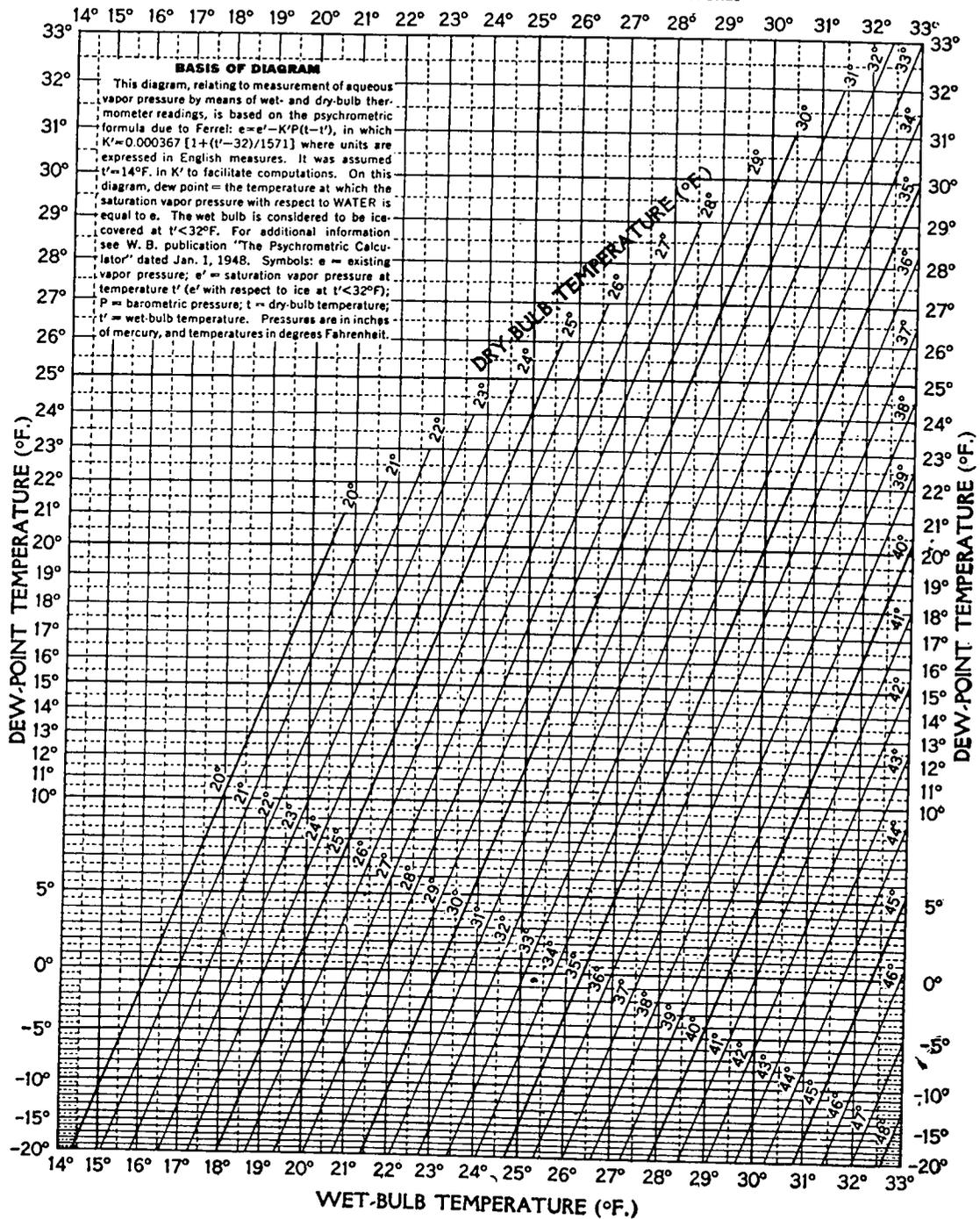


FIGURE A2-a

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

W. B. Form No. 1184-B

PSYCHROMETRIC DIAGRAM I-B

For P = 29 In. Hg.

RELATING DEW-POINT, DRY- AND WET-BULB TEMPERATURES

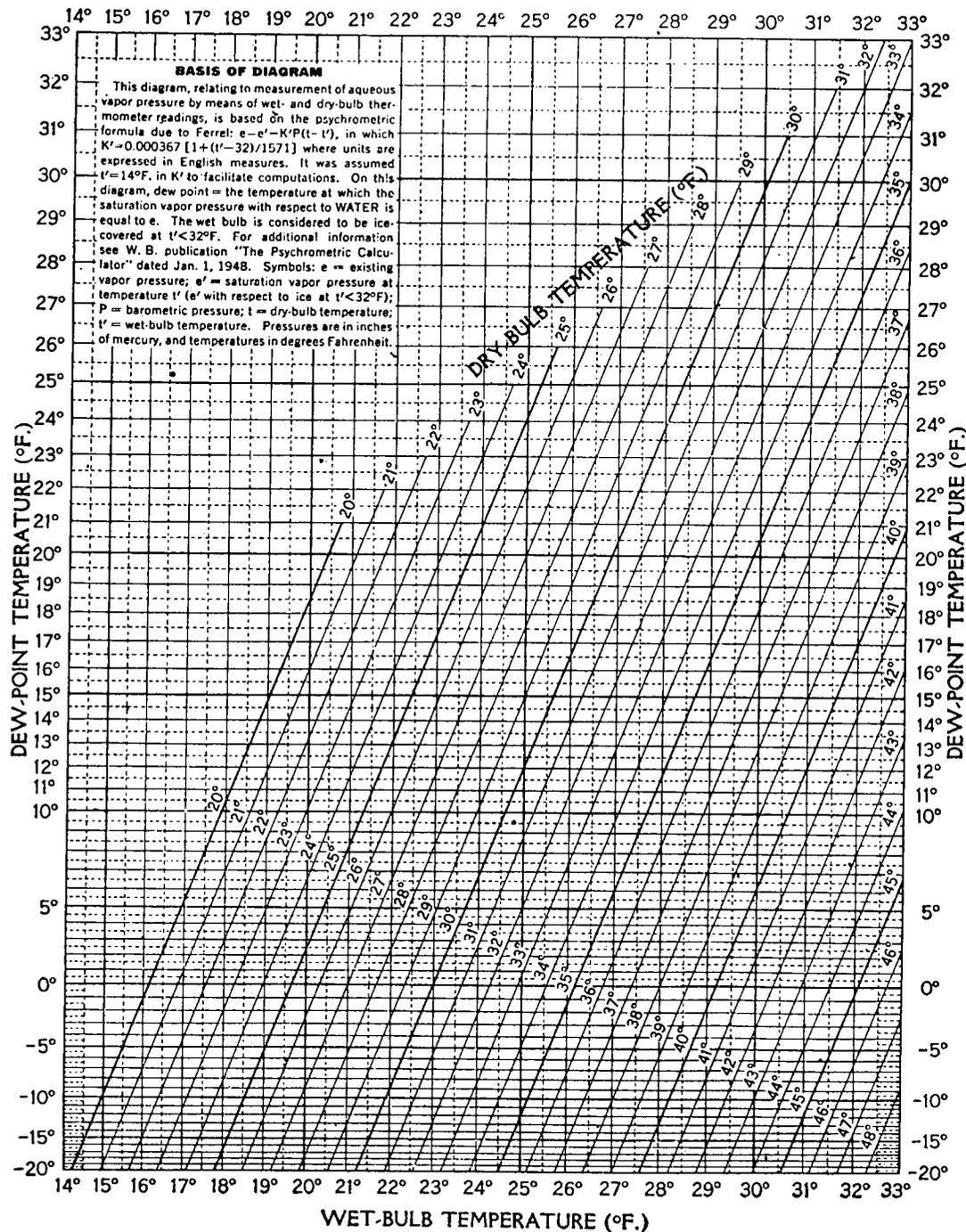


FIGURE A2-b



CHAPTER A-7. PRESSURE

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(1-1-49)

A7250. ERRATIC ANEROID BAROMETER CORRECTIONS. Report erratic aneroid barometer corrections immediately to the Regional Office.



A9012. CONTROL-TOWER VISIBILITY OBSERVATIONS. At Weather Bureau stations where CAA airport traffic control towers are situated, visibility observations will be taken in accordance with instructions contained in paragraph 9012, unless specific exception has been made by the Central Office. At stations where telautograph facilities are available to both Weather Bureau and control tower personnel, control tower personnel may record visibility observations on the telautograph tape instead of on Form 1130. Whenever this is done, the attention of the Weather Bureau observer will be brought to the observation immediately, either by buzzer or otherwise. Receipt of the observation will be acknowledged by the observer, and the observation will then be recorded on Form 1130 in the Weather Bureau office.

A9120.01. OFF-TELETYPE OBSERVATIONS. The time at which record observations at off-teletype stations are to be telephoned or telegraphed to a relay station will be specified by the Regional Office.

A9120.02. OMITTED OBSERVATIONS. A record observation may be omitted when a pilot balloon is being observed, provided the ceiling is above 9750 feet and the visibility is 10 miles or better. However, before the pibal is started in such cases, arrangements should be made with the CAA operator to transmit the code group "DCAVU" instead of the regular hourly observation. This code group means "Surface observation omitted on account of pibal, but ceiling is more than 9750 feet and visibility is more than 10 miles." Since at such times the ceiling and visibility would be unrestricted, safety of aviation would not be endangered. (See paragraph A1104.)

A9134.04 (3). TORNADO REPORTS. Officials in charge will make such arrangements as are possible with local news agencies, state or local police departments, or other organizations having special communication facilities, to insure that reports of tornadoes in the vicinity will be relayed promptly to their stations.

#### A9140. LOCAL EXTRA OBSERVATIONS

A9141. Local extra observations will be taken at intervals not exceeding fifteen minutes under the conditions specified in paragraph 9141. They will be taken at first-order airport stations unless otherwise specified by the Central Office, and at certain CAA stations specified by the Regional Offices.

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A9142. Local extra observations of one or more elements requested for aircraft arrivals or departures will be taken upon request at all stations.

A9150. CHECK OBSERVATIONS. Check observations will be taken at all stations where scheduled broadcasts of local weather are made.

A9216. LOG OF DIFFERING LOCAL WEATHER OBSERVATIONS. A log will be maintained of differences in local weather conditions observed by a pilot in flight from those observed at the ground. The pilot's position with respect to the station and the exact time he took the observation will invariably be entered in the log, which may otherwise be as brief as is consistent with a detailed account of circumstances relevant to the differences. The log will be maintained in the station file for a period of at least one year, after which it may be destroyed.

A9217. RECEIPT OF PILOT REPORTS. In order that all pireps may become available for dissemination promptly after their receipt at the ground station, and to insure that any differences in reports of local weather may be discussed with pilots or ground personnel of commercial airlines before the relevant circumstances have been forgotten, the personnel at each station used as a terminal for commercial airlines will arrange with the ground personnel of the airlines for prompt delivery and, where necessary, discussion of the pilots' reports.

CHAPTER A-10. DISSEMINATION AND TRANSMISSION

A10080. CORRECTED REPORTS - ENTRIES ON WB FORM 3069. Entries on Form 3069 will be made in the following manner:

1. When a correction for an airway or synoptic record observation has not been filed for transmission in accordance with paragraph 10080, Form 3069 will be prepared and routed in accordance with instructions printed on the form.
2. When the attention of the observer has been called to an error by receipt of Form 3069 from another station, the error will be corrected in accordance with paragraph 10080. Form 3069 will be signed and routed in accordance with instructions on the form.

A10400. USE OF FORM 3024B

A10410. GENERAL. Data from original records of observations, telegrams, or observations received by telephone, will be entered on Form 3024B prior to filing coded observations for transmission by teletype or radio. It will be used at all stations where Civil Aeronautics Administration communicators transmit (but do not take) airway or synoptic observations. (Exceptions may be authorized by the Regional Offices when it is impractical to use this form.) Observations received at Weather Bureau stations from other weather observing stations for teletype transmission will be entered on Form 3024B wherever the observations are filed with the Civil Aeronautics Administration. In this case only, a file copy will be retained in the station files for six months. Prepare additional copies as required locally.

A10420. INSTRUCTIONS FOR ENTRY OF DATA ON FORM 3024B (Revised - Effective January 1, 1949).

A10421. HEADING. Enter the date and time of filing the observation in the upper right corner. (A time stamp may be used for this purpose.) Use a six-figure group: the first two figures for the day of the month and the last four for the filing time of the observation in terms of the 24-hour clock. The group will be followed by a letter designating the time zone, local standard or Greenwich, e.g., 061932E, 110028Z. The use of local or Greenwich time will accord with transmission requirements.

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A10422. ENTRIES FOR AIRWAY OBSERVATIONS (Including Pilot Reports and Additive Data).

A10422.1. In the "Station" block, enter station letter identification as listed in Civil Aeronautics Administration Federal Airways Manual of Operations.

A10422.2. In the "Type" block, enter "S," followed by the serial number of the observation if the observation is a special or record-special, "L" if it is a local extra, (✓) if it is a check observation. Omit entry for record observations.

A10422.3. In the "Time" block enter a four-figure time group, followed by a letter time-zone designator, in 24-hour clock, for special, local extra, and check observations. Omit entry for record and record-special observations.

A10422.4. Succeeding entries will correspond to those in columns 3 - 14, inclusive, of WBAN 10A. (For coding instructions for entry on WBAN 10A, see chapters 10 and 11.)

A10423. ENTRIES FOR SYNOPTIC OBSERVATIONS. Transcribe coded messages or enter telephoned or telegraphed messages on the lower lines of the form.

A10424. OBSERVER'S INITIALS. Enter observer's initials on the lower right side of the form.

A10425. CORRECTED OBSERVATIONS. When transcribing corrections to observations, enter "CQN" above the station designator block. Transcribe the entire corrected airway or synoptic observation. Note that although paragraph 11032 does not require an additional entry on WBAN 10A of the entire observation in which an error occurred, it is necessary that the complete corrected observation be entered on Form 3024B, since the entire observation must be transmitted to correct a single error.

#### A10500. CODING FOR COMMERCIAL TELEGRAPH TRANSMISSION

A10520. 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 that indicated in paragraphs 10010 - 10070. Decimal points and the word "slant" will not be transmitted. The complete value of ceiling and cloud height, sea-level pressure, and altimeter setting will be

transmitted, 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 identification 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 identification, and time of the report when required, will be supplied from the heading of the telegram and coded in accordance with paragraphs 10110 - 10140.

Example

As received at San Francisco from Hollister, California:

ESTIMATED 5500 OVERCAST LOWER BROKEN 9 LIGHT RAIN 6563  
NORTHEAST 11 ESTIMATED 11000 OVERCAST 2000 SCATTERED

As prepared for teletype distribution:

HLL 0600P E55⊕9R- 65/63×11/E110⊕20⊕



AL1001. GENERAL. WBAN 10 A, B and D will be used at all stations taking airway observations. In addition, WBAN 10D will be used at all stations preparing WB 1001B. CAA stations will omit entries in columns 20, 22-35, 50-56, and 71-77 of WBAN 10 A and B.

AL1002. PREPARATION AND DISPOSITION OF WBAN 10. WBAN 10 will be prepared in duplicate unless additional copies are required locally. A moderately hard pencil will be used. Forward the original copies for the preceding week to WRPC every Saturday. On the second working day of the following month, forward all remaining original copies for the completed month with the month's automatic records, which will include all data for the last day. When any form cannot be mailed on the specified date, forward an explanation to the WRPC on or before that date. When the originals are returned from WRPC, file them as part of the permanent local record and forward the carbon copies to the Section Center.

AL1004. RECORD OBSERVATIONS OMITTED DURING A PIBAL. Visual data observed at the scheduled time of an omitted record observation, and data taken from autographic records corresponding to the time of the omitted record observation, will be entered on WBAN 10, for record purposes, as follows:

1. Enter "R" in column 1.
2. Enter, in columns 2 and 16, the time of the beginning of the observation sequence in which the omitted observation normally would have appeared.
3. Enter data pertaining to ceiling in column 3, sky in column 4, visibility in column 5, weather and obstructions to vision in column 6, and clouds and obscuring phenomena in columns 21-35. These data will be observed during the pibal at the time the omitted observation was scheduled to be taken.
4. Enter dry-bulb and wet-bulb temperature data in columns 8, 18, and 19. These data will be interpolated between the dry-bulb and wet-bulb values recorded in the observations immediately preceding and following the omitted observation, except that the data will be taken from thermographs or telepsychrometers at stations equipped with them.

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5. Enter, in columns 9 and 20, dew point and relative humidity data, computed in the usual manner from the interpolated dry-bulb and wet-bulb temperature data.
6. Enter data pertaining to sea-level pressure in column 7, altimeter setting in column 13, station pressure in column 17, pressure tendency in column 36, and net three-hour change in column 37. The basic data will be taken from the barograph trace. The dry-bulb temperature obtained in accordance with the preceding instructions will be used to obtain the 12-hour mean temperature for pressure reductions.
7. Enter surface wind direction and speed in columns 10 and 11. These data will be taken from multiple registers at stations equipped with them. At other stations, the wind data will be estimated during the pibal at the scheduled time of the omitted observation.
8. Enter any remarks noted during the pibal, and additive data, if appropriate, in column 14. Enter the authorized contraction "FIBI" in parentheses in column 14.

All021. LATE OBSERVATIONS. If an observation is taken late and no appreciable changes have occurred since the scheduled time, the entire observation will be enclosed in parentheses. If conditions have changed appreciably since the scheduled time, estimate the probable conditions at that time, using recording instruments wherever possible, and enter the observation in red pencil. In either case, the observation will be used for computation of sums and averages.

All032. CORRECTION OF ENTRIES. Corrections indicated by the WRPC on WB Form 5066 will be made on retained records in red.

All105. VISIBILITY. (Column 5) At stations taking less than 24 record observations, enter the visibility value for hours when personnel are on duty. The entries will be made at thirty minutes past the hour.

All105.3. CONTROL TOWER VISIBILITY. See paragraph A9012.

All106. WEATHER AND OBSTRUCTIONS TO VISION. (Column 6) At stations taking less than 24 record observations, enter the weather and obstructions to vision during hours when personnel are on duty. These entries will be made at thirty minutes past the hour.

A11111. WIND SPEED. (Column 11) Enter wind speed in miles per hour.

A11114.5. ADDITIVE DATA GROUPS. Separate instructions for the coding and transmission of additive data groups transmitted with record observations at 3- and 6-hourly periods will be furnished stations requiring them.

A11418. DRY-BULB. (Column 18) At stations taking less than 24 record observations daily, enter the corrected thermograph temperature indicated at thirty minutes past the hour for hours in which an hourly observation was not taken. Enter these temperatures to whole degrees. If the thermograph fails, enter in parentheses data obtained by interpolation.

A11421. TOTAL SKY COVER. (Column 21) At stations taking less than 24 record observations, enter total sky cover, observed at thirty minutes after each hour that personnel are on duty between sunrise and sunset. Enter estimated total sky cover in parentheses for daylight hours that personnel are not on duty.

A11438. PRECIPITATION. (Column 38) At stations equipped with recording gages, enter corrected hourly amounts of precipitation in inches and hundredths for the period beginning with the hour printed in column 16. Enter "T" for amounts of 0.005 inch or less. Omit entry if precipitation has not occurred during the hour. If the automatic record fails, enter estimated hourly amounts in parentheses.

A11439. SUNSHINE. (Column 39) Enter corrected hourly sunshine in minutes, for the period beginning with the hour printed in column 16, as obtained from Form 1017. If the automatic record fails or is known to be incorrect, enter estimated hourly values in parentheses.

A11440. WIND DIRECTION AND SPEED. (Column 40) At stations not taking 24 record observations daily, enter prevailing hourly wind direction and the corrected wind speed for the period beginning with the hour printed in column 16. Wind speeds obtained from Form 1017 will be corrected in accordance with Table 14, e.g., SW-18 DI-1.

A11449. HEIGHT OF 850-MILLIBAR SURFACE. Entries will be made on WBAN 10B at stations designated by the Central Office to compute this datum.

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All451. SEA, STATE AND DIRECTION.

All455. WATER TEMPERATURE.

All456. SOIL TEMPERATURE.

All474. THICKNESS OF ICE ON WATER.

All475. FROZEN GROUND LAYER.

Entries will be made on WBAN  
10B at stations designated by  
the Central Office to observe  
these data.

All478. MAXIMUM AVERAGE 5-MINUTE SPEED AND DIRECTION. (Column 78)

Enter corrected data from Form 1017 in this column. To obtain corrected wind speed data, apply appropriate corrections from Table 14 (see paragraph 8231) to the uncorrected data obtained from Form 1017.

All479. TIME OF MAXIMUM AVERAGE 5-MINUTE SPEED. (Column 79) Enter the time of beginning to nearest minute L.S.T.

All480. FASTEST MILE AND DIRECTION. (Column 80) Enter corrected data from Form 1017 in this column. To obtain corrected wind speed data, apply appropriate corrections from Table 14 (see paragraph 8231) to the uncorrected data obtained from Form 1017.

All481. TIME OF FASTEST MILE. (Column 81) Enter time of beginning to nearest minute L.S.T.

All485. REMARKS, NOTES, AND MISCELLANEOUS PHENOMENA. (Column 90)

(a) General. At stations on the Great Lakes and navigable rivers, enter the dates of opening and closing of navigation. At all stations, enter notes on receipt of flood or storm warnings and advisories, and severity of damage done by floods or storms; and notes of unusual meteorological conditions, such as obstructions to vision at a distance, or wind shifts not entered in columns 10-12. Enter additional weather information not provided by the recording instruments and scheduled observations. Attach newspaper clippings of weather conditions of exceptional general or local interest. When space in column 90 is insufficient, entries will be continued on an additional sheet attached to it.

(b) Frost and Freeze. Record frost and freeze as follows:

1. In California, Southern Arizona, Florida and along the immediate coast of the Gulf of Mexico, enter date of occurrence of each frost or freeze throughout the year.

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2. In those portions of Washington and Oregon west of the Cascades and at all stations south of the 35th parallel except those in (1) above, enter date of occurrence of each frost or freeze after March 1 until the first killing freeze in autumn.
3. At all stations, enter date of occurrence of each frost or freeze:
  - a. on and after the date the daily normal mean temperature rises to 43°F. until the first killing freeze in autumn.
  - b. between May 1 and August 31.

Whenever killing freeze occurs, enter a statement of the kind of vegetation killed, degree of maturity at time of freeze, estimated percentage of loss, and any other pertinent data. If the dates of the first and last killing freeze cannot be determined, enter the first date with a minimum temperature of 32° or lower in the autumn and the latest date with a minimum temperature of 32° or lower in the spring, provided that while the temperature was 32° or lower, there was a period when precipitation was not occurring.

(c) Excessive Precipitation. (Column 90) A rubber stamp will be used to provide spaces when necessary for the entry of excessive precipitation data in column 90. When the rate of fall of precipitation for any period equals or exceeds the depths shown in Table A3, enter the maximum amount of precipitation for each period. If any of these amounts occur on parts of two days, underline the amounts concerned and enter both dates to the right of the 180-minute column. If two or more storms, each having excessive precipitation, occur on the same day, separate entries will be made for each.

TABLE A3  
EXCESSIVE PRECIPITATION  
(For all stations)

Duration in Minutes	Depth of Precipitation in Inches	Duration in Minutes	Depth of Precipitation in Inches
5	0.25	60	.80
10	.30	80	1.00
15	.35	100	1.20
20	.40	120	1.40
30	.50	150	1.70
45	.65	180	2.00

All485.2. TORNADO. Enter an accurate description of all meteorological elements accompanying the tornado. Information on the following points is desirable:

- (1) A map showing date, hour of occurrence, and path of the tornado.
- (2) Appearance of clouds.
- (3) Character and amount of precipitation.
- (4) Description of whirl, either as seen in a cloud or as evidenced by the distribution of debris.
- (5) Number of persons killed and injured.
- (6) Rate of movement.
- (7) Estimated crop loss and property damage.

All485.4 AURORA, ETC. Enter notes concerning various optical phenomena, such as auroras, halos (solar and lunar), rainbows, and mirages. Auroral displays should be carefully described, giving the time of beginning and ending, and the altitude and azimuth of each extremity and of the crown of any arch of light that may be formed. Azimuths should be recorded with North as zero. When an aurora extends past midnight, entry will be made for both dates.

All485.6. SNOW SURFACE TEMPERATURE. Enter snow surface temperature and related data at raob stations north of the 40th parallel.

All485.9. NOTES ON TELEPSYCHROMETER OPERATION. Whenever use of the telepsychrometer is discontinued or resumed, enter the date, time and nature of the change.



CHAPTER A12. ENTRIES ON FORM 1001

A12000. WB FORM 1001-B. GENERAL

A12010. PREPARATION AND DISTRIBUTION. Form 1001-B will be prepared daily in duplicate at all first-order stations not taking airway observations. Entries from Form 1017 will be omitted at stations not equipped with a triple register. Black or blue-black ink or a moderately hard lead pencil will be used except where red ink is specified. Ditto marks will not be used. Forward the original copies with the automatic record sheets for the month (including all the records for the last day of the month) to the Weather Records Processing Center by the second working day of the following month. When any form cannot be mailed by then, forward an explanation to the WRPC on or before that date. When the originals are returned from WRPC, correct the carbon copies and forward them to the Section Center. The originals will be retained as part of the permanent local record. Note that WBAN 10D will be prepared at all stations where 1001-B is prepared.

A12011. TIME. Use twenty-four-hour local standard time with 0000 as the beginning, and 2359 the ending, of the day.

A12013. CORRECTIONS. Corrections indicated by WRPC on Form 5066 will be made on retained records in red.

A12014. HEADING. Enter the station name and date in the spaces provided.

A12100. WB FORM 1001-B. COLUMN ENTRIES

A12101. TIME. (Column 1) In the heading, enter the time zone indicator from Table 19.

A12102. TEMPERATURE. (Column 2) Enter the corrected hourly thermograph temperature recorded at thirty minutes past the hour in whole degrees, supplying minus signs where required. For example, the entry for the hour 12-13 will be the temperature indicated at 1230. If the thermograph fails, obtain temperatures by estimation and enter them in parentheses.

A12103. PRECIPITATION. (Column 3) Enter corrected hourly amounts of precipitation in inches and hundredths from the automatic record (see Chapter A-4). If the automatic record fails, enter estimated hourly amounts in parentheses. Enter "T" for amounts of 0.005 in. or less. Omit entry if no precipitation has occurred during the hour. Enter the total precipitation for the day opposite "Sum."

A12104. WIND DIRECTION. (Column 4) Enter the prevailing wind direction, taken from Form 1017, to eight compass points for each hour. Enter the prevailing direction for the day under "Prevailing." Direction indeterminate (DI) will not be considered as the prevailing direction for the day. If two or more directions occur an equal number of times, select the prevailing direction on the basis of adjacent directions. Example: If SE recorded for 10 hours, S 10 hours, SW 3 hours, and E 1 hour, the prevailing direction would be south.

A12105. WIND SPEED. (Column 5) Enter the corrected number of miles of wind for each hour. Wind speeds obtained from Form 1017 will be corrected in accordance with Table 14. Enter the total wind movement for the day opposite "Sum" and the mean hourly speed to tenths of a mile opposite "Average."

A12106. SUNSHINE. (Column 6) Enter hourly sunshine in minutes as obtained from Form 1017. If an hourly value is wholly estimated, enter it in parentheses. Enter the character of sunrise and sunset immediately above the sunshine entry for the corresponding hour. Use the terms "clear, cloudy, foggy, smoky, dusty or hazy." Opposite "Sum" enter the total minutes of sunshine for the day, and under "Possible" enter the possible number of minutes as given in the Station Sunshine Tables. Obtain percentage of sunshine by dividing the total minutes for the day, multiplied by 100, by the "possible" as shown in the Sunshine Table. Enter percentage of sunshine in whole percent adjacent to "%."

A12107. SKY COVER. (Column 7) Enter total sky cover, as indicated in paragraph 11421, for the hours that personnel are on duty between sunrise and sunset. Enter the estimated values in parentheses for the daylight hours during which no personnel are on duty. These entries correspond to observations taken at thirty minutes past the hour. Opposite "Sum" enter the total of the hourly entries. To obtain the sum, add 9+ as 10 and 1- as 0. Enter the average hourly sky cover in the space provided. Do not use 9+ and 1- as averages.

A12108. LOWEST VISIBILITY. (Column 8) Using the values from Table 25, enter the lowest visibility observed during each daylight hour that personnel are on duty.

A12109. WEATHER AND OBSTRUCTIONS TO VISION. (Column 9) Using the symbols printed on the form, enter in the order of their predominance the meteorological phenomena occurring at the time of the visibility observation entered in column 8. Enter obstructions to vision only when the visibility is six miles or less. Use intensity symbols for precipitation as indicated in paragraph 11106.1. (Use the symbol "S" to represent any form of snow, including snow grains, snow pellets, etc.; use other symbols similarly, e.g., "F" to represent ground fog and ice fog.)

A12110. EXTRA COLUMNS. (Columns 10-13) Enter any additional data that are required locally.

A12114. BEGINNINGS AND ENDINGS OF METEOROLOGICAL PHENOMENA, REMARKS, NOTES, ETC. (Column 14) Enter in chronological order the times (LST) of beginnings and endings of precipitation and obstructions to vision. Use the symbols indicated on the form and disregard intensities. (Use "DL" to record distant lightning.) When the time of beginning or ending is unknown, enter the estimated time in parentheses. Example: R 0305-0325; RS 0325-(0350); S (0350) - 1330. Intervals of 15 minutes or less between the time of ending and beginning will not be recorded. If additional space is required, use column 61; columns 10-13 may also be used if not required for hourly data. The following data will also be entered in column 14 as indicated in paragraphs 11485-.7 and 11485-.7.

- |                               |                              |
|-------------------------------|------------------------------|
| 1. Hailstorms                 | 5. Harbor ice                |
| 2. Tornadoes and water spouts | 6. Snow surface temperatures |
| 3. Lightning                  | 7. Frost and freeze          |
| 4. Aurora                     | 8. Miscellaneous             |

A12115. SCHEDULED OBSERVATIONS. (Columns 15-26) Enter data in these columns for scheduled observations, including synoptic, when these observations are taken.

A12116. TIME. (Column 15) Enter the time that the observation is begun, to the nearest minute (LST), e.g., 0110, 1805.

A12117. STATION PRESSURE. (Column 16) Enter mercurial or precision aneroid barometer reading to the nearest 0.001 inch.

A12118. DRY-AND-WET-BULB. (Columns 17-18) Enter these temperatures to the nearest degree and tenth, supplying minus signs where required.

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A12119. DEW POINT. (Column 19) Enter the dew point to the nearest whole degree, supplying minus signs where required.

A12120. RELATIVE HUMIDITY. (Column 20) Enter relative humidity to the nearest whole per cent.

A12121. MAXIMUM AND MINIMUM TEMPERATURES. (Columns 21 and 22) At stations equipped with maximum and minimum thermometers, thermographs or telepsychrometers, enter the maximum and minimum temperatures to degrees and tenths for the period covered by the observation. Take the data from the telepsychrometer or the maximum and minimum thermometers, if available; if not, use the thermograph (see Chapters 5 and A-5). Note that these temperatures must be as high and low respectively as any temperature recorded within the period covered, including the current temperature.

A12123. PRECIPITATION. (Column 23) Enter total precipitation in inches and hundredths for the period covered by the observation, e.g., 0.06. Use the gage indicated by paragraphs 4030 and A4030. When precipitation has occurred in amounts of 0.005 inch or less (trace), enter "T." When precipitation has not occurred, enter 0.00.

A12124. SNOWFALL, SLEET AND HAIL. (Column 24) Enter the depth of snow, sleet and hail (unmelted), to inches and tenths, that has fallen during the period covered by the observation. When snow, sleet or hail has fallen in amounts of 0.05 inch or less, enter "T" denoting trace. When none has occurred, enter 0.0. When snow, sleet or hail melted as it fell, enter "T" with a reference note "Melted as it fell" in column 14.

A12125. SNOW DEPTH. (Column 25) Enter the depth of snow, sleet, hail and ice on the ground to the nearest inch. When snow, etc., is on the ground and the depth amounts to 0.5 inch or less, enter "T" denoting trace. Enter 0 when none is on the ground. Ice depth, which is the depth of sheet ice formed directly or indirectly from precipitation, should not be confused with "thickness of ice on water." If snowfall melts and refreezes, the depth of ice formed will be included in the entries in this column.

A12126. HEIGHT OF 850-MB. SURFACE. (Column 26) At stations designated to compute this datum, enter the height of the 850 mb. surface above sea-level in feet to the nearest ten g-feet.

A12127. SUMMARY OF DAY. (Columns 27-38) Enter data for the 24-hour period from midnight to midnight (LST) in these columns.

A12128. MAXIMUM AND MINIMUM TEMPERATURES. (Columns 27 and 28) Enter these data in whole degrees (see Chapters 5 and A-5). Note that the maximum and minimum temperatures must be at least as high and low, respectively, as any temperature recorded through the day.

A12129. AVERAGE TEMPERATURE. (Column 29) Enter the average temperature for the day, to whole degrees. This temperature is half the sum of the maximum and minimum temperatures for the day.

A12130. NORMAL TEMPERATURE. (Column 30) Enter the normal temperatures for the day, to whole degrees, when available. Use the normal for February 28 as the normal for February 29 also.

A12131. TWENTY-FOUR-HOUR PRECIPITATION. (Column 31) Enter the total amount of precipitation (water equivalent of solid types) to the nearest 0.01 inch. If precipitation has occurred in amounts of 0.005 inch or less, enter "T" denoting trace. If precipitation has not occurred, enter 0.00. The sum of any number of "T" observations will be regarded as a trace unless recording equipment indicates the total is greater than 0.005 inch (liquid).

A12132. TWENTY-FOUR-HOUR SNOWFALL, SLEET AND HAIL. (Column 32) Enter to tenths of an inch the total amount of unmelted snow, sleet, and hail that falls during the 24-hour period. If there are separate falls, each of which melts before the following occurs, the total for the day will be the sum of the maximum depth of each fall. Record amounts in inches and tenths. When snow, sleet or hail melts as it falls, enter "T" with a reference note "Melted as it fell" in column 14. If snow, sleet or hail has fallen in amounts of 0.05 inch or less, enter "T" denoting trace. If none has fallen, enter 0.0.

A12133. SNOW DEPTH. (Column 33) Enter the depth of snow, sleet, hail and ice on the ground at 1930 EST (0030 GCT) to the nearest inch. Enter "T" for amounts of 0.5 inch or less. Enter 0 when none is on the ground.

A12134. MAXIMUM AVERAGE 5-MINUTE SPEED AND DIRECTION. (Column 34) Enter the corrected maximum average 5-minute speed and direction from Form 1017, applying the corrections indicated in Table 14.

A12135. TIME OF MAXIMUM AVERAGE 5-MINUTE SPEED. (Column 35) Enter the time of beginning to nearest minute (LST).

A12136. FASTEST MILE AND DIRECTION. (Column 36) Enter these data (corrected) from Form 1017, applying the corrections indicated in Table 14.

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A12137. TIME OF FASTEST MILE. (Column 37) Enter time of beginning to the nearest minute (LST).

A12138. RIVER STAGE. (Column 38) At stations where a river gage is read, enter this reading to the nearest 0.1 foot.

A12139. EXCESSIVE PRECIPITATION. (Columns 39-50) Enter amount of excessive precipitation in these columns as instructed in paragraph A11485(c).

A12151. EXTRA COLUMNS. (Columns 51-53) Enter any additional data that are required locally.

A12154. STATION PRESSURE COMPUTATIONS. (Columns 54-60) Enter data in these columns in accordance with instructions in paragraphs 11459-11465.

A12161. ADDITIONAL REMARKS AND NOTES. SEE PAR. A12114.

A12200. WB FORM 1001C - GENERAL

A12210. PREPARATION AND DISTRIBUTION. Form 1001C will be prepared in duplicate by all first-order stations. Entries will be made daily in black or blue-black ink or a moderately hard pencil. Ditto marks will not be used. Forward the original copy with the last shipment of WB Form 1130 for the month, or with daily copies of Forms 1001B, to the WRPC not later than the second working day of the following month. When the original Form 1001C is returned from WRPC, correct the carbon copies and forward them to the Section Center.

A12211. CORRECTIONS. Corrections listed by the WRPC on Form 5066 will be made on retained records in red.

A12212. HEADING. Enter the station name, month and year, and time zone indicator (from Table 19), in the spaces provided.

A12300. WB FORM 1001C - COLUMN ENTRIES

A12302. MAXIMUM AND MINIMUM TEMPERATURES. (Columns 2 and 3) Enter these data to whole degrees. In the footings of these columns, enter the sums and averages to tenths of a degree.

A12304. AVERAGE TEMPERATURE. (Column 4) Enter these data to whole degrees. The average daily temperature is half the sum of the daily maximum and minimum temperatures.

A12305. DEPARTURE FROM NORMAL. (Column 5) When normals are available, compute the departure by subtracting algebraically the normal temperature from the daily average temperature. Example: Daily average temperature, 65°; normal temperature, 60°; departure = +5°. Use the normal for February 28 as the normal for February 29 also.

A12306. DEGREE DAYS (BASE 65°). (Column 6) Enter heating degree days to whole numbers, i.e., the difference between the mean temperature and 65°, when the daily average temperature is less than 65°. Enter 0 when the daily average temperature is 65° or higher.

A12307. TOTAL PRECIPITATION (WATER EQUIVALENT). (Column 7) Enter the total 24-hour precipitation, midnight to midnight, in inches and hundredths, as obtained from Form 1130B or 1001B. In the footing, enter the sum of the daily amounts of precipitation.

A12308. SNOWFALL, SLEET, HAIL. (Column 8) Enter 24-hour unmelted depth of snowfall, sleet or hail, midnight to midnight, in inches and tenths as obtained from Form 1130B or 1001B. Enter column total in the footing.

A12309. SNOW, SLEET, HAIL OR ICE ON THE GROUND. (Column 9) Enter the depth to the nearest inch of snow, sleet, hail or ice that was on the ground at 1930 EST (0030 GCT), as obtained from Form 1130B or 1001B. In the heading, enter the local standard time corresponding to 1930E.

A12310. PREVAILING DIRECTION. (Column 10) At stations where 24 record observations are taken daily, enter the prevailing direction to 16 points of the compass computed from column 10 of Form 1130A for record observations. At stations where 1 to 23 record observations are taken daily, enter the prevailing direction to 8 points of the compass computed from column 40 of Form 1130B. At all other stations, enter the prevailing direction to 8 points of the compass from the bottom of column 4 of Form 1001B. In the footing of column 10, enter the direction recorded the greatest number of times. If two or more directions occur an equal number of times, select the prevailing direction in the manner described in paragraph A12104.

A12311. AVERAGE WIND SPEED. (Column 11) At stations taking 24 record observations daily, enter the average wind speed computed from column 11 of Form 1130A for record observations. At stations taking less than 24 record observations daily, enter this datum computed from column 40 of Form 1130B. At all other stations, enter this datum from column 5 of Form 1001B. In the footing, enter the sum of the daily average hourly speeds, and the average of these speeds as obtained by dividing the sum by the number of days in the month. All entries in this column are made to tenths of a mile.

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A12312. FASTEST MILE AND DIRECTION. (Columns 12 and 13) Enter the speed and direction of the fastest mile as obtained from Form 1130B or 1001B. In the footing, enter the speed and direction of the fastest mile for the month.

A12314. TOTAL SUNSHINE. (Column 14) Enter the total sunshine in hours and minutes as obtained from Form 1130B or 1001B, e.g., 5:32; 12:03. In the footing, enter similarly the total sunshine for the month, and the possible sunshine as obtained from the Station Sunshine Tables.

A12315. PER CENT OF POSSIBLE SUNSHINE. (Column 15) Enter these data in whole per cent as obtained by dividing the entry in column 14 by the possible sunshine indicated by the Station Sunshine Tables. In the footing, enter in whole numbers the per cent of sunshine obtained by dividing the sum of column 14 by the possible sunshine entered below it, and multiplying the quotient by 100.

A12316. SKY COVER - SUNRISE TO SUNSET. (Column 16) Enter tenths of sky cover as obtained by averaging hourly entries on Forms 1130B or 1001B for the period from sunrise to sunset. In the footing, enter the sum, and the average to tenths. Obtain averages as indicated in paragraph A12107.

A12317. SKY COVER - MIDNIGHT TO MIDNIGHT. (Column 17) Enter data for the period from midnight to midnight, using the procedure described in paragraph A12316. Omit entry at stations where personnel are not on duty 24 hours a day.

A12318. THUNDERSTORMS OR DISTANT LIGHTNING. (Column 18) Enter "T" for thunderstorm or "DL" for distant lightning when observed during the period from midnight to midnight. Do not enter more than one T or DL for a day. Enter DL only if thunder is not heard, except that if lightning occurs before midnight and thunder is heard after midnight, enter DL for the first day and T for the following day. Similarly, if thunder occurs before midnight and lightning after midnight, enter T for the first day and DL for the following day. Enter both T and DL if lightning only is observed in one storm, and thunder is heard from another storm.

A12319. VISIBILITY, 1/4 MILE OR LESS, CAUSED BY: (Column 19) Enter symbols for hydrometeors or lithometeors that reduce visibility to 1/4 mile or less. If the visibility is reduced by several phenomena, enter all in the order of their predominance, using applicable symbols. Example: F, R. Use only those symbols printed on the form; use S to represent all form of snow, including snow grains, pellets, etc.; use other symbols similarly, e.g., F to represent both ground fog and ice fog.

A12320. EXTRA COLUMNS. (Columns 20, 21, 22) Enter any additional data required locally.

A12330. TEMPERATURE DATA. Enter these data as follows:

A12331. AVERAGE MONTHLY. Enter, to degrees and tenths, one-half the sum of the average maximum and minimum temperatures for the month.

A12332. DEPARTURE FROM NORMAL. At all stations for which normals have been computed, enter the departure of the average monthly temperatures from the monthly normal. February monthly normal temperatures will not be changed for leap years.

A12333. HIGHEST AND LOWEST TEMPERATURES. Enter these data, as obtained from columns 2 and 3, and their dates of occurrence. In selecting the highest or lowest temperatures, consider tenths of degrees if necessary. If temperatures are identical to tenths, enter all dates.

A12334. NUMBER OF DAYS WITH MAXIMUM  $32^{\circ}$  OR BELOW OR  $90^{\circ}$  OR ABOVE, MINIMUM  $32^{\circ}$  OR BELOW OR  $0^{\circ}$  OR BELOW. Enter these data as obtained from columns 2 and 3.

A12335. DEGREE DAYS. Enter the sum of the entries in column 6 and the departure from normal at all stations for which normals have been computed. Enter the seasonal total, using July 1 as the beginning of the season, and the departure from normal at all stations for which normals have been computed.

A12340. PRECIPITATION DATA. Enter these data as follows:

A12341. TOTAL FOR THE MONTH. Obtain this entry from column 7.

A12342. DEPARTURE FROM NORMAL. Enter the monthly departure from normal at all stations for which normals have been computed. The normal precipitation for February 29 will be the same as for February 28.

A12343. GREATEST IN 24 HOURS. Enter this datum to the nearest hundredth of an inch with the date or dates of occurrence. If the 24-hour period begins on the last day of one month and ends on the first of the following, enter the data on Form 1001C for the month in which most of the precipitation fell. Include data for the entire period on this form, and do not repeat the compilation on Form 1001C for the other month, but enter an explanatory note on the bottom of the form.

A12350. SNOWFALL, SLEET, AND HAIL. Enter these data as follows:

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- A12351. TOTAL FOR MONTH. Obtain this entry from column 8.
- A12352. GREATEST IN 24 HOURS. Enter this datum to the nearest tenth of an inch. See paragraph A12343 above.
- A12353. GREATEST DEPTH ON GROUND. Enter this datum to the nearest inch, and the date or dates of occurrence.
- A12360. BAROMETRIC PRESSURE. Enter data as follows:
- A12361. MONTHLY AVERAGE STATION PRESSURE. Enter one-half the sum of the average 1230 and 0030 GCT station pressures as obtained from data in column 58 of Form 1001B or column 63 of Form 1130B.
- A12362. HIGHEST AND LOWEST SEA-LEVEL PRESSURES. Enter these data as obtained from the corrected barograph trace. Reduce station pressures to sea-level in accordance with Chapter 7.
- A12370. WEATHER. Enter data as follows:
- A12371. NUMBER OF DAYS CLEAR, PARTLY CLOUDY, AND CLOUDY. Obtain these data from column 16.
- A12372. NUMBER OF DAYS WITH 0.01, 0.10, 0.50, AND 1.00 (INCH) OR MORE PRECIPITATION. Obtain these data from column 7.
- A12373. DATES OF HAIL, SLEET, AND GLAZE. Obtain these data from Forms 1130B or 1001B.
- A12380. SUMMARY. Enter in the spaces provided near the bottom of the form a brief summary of prevailing weather conditions during the month, noting unusual or extreme conditions. Include data on damaging rain, snow, glaze, hail or wind storms, unusually high or low temperatures, frosts and killing freezes, etc.

CHAPTER A13. RECORDING INSTRUMENT FORMS

A13000. GENERAL

A13010. Automatic records will be evaluated in accordance with the instructions below. The records from barograph, multiple register, and thermograph (which will include all records for the last day of the month) will be forwarded to the WRPC on the second working day of the following month with original copies of WBAN 10A, B and D, and Form 1001B-C. Telepsychrometer records completed during the month will also be forwarded.

A13100. BAROGRAPH FORMS 1068 - 1068D

A13110. CHANGING FORMS. Forms will be changed on 4-day barographs on the 1st, 5th, 9th, 13th, 17th, 21st, 25th, and 29th of the month. Forms will be changed on weekly barographs on the 1st, 8th, 15th, 22nd, and 29th of the month. The change will ordinarily be made at the time of the 1830 G.C.T. 6-hourly observation. If for any reason the form is not changed at the accustomed time, it will not be changed before the succeeding 3-hourly pressure tendency observation at stations observing these data, since an unbroken record is required for the observation; at other stations the form will be changed as soon as practicable.

A13120. PREPARATION OF FORMS. Before placing a form on the barograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

1. In the spaces provided, enter name of station (airport or city office), meridian of local standard time, and, on the first of the month, the time pen is touched.
2. Across the top of the form enter the date of each day's record on the noon line.
3. On each noon line, enter the appropriate value of each inch of pressure in tens and units (e.g., 28) before the tenths and hundredths printed on the form.

4. Above the point where the trace will begin, enter the time and the current station pressure obtained from the mercurial or precision aneroid barometer, or the altimeter setting indicator.

A13121. After removing the forms, proceed as follows:

1. Enter the time of any adjustment, and an arrow to indicate the point of adjustment.
2. Above the ending of the trace, enter the time of removal and the current station pressure obtained from the mercurial or precision aneroid barometer, or the altimeter setting indicator.
3. Above the time-check lines, enter the corrections from column 65 of Form 1130B or column 60 of Form 1001B. Enter corrections in red ink.
4. When adjustment for pressure is made, enter the barometer (mercurial, etc.) reading and corrections applying to both the preceding and following record, e.g.,  $-.05/.00$ .

#### A13200. CEILOMETER RECORD

A13210. Enter the station name, month, year and time of removal on each expended roll of recorder paper. Expended rolls will be retained at the station for a period of five months, after which they may be destroyed. If a portion of the record is torn or otherwise detached from the roll, these data will be entered on all separate portions of the roll.

#### A13300. HYGROGRAPH FORMS 1074 and 1074A

A13310. Evaluate hygrograph records according to local requirements. If the hygrograms are unnecessary for local use, they may be destroyed. See Thermographs (Par. A13610) for evaluation of hygrothermograph records.

A13400. MULTIPLE REGISTER FORMS 1017 and 1017B

A13410. GENERAL. Use Form 1017B at stations where the forms are changed at midnight, and Form 1017 at stations where forms are changed at noon. On Sundays and holidays, Form 1017 may be changed one or two hours earlier than usual. At stations taking 24 record observations daily, data for hourly wind speed and direction, and anemometer dial readings, will not be entered on Form 1017. However, maximum 5-minute and fastest single mile wind speeds will be entered at all stations. All entries will be made in pencil unless red ink is specified. Station name and date will be stamped in the spaces provided.

A13411. MISSING RECORD. Whenever any portion of the record is missing or incorrect, enter appropriate explanatory notes. To prevent loss of record, avoid changing the charts during periods of excessive precipitation or high winds. Whenever the period of missing record is less than 24 hours, hourly data will be interpolated and entered in parentheses. Whenever the record is missing for 24 hours or more, enter the station name, date, anemometer dial readings, and precipitation measurements (stick) on a blank form and forward the form with the month's records.

A13420. WIND. Wind movement and direction will be entered in accordance with the following instructions.

A13421. HOURLY WIND DIRECTION. Determine the prevailing wind direction for each hour and enter to eight points of the compass midway between the hour lines. The prevailing direction is the direction recorded most frequently during the hour. When two or more directions are recorded an equal number of times, select the prevailing direction on the basis of adjacent directions. (See par. A12104). Enter "DI" for "direction indeterminate", when the uncorrected hourly wind speed is less than 1 mile per hour.

A13422. HOURLY WIND MOVEMENT (UNCORRECTED). Enter the total number of miles for each hour above the trace and near the end of the hour. As an aid in counting miles of wind, some anemometers have a 10-mile marker which represents two miles. If a contact is begun but not finished in the same hour, consider the mile of wind as passing in the hour when the contact was begun.

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However, in the case of the 10-mile marker, consider one mile of wind as passing when the contact is begun and another when the contact ends.

A13422.1. Enter the total uncorrected movement of the wind for each six hours and for the day in the spaces near the left margin.

A13423. MAXIMUM AVERAGE 5-MINUTE SPEED. Determine the uncorrected maximum average five-minute speed and its prevailing direction for the period midnight to midnight. Enter the data immediately above the corresponding trace, e.g., MAX-31-NW. To obtain an uncorrected speed, multiply by 12 the number of miles and tenths of miles recorded in five minutes. To select the proper five-minute interval, use a scale graduated in one-minute intervals or a draftsman's dividers, set to equal a five-minute interval.

A13424. FASTEST MILE. Enter the uncorrected fastest mile and its direction immediately below the corresponding trace, e.g., FAST-39-NE. A scale graduated in divisions corresponding to various wind speeds is used to select the fastest mile. In using this scale, find the division whose length most nearly corresponds to the distance between the mile marks and read the speed from the scale.

A13425. TOTAL WIND MOVEMENT FROM DIAL TYPE ANEMOMETERS. On the first day of each month and on each Monday, weather permitting, read the anemometer dial at noon, local standard time, and enter the actual dial reading in the spaces provided. Additional readings will be taken and recorded as often as necessary to indicate the total wind movement during periods of incomplete records. To obtain the total wind movement from a dial type (totalizing) anemometer, subtract the preceding reading of the anemometer from the current reading. When the reading of the anemometer dial at the end of the period is less than the reading at the beginning, add 990 to the lesser reading and subtract the higher reading to obtain the total wind movement, e.g., the current dial reading is 91, previous was 950; hence,  $91 + 990 = 1081$ ;  $1081 - 950 = 131$ , the total wind movement.

A13425.1. Compare the total wind movement from the anemometer dial with the weekly total from the record. Differences must be due to errors in computation or missing record. In the latter case, estimate hourly values as indicated in paragraph A13411.

A13425.2. Whenever the anemometer is changed, enter a note on the margin of the form, giving the date and time of the change, the dial readings, identifying numbers and types of both instruments.

A13430. SUNSHINE. Sunshine is indicated by a zig-zag trace on the record. Steps on this trace occur at one-minute intervals with the cycle completed in ten minutes. For each hour between sunrise and sunset, count the number of steps (minutes of sunshine) in each hour and enter the minutes above the trace midway between the hour time lines. If sunshine is observed but not recorded, include the minutes of observed sunshine in the hourly entry. If the automatic record fails or is known to be incorrect and no visual observation of sunshine has been taken, enter estimated minutes of sunshine in parentheses.

A13431. Enter check marks on the sunshine trace indicating the exact time of sunrise and sunset. Indicate the character of sunrise and sunset just above the check, e.g., "clr," "cldy," etc.

A13432. While both sunshine and precipitation are recorded on the same trace, the uniformity of the steps in the sunshine trace should distinguish it from that for precipitation. If both sunshine and precipitation occur almost simultaneously, interpret the record with the aid of observed data and enter appropriate notes.

A13440. PRECIPITATION. Precipitation is indicated by a zig-zag trace on the record. Each step on this trace indicates 0.01 inch of precipitation, with one complete cycle representing 0.10 inch. Hourly recorded amounts will be corrected to agree with stick measurements. Enter a caret in red ink to indicate the addition, and an "x" the deletion, of 0.01 inch. Enter the corrected hourly amounts of precipitation in red ink above the trace and midway between the hour time lines.

A13441. Enter a check mark (✓) to indicate the time of beginning and a reverse check (∨) to indicate the ending of precipitation, preceded by the letters "B" and "E" respectively. If these times are doubtful, enter the checks in parentheses. When precipitation is occurring at the time of the observation, make a pencil check on the precipitation trace to indicate the time of emptying the gages.

A13442. Enter 6-hourly amounts of precipitation, as determined both from the uncorrected precipitation trace and the stick measurement, in the block captioned "Precipitation at Time of Observation." Enter also the time of the precipitation measurement.

A13443. See paragraph A13432 for distinguishing the precipitation trace from sunshine.

#### A13500. TELEPSYCHROMETER RECORDS

A13510. Each day stamp the month, date and year on the extreme right side of the form. At the time the form is removed from the recorder, enter the station name and the dates of beginning and ending the record at the end of the traces and approximately midway between the margins of the form. Beneath the station name and near the end of the traces, identify the ordinates of the wet-bulb depression and dry-bulb scales by labeling them in increments of 10°F. Identify each set of labels as "1-dry-bulb" and "2-depression."

#### A13600. THERMOGRAPH AND HYGROTHERMOGRAPH FORMS

A13610. CHANGING FORMS. Forms will be changed on thermographs at midnight, local standard time, at stations having an observer on duty at that time; at other stations, forms will be changed at noon, local standard time. Forms will be changed on seven-day thermographs (Forms 1072, 1072-A, 1076 and 1076A) and hygrothermographs (Forms 1072-D, 1074-B and C) on the 1st, 8th, 15th, 22nd, and 29th of the month.

A13620. PREPARATION OF FORMS. Before placing the forms on the thermograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

1. In the spaces provided, enter name of station (airport or city office), meridian of local standard time, and, on the first of the month, time the pen is touched.
2. Across the top of 7-day forms and on each noon line, enter dates of the record.
3. Above the point where the trace will begin, enter the time the form is to be placed on the instrument.

A13621. After removing the forms, proceed as follows:

1. Enter the time of any adjustment, an arrow indicating the point of adjustment, and the instrumental reading if adjustment for other than time has been made.
2. Above the ending of the trace, enter the time of removal.
3. Above the time-check lines and the times of the daily maximum and minimum temperatures, enter as corrections the differences with the proper sign prefixed between (1) the thermograph temperature and the 6-hourly dry-bulb temperatures and (2) the thermograph temperature and the daily maximum and minimum temperatures. Enter corrections in red ink. E.g., maximum temperature, from column 66 of Form 1130B, "66°F.;" maximum temperature, from thermograph trace, "68°F.;" correction entered on the thermograph "-2."

WEATHER BUREAU ADDENDUM  
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WEA MANUAl OF SURFACE OBSERVATIONS  
CIRCULAR N, 6TH EDITION  
WEATHER BUREAU ADDENDUM

CHAPTER A-1. CEILING AND CLOUD HEIGHT

A1300. DETERMINATION OF DIRECTION

A1311. NEPHOSCOPE\*. Find the image of the cloud in the mirror of the nephoscope. Move the eyepiece about, at the same time shifting the horizontal arm until the cloud image seen through the eyepiece is at the center of the mirror. Rotate the mirror until the cloud movement is along one of the radial lines. The azimuth corresponding to this line is the cloud direction. Convert the azimuth to one of 8 compass points by use of the following table:

Table A1 Direction equivalents

Letters	Degrees	Letters	Degrees
N	338° - 22°	S	158° - 202°
NE	23° - 67°	SW	203° - 247°
E	68° - 112°	W	248° - 292°
SE	113° - 157°	NW	293° - 337°

\* These instructions apply to the mirror-type nephoscope, which is used in the Weather Bureau almost exclusively at this time.

A1440. METHODS OF DETERMINING CLOUD HEIGHT AND VERTICAL VISIBILITY

A1448. CEILOMETER. The ceilometer will be placed and continued in operation whenever clouds cover 0.1 or more of the sky. If the sky is clear and clouds are forecast for the station, the equipment will be placed in operation at least one hour before the expected time of the appearance of clouds. The recorder gain should be set at 9, and reduced as necessary after clouds are detected by the equipment. If clouds are neither present nor forecast, the recorder, scanning, and projector switches will not be turned on, but the ceilometer amplifier will remain on continuously to keep the ceilometer ready for immediate use. The scanning drum will be stopped at an angular elevation that most nearly eliminates possibility of damage either from a strong baseline reaction or from rays of the sun entering the drum.

A1448.1. PREPARATORY OPERATIONS. The following procedure will be followed in placing the ceilometer in operation:

1. Projector — Turn the projector switch on.
2. Detector -
  - a. Adjust the amplifier gain control to insure optimum performance in accordance with technical instructions. (See Figure A1-a).
  - b. Place recorder-meter switch in the "recorder" position.
3. Recorder -
  - a. Turn the recorder switch and the selsyn and scanning switch on.
  - b. Adjust the recorder gain control to provide a maximum stylus oscillation of 5/32 inch in width.
  - c. Adjust the recorder paper so that the position of the stylus with respect to the heavy horizontal time-lines corresponds to the number of minutes after the hour at the time of adjustment.
  - d. Record the time (IST) and date of adjustment on the extreme right side of the record.

A1448.2. INTERPRETATION OF CEILOMETER RECORD. The height corresponding to the lowest angle at which maximum width of the stylus trace occurs will be ascribed to the cloud base. (See Figure A1-a). This height may be computed in accordance with paragraph 1441(5)-(7) or read from the scale attached to the recorder.

A1448.3. CEILOMETER DETERMINATION OF VARIABLE CLOUD HEIGHTS. The height ascribed to a variable ceiling will be the average height indicated during several successive sweeps of the scanning drum. A variable cloud height may be classified as measured, indefinite, or otherwise in accordance with paragraph 1430-6.

A1448.4. INDICATIONS OF VERTICAL VISIBILITY. Under the conditions indicated in paragraph 1441.2, the reaction of the ceilometer is in general characterized by a strong signal at low angles. The signal slowly falls to zero as the angle increases. The height corresponding to the angle at which the reaction becomes zero will be used only as a guide in evaluating the vertical visibility which may be several times greater than this height (See Figure A1-b).

Al448.5. MANUAL OPERATION OF THE CEILOMETER. When the recorder record cannot be interpreted with certainty during the daytime, the detector will be operated manually during the period of the observation, as follows:

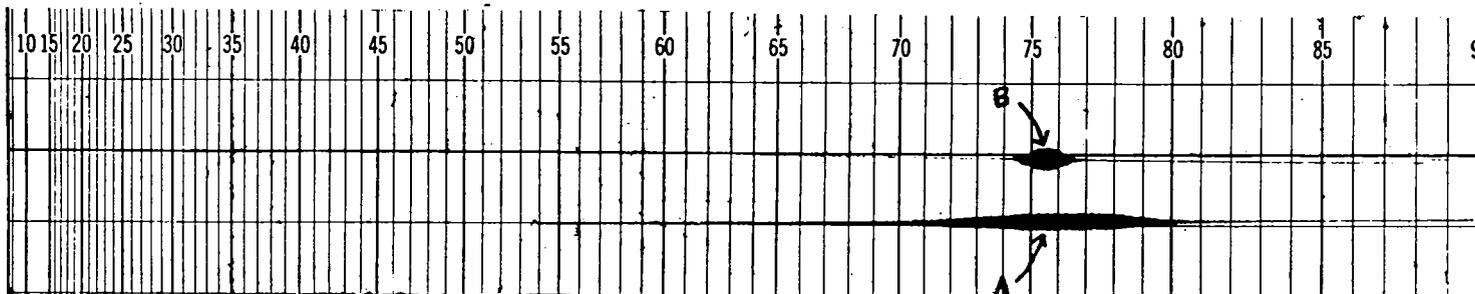
1. Turn off the recorder switch labeled "selsyn and scanning". Record the time (IST) and the date on the extreme right side of the chart.
2. Turn the switch on the discriminator chassis to the position labeled "meter".
3. Turn on the detector meter switch.
4. Note the elevation angle of the scanner to the nearest 0.1°.
5. Elevate the scanning drum by means of the crank, more slowly as the critical angle is approached.
6. Determine the lowest point of maximum deflection of the output meter as follows:
  - a. Elevate the drum beyond the lowest point of maximum deflection.
  - b. Lower the drum again to the lowest angle at which a signal is indicated.
  - c. Elevate the drum to the lowest point of maximum deflection.
7. Read the angle determined in 6c and obtain the corresponding height in accordance with paragraph 1441 (6) and (7).

Note: Values pertaining to variable ceilings and to vertical visibility will be selected similarly to those described in paragraphs Al448.3 and 1441.2, except that the deflection of the meter will be observed, rather than the width of the stylus trace; e.g., the point of first full-scale deflection of the meter will correspond to the lowest point of maximum oscillation of the stylus, and the point at which the meter returns to zero will correspond to the point at which oscillation of the stylus ceases.

A1448.51. When the cloud height observation has been completed, return the ceilometer to automatic operation as follows:

1. Reset the scanning drum to the angle noted in paragraph A1448.5(4). (Note: If the drum is not reset, the scanner will be out of phase with the stylus until the stylus has returned either to the extreme left or to the extreme right of the recorder paper, when correct phasing will usually occur automatically, but may require manual re-setting. If the accuracy of a transit or of a complete cycle is doubtful, cross out the trace at the left edge of the transit.)
2. Turn off the detector meter switch.
3. Turn the switch on the discriminator chassis to the position labeled "recorder".
4. Turn on the recorder switch labeled "selsyn and scanning". Record the time (LST) and the date on the extreme right side of the chart.

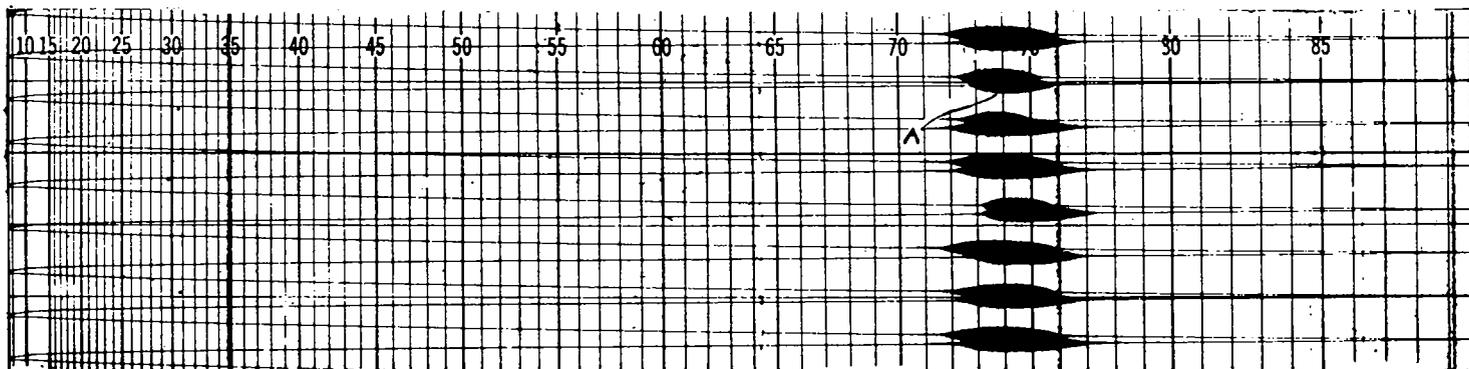
A1448.6. USE OF CEILOMETER PROJECTOR AS A CEILING LIGHT. When the recorder record cannot be interpreted with certainty during the nighttime, the projector will be used as a ceiling light in accordance with paragraphs 1441-1441.4.



Adjustment of Gain Controls

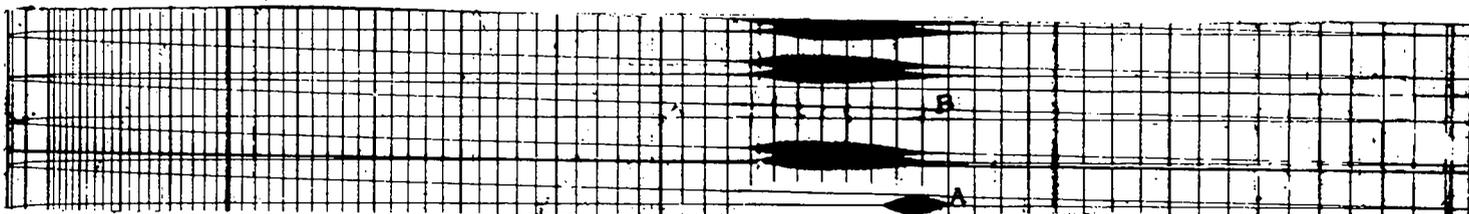
These traces were made as nearly simultaneously as possible with a detector gain setting of 7 and a recorder gain of 5 at A, and a detector gain of 4 and a recorder gain of 8 at B. The lower detector gain makes more apparent the lowest point of maximum reaction. Note, however, that in both instances this point occurs at approximately the same angular elevation.

FIGURE A1-2



Selection of Lowest Point of Maximum Reading

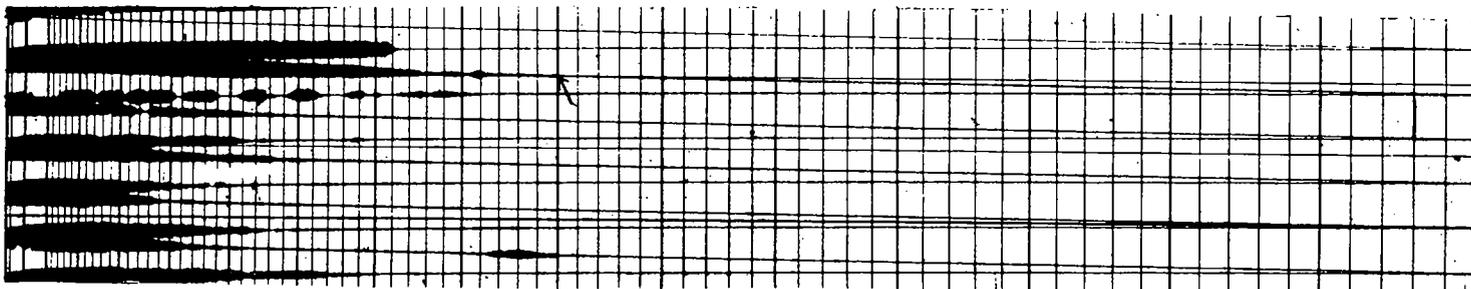
The lowest point of maximum reading during one of the transits is indicated at A. Slight variation in lowest point of maximum reaction probably due to roll structure of cloud base. Several transits must be examined and careful visual observation of the sky made in order to select representative value. In this example, an angular reading of  $73.5^\circ$  is representative of the entire period.



Correlation of Recorder Record with Visual Observation

Owing to broken clouds the traces at A and B are non-representative, and must be disregarded. At A the reaction is apparently from the side of a cloud; at B no clouds were overhead at the time of the transits. This example illustrates the importance of a careful visual observation of the sky and of an examination of the preceding transits to avoid ascribing erroneous height values to cloud bases.

FIGURE AI-b



Indication of Vertical Visibility

A light snow that was falling obscured the clouds above. The point at which reaction ceased, indicated on one of the transits by a small arrow, may be used as a guide in estimating the vertical visibility. However, this point represents a minimum ceiling value and the actual vertical visibility may frequently be much greater. Every effort must be made under these circumstances to obtain ceiling observations from aircraft. If pilot reports cannot be obtained, the observer will qualify the ceilometer indications as necessary on the basis of visual observations and past experience.

Revised  
Eff. 5-15-49

A2-1

## CHAPTER A-2. VISIBILITY

A2010. All distances referred to in this manual are in statute miles.

CHAPTER A-3. ATMOSPHERIC PHENOMENA

\*A3442.3. ICE-ACCRETION INDICATORS. Ice-accretion indicators are furnished selected stations (See paragraph 3510). The indicator consists of a strip of aluminum, held in alignment by spring clips mounted on a wooden bracket. Each station is supplied with several strips. Any location that will insure exposure of the indicator to precipitation, under any condition of wind speed and direction, will be satisfactory. The support is mounted such that the exposed strip will be held in a nearly vertical plane with the longer sides horizontal.

\*A3442.31. The strips will be stored in the shelter and protected from blowing rain to insure that when they are exposed they will be dry and their temperature close to that of the ambient air. One strip of the ice-accretion indicator will be exposed whenever freezing rain is expected.

A3442.32. When freezing precipitation is occurring, a strip free of ice will be exposed ten or fifteen minutes before taking an observation. It is essential that this interval of exposure be just prior to the observation to avoid the possibility of reporting freezing precipitation as occurring at the time of observation when, actually, ice on the indicator might have formed some time earlier.

CHAPTER A-4. MEASUREMENT OF PRECIPITATION

\*A4030. TYPES OF GAGES. The gages are of three types: 4- and 8-inch standard, 12-inch tipping bucket, and 8-inch weighing. The inside diameter of the top cylindrical portion of the receiver is used to define the size of the gage. If other gages are available, the weighing gage, even though shielded, will not be used for official precipitation measurements unless it is equipped with 24-, 12- or 6-hour gears.

\*A4030.1. Measuring tubes appropriate to the 8-inch standard and tipping-bucket gages hold 2 inches and 1 inch, respectively. A special measuring stick, graduated in terms of hundredths of an inch of rainfall, may be used with either of these tubes. Measurement is facilitated because of a ten to one ratio of the cross-section area of the receiver to that of the measuring tube. Therefore, a twenty-inch length of the measuring stick is graduated to denote a measure of two inches of rainfall.

\*A4030.2. The 4-inch gage, which holds one inch of precipitation, is made of transparent plastic. The measuring tube portion of the gage is graduated in terms of hundredths of an inch of rainfall. This construction permits of measuring the precipitation without the use of a measuring stick.

\*A4030.3. In the weighing-bucket gage, a continuous trace of the accumulated precipitation is recorded on a record form. A stick measurement is not made of precipitation accumulated in this type of gage.

A4031. 4- AND 8-INCH STANDARD GAGES. These gages consist of three parts: the overflow container, the measuring tube, and the receiver assembly. Whenever freezing rain or solid forms of precipitation occur or are expected, the receiver and the measuring tube should be removed to allow representative amounts of these forms of precipitation to be caught in the overflow container.

A4032. 12-INCH TIPPING BUCKET GAGE. This gage is used to measure liquid precipitation only. The mechanism of the gage consists of a double bucket that tips back and forth on pivot bearings. When 0.01 inch of rain has fallen through the funnel into one of the buckets, the bucket tips, discharging the water into the reservoir, and bringing the other bucket under the funnel. The gage is connected electrically to a register, in which the tipping action of the gage is recorded as a zig-zag trace on a record form. From this record, amounts of precipitation, to the nearest 0.01 inch, and rates of fall can be determined.

A4032.1. The mechanism is enclosed in a cylindrical container that includes the reservoir. A detachable cover fits on the upper part of the container. This gage is subject to damage by snow, sleet, and freezing rain; therefore, when any of these forms of precipitation is present or expected, remove the tipping bucket and cover the cylindrical container.

\*A4032.2. If precipitation is not occurring at the time of observation and a tipping-bucket gage is being used for official precipitation measurements, open the door of the tipping mechanism and tip the bucket ten times. This places a time mark on the chart and tests the mechanism for correct functioning. Tipping the bucket ten times will bring the register pen into the same position as before tipping. If precipitation is occurring, omit this operation.

\*A4033. 8-INCH WEIGHING GAGE. The 8-inch weighing gage consists of a collector ring with a removable funnel and a bucket mounted on a weighing mechanism that is comprised of a platform, spring, and linkage. The weight of the precipitation is converted to equivalent inches of precipitation by the gage and recorded on a chart calibrated in hundredths of inches of precipitation.

\*A4033.1. The capacity of weighing gages depends on whether the pen linkage permits single, double or triple traverse of the pen over the chart. The pen records on its ascent in the single traverse type; on its ascent and descent in the double traverse type; and through a second ascent in the triple traverse type. The series of traverses is usually equivalent to the capacity of the weighing bucket. In summer, the weighing bucket will ordinarily be emptied when the chart is changed. In winter, during periods of freezing temperature, the gage should be charged with antifreeze by placing in the bucket one quart of commercial anhydrous calcium chloride (weight approximately 1-1/2 pounds) which is then dissolved in one quart (two pounds) of water. Do not use a more concentrated solution of calcium chloride. The solution may be covered with a small amount of light oil (SAE 10) to prevent evaporation. The calcium chloride will ordinarily be furnished by the inspector or from the supervising station. The bucket will not be emptied until it is filled to 75% or 80% of capacity.

\*A4033.2. At each observation, inspect the mechanism to determine that the clock is running and that ink is flowing from the pen. At the time of the 6-hourly observation, if precipitation is occurring or has occurred in the last 6 hours, and the weighing gage is being used for official precipitation measurements, make a time check line by elevating the pen approximately two ordinates and allowing it to return to its original position. If vibration or repetition of the trace over the same ordinate causes the pen line to appear too wide for accurate evaluation of small amounts of precipitation, adjust the pen upwards 0.25 inch and make a notation to this effect on the chart.

\*A4033.3. To determine, to the nearest 0.01 inch, the amount of precipitation during a designated period, subtract the reading (in inches and hundredths) at the beginning of the period from the reading at the end of the period. Some forms are graduated to read directly to 0.10 inch and others read directly to 0.05 inch; interpolation is necessary for intermediate values.

\*A4033.31. If the pen traverse has reversed during the observational period, the total precipitation for the period is the sum of (a) the difference between the reading at the beginning of the period and the reading corresponding to the point of reversal of the trace, and (b) the difference between the reading at the point of reversal of the trace and the reading at the end of the observation period. If the pen does not reverse at the exact ordinate boundary on the form, computations will be based on the indicated reading at the point of reversal, not on the ordinate printed at the boundary of the form.

Examples

(A) Pen reversed before reaching upper ordinate boundary of form.

- Given: (1) Previous reading (0700 LST): 5.87"  
(2) Pen reversal point reading (0724 LST): 5.94"  
on rise (equivalent of 6.06" on fall)  
(3) Present reading (0800 LST): 6.26"

Computation:

$$\begin{array}{r} (1) \quad 5.94 \\ \quad \underline{-5.87} \\ \quad \quad .07 \text{ inch (precipitation from 0700-0724)} \end{array}$$

$$\begin{array}{r} (2) \quad 6.26 \\ \quad \underline{-6.06} \\ \quad \quad .20 \text{ inch (precipitation from 0724-0800)} \end{array}$$

$$\begin{array}{r} (3) \quad .07 \\ \quad \underline{.20} \\ \quad \quad .27 \text{ inch (precipitation from 0700-0800)} \end{array}$$

- (B) Pen reversal after reaching (above) upper ordinate boundary of form.

- Given: (1) Previous reading (0700 LST): 5.87"  
 (2) Pen reversal point reading (0724 LST): 6.04"  
 on rise (equivalent of 5.96" on fall)  
 (3) Present reading (0800 LST): 6.26"

Computation:

$$(1) \begin{array}{r} 6.04 \text{ (extrapolated reading - taken on rise)} \\ -5.87 \\ \hline .17 \text{ inch (precipitation from 0700-0724)} \end{array}$$

$$(2) \begin{array}{r} 6.26 \\ -5.96 \\ \hline .30 \text{ inch (precipitation from 0724-0800)} \end{array}$$

$$(3) \begin{array}{r} .17 \\ .30 \\ \hline .47 \text{ inch (precipitation 0700-0800)} \end{array}$$

\*A4033.32. If the pen has reversed during heavy precipitation and the rainfall is recorded as a flat trace during reversal owing to loose linkage, extrapolate the curve to an approximate apex. The position of the apex above or below the top of the graph will determine which of the preceding methods is appropriate for computing the total precipitation for the period.

CHAPTER A-5. TEMPERATURE

\*A5131.1. WET-BULB. If the wet-bulb temperature is below 32°F. and there is doubt as to whether the wick is unfrozen or ice-covered, it should be brought to the latter state by touching it with clean ice, or snow, if available, or some other object whose temperature is approximately the same as or less than the dry-bulb. After the wick is ice-covered, continue to ventilate the wet-bulb until the lowest wet-bulb temperature has been reached.

\*A5310. SNOW SURFACE TEMPERATURE OBSERVATIONS. These observations will be taken under the specified conditions at all Weather Bureau raob stations north of the 40th parallel.

A5410. WATER TEMPERATURE OBSERVATIONS. See paragraph A11455.

A5500. TELEPSYCHROMETER

A5510. GENERAL. The telepsychrometer is designed to measure dry-bulb temperatures and wet-bulb depressions at a meteorologically representative location and record them on a chart in an observatory. The L and N (Leeds and Northrup) type provides dry-bulb temperatures over a range of 20° to 120°F., and wet-bulb depressions from 0° to 50°F. at temperatures above 32°F. The telepsychrometer consists of two basic units: the exposure unit and the recorder.

A5520. EXPOSURE UNIT. The exposure unit contains two continuously ventilated resistance thermometers, called thermohms, which correspond to the dry- and wet-bulb thermometers of mercurial psychrometers. One of these thermohms is kept wet by a wick partially immersed in a tray of water automatically replenished from a conical reservoir. Access to the thermohms and reservoir is gained by loosening the knurled nuts on each of the three supporting legs near the bottom of the cylindrical housing. The housing should be turned slightly before it is lowered over the legs.

A5521. MAINTENANCE. Clean wicking must be kept on the wet thermohm. The replaced wick will be discarded and a new one installed at least weekly, and more often if necessary. If the wick is not clean, indicated depressions will be incorrect. For convenience in changing the wick, a spring arrangement on the wet thermohm permits of elevating it from the normal horizontal position.

A5521.1. The conical reservoir must be supplied with distilled water. If the reservoir becomes dry, indicated depressions will gradually decrease. The reservoir is removed for filling by lifting it upwards through its upper support. The water tray must be clean and the ventilation ducts unobstructed. Routine inspection trips to the exposure unit will be regularly scheduled to insure the required maintenance. The fan motor bearings will be lubricated with SAE 20 oil once every three months. Access to the motor is gained by removing the conical cap on the exposure unit.

A5530. RECORDER. A complete description of the recorder mechanism and charts, and details of maintenance, will be found in the I&N booklets furnished with the recorder. Special attention will be given the instructions for lubricating the equipment, inking the pad, and changing the paper. These instructions are in Section 22, 18A and 16 of the I&N Booklet 1235.

A5531. CALIBRATION. Calibration of the equipment will not be made by station personnel. As a special precaution against turning the small calibration dial in the upper left corner of the recorder between calibrations, the dial will be securely fastened to the recorder chassis with scotch tape.

A5532. RECORD. The recorder prints alternately the current dry-bulb temperature and the depression of the wet-bulb on a chart whose vertical lines represent  $1^\circ$  intervals of dry-bulb temperature and  $0.5^\circ$  intervals of depression. The dry-bulb temperature trace consists of a dot and the figure "1" printed simultaneously. The wet-bulb depression trace consists of a dot and the figure "2". All readings will be estimated to tenths of degrees from the position of the extreme left edge of the dots with respect to the vertical lines.

A5532.1. Horizontal lines identify the hours by the figures 0 to 23 printed near the left margin of the chart. When a new roll of paper is first installed, or when the recording of temperatures and depressions is incorrect with respect to time, the paper will be adjusted for time by turning the upper cylinder on the recorder. Notations concerning the adjustment will be made in accordance with Chapter A-13.

A5532.2. Maximum and minimum dry-bulb temperatures for any period are selected by noting the dots on trace "1" farthest to the right and left respectively during the given period.

A5532.3. A short line will be directed to the right of the dry-bulb reading and the notation "6 H" entered at each 6-hourly observation.

A5540. OBTAINING PSYCHROMETRIC DATA. During the period of operation of the telepsychrometer, temperature, dew point, and relative humidity will be obtained in accordance with the following instructions.

A5541. When the wet-bulb temperature obtained from the telepsychrometer data is higher than 33°F., temperature, dew point, and relative humidity will be obtained from the telepsychrometer data.

A5542. When the wet-bulb temperature obtained from the telepsychrometer data is 33°F. or less, and the telepsychrometer dry-bulb is above 20°F.:

1. Dry-bulb temperatures, including maximum and minimum temperatures, will be taken from the telepsychrometer.
2. Wet-bulb temperature will be obtained by comparing the telepsychrometer dry-bulb temperature with the dew point derived from mercurial psychrometer data.
  - (a) If the dew point is equal to or higher than the telepsychrometer dry-bulb temperature, the wet-bulb temperature will be regarded as equal to the telepsychrometer dry-bulb temperature.
  - (b) If the dew point is lower than the telepsychrometer dry-bulb temperature, the wet-bulb temperature will be computed from the observed telepsychrometer dry-bulb temperature and the dew point computed from the observed mercurial wet- and dry-bulb temperatures. Psychrometric diagram 1-A (Form 1186-A) or 1-B (Form 1186-B) is used for this computation (See paragraph A5545).
3. Dew point will be derived from mercurial psychrometer dry- and wet-bulb temperatures.
4. Relative humidity will be derived from the telepsychrometer dry-bulb and the dew point temperature obtained from the mercurial psychrometer data.

A5543. When the telepsychrometer dry-bulb temperature is 20°F. or less, temperature, dew point, and relative humidity data will be obtained from psychrometers using standard mercurial or alcohol thermometers.

\*A5544. See Table A2 for a tabulation of the instructions contained in paragraph A5540-43.

TABLE A2

Methods for Obtaining Dry- and Wet-Bulb, Dew Point, and Relative Humidity Values at Stations Using Telepsychrometers.

	Wet-bulb (from telepsychrometer data) higher than 33°F.	Telepsychrometer dry-bulb higher than 20°F., wet-bulb 33°F. or lower.	Telepsychrometer dry-bulb 20°F. or less.
Dry-Bulb	From telepsychrometer.	From telepsychrometer.	From mercurial or other standard psychrometer.
Wet-Bulb	From telepsychrometer dry-bulb temperature and wet-bulb depression.	From telepsychrometer dry-bulb and standard psychrometer dew point. (Use diagram 1-A and 1-B.)	From mercurial or other standard psychrometer.
Dew Point	From above dry- and wet-bulb temperatures.	From standard psychrometer dry- and wet-bulb values.	From standard psychrometer dry- and wet-bulb values.
Relative Humidity	From above dry- and wet-bulb temperatures.	From telepsychrometer dry-bulb and standard psychrometer wet-bulb.	From standard psychrometer dry- and wet-bulb values.

\*A5545. PSYCHROMETRIC DIAGRAM. Diagram 1-A will be used at stations whose mean pressure is 29.5 inches or more, and diagram 1-B at stations whose pressure is less than 29.5 inches. (See Figure A2 a-b.) The diagram appropriate to the mean station pressure is used in the following manner:

1. Locate the intersection of the horizontal line corresponding to the dew point temperature and the slanting line corresponding to the dry-bulb temperature. Interpolate to tenths of degrees when necessary.
2. Read from the adjacent vertical lines the wet-bulb temperature to tenths of degrees Fahrenheit.

EXAMPLE

- Given:
1. Mercurial dew point temperature of  $20.0^{\circ}\text{F}$ .
  2. Telepsychrometer dry-bulb temperature of  $27.7^{\circ}\text{F}$ .
  3. Mean station pressure of 29.62 inches.

Computation: Enter diagram 1-A along the horizontal  $20.0^{\circ}\text{F}$ . line and the slanting  $27.7^{\circ}\text{F}$ . line (interpolated). The vertical temperature line of  $25.5^{\circ}\text{F}$ . (interpolated), passing through their point of intersection, is the wet-bulb temperature.

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

W. B. Form No. 1184-A

PSYCHROMETRIC DIAGRAM 1-A

For P=30 in. Hg.

RELATING DEW-POINT, DRY- AND WET-BULB TEMPERATURES

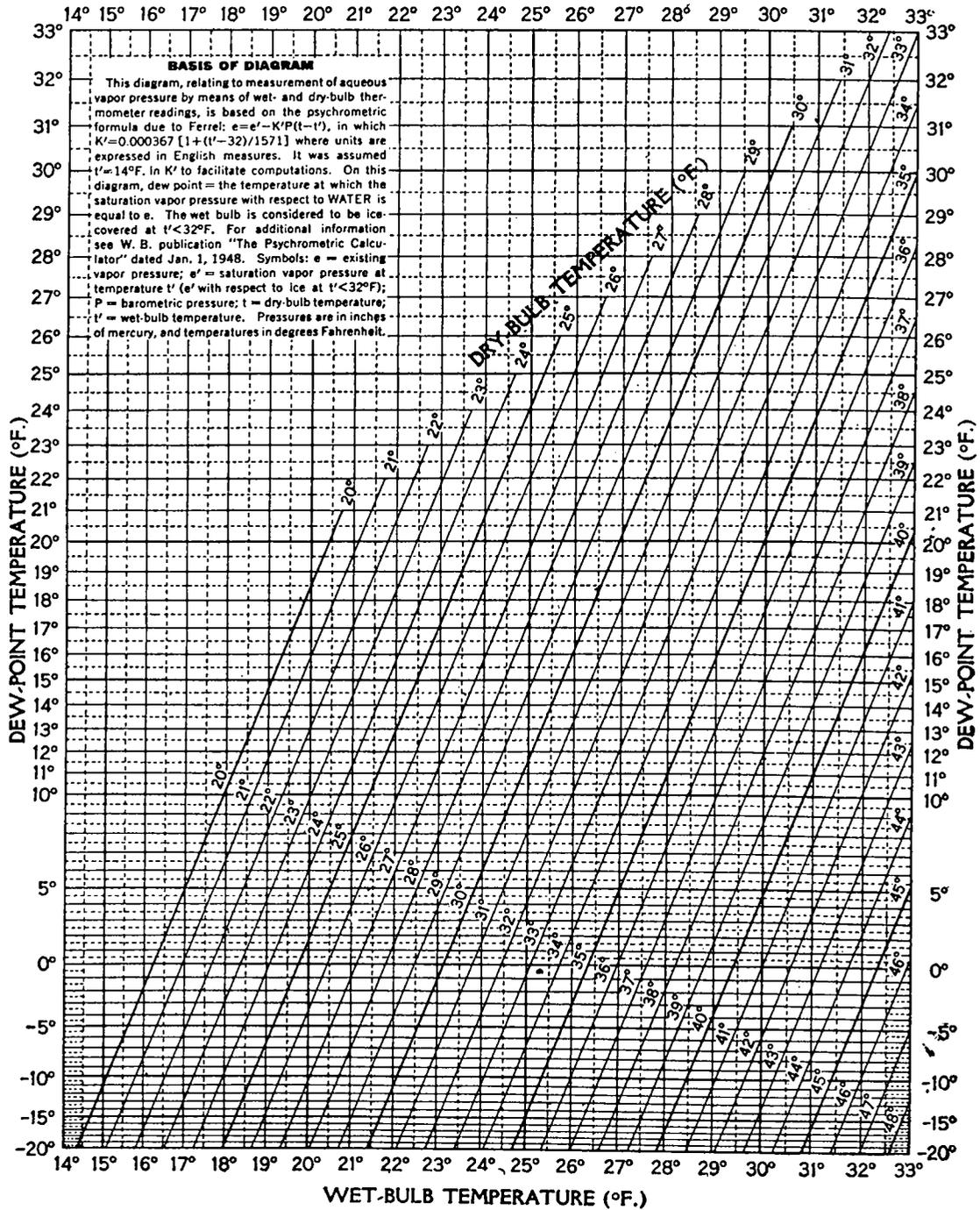


FIGURE A2-a

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

W. B. Form No. 1186-B

PSYCHROMETRIC DIAGRAM I-B

For P = 29 in. Hg.

RELATING DEW-POINT, DRY- AND WET-BULB TEMPERATURES

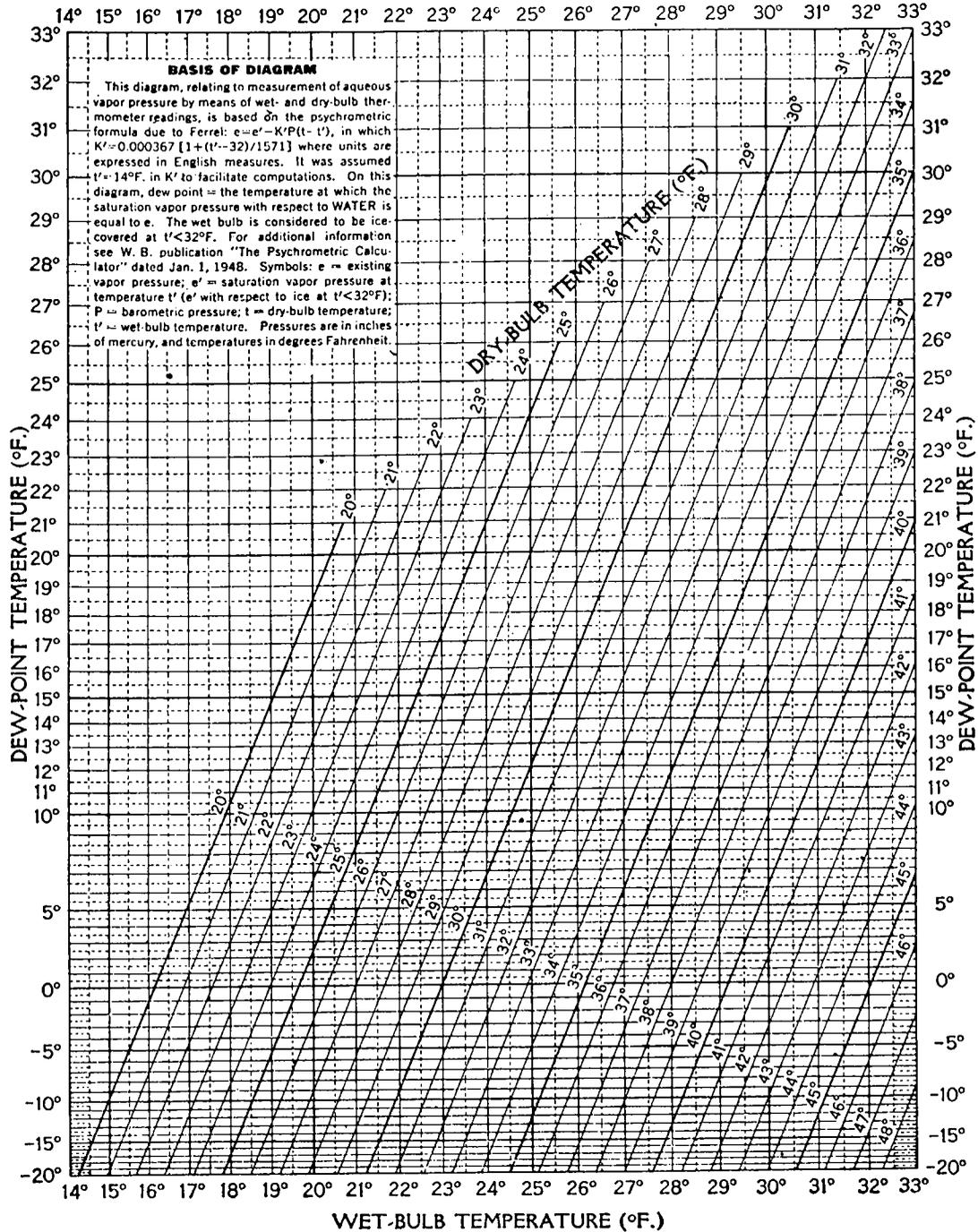


FIGURE A2-b

CHAPTER A-6. HUMIDITY MEASUREMENT

- \*A6120. PSYCHROMETRIC SLIDE RULE. Use the HIGH TEMPERATURE RANGE (WB 1183) of the circular psychrometric calculator when the wet-bulb temperature is 32°F. or more, and the LOW TEMPERATURE RANGE (WB 1184) when the wet-bulb temperature is less than 32°F.
- \*A6121. When not in use the psychrometric calculator should be kept in an envelope or drawer, or otherwise protected. It should be kept out of direct sunlight and away from radiators or other objects with relatively high temperatures.
- \*A6122. The calculator should be cleaned with a damp blotter and dried to prevent the accumulation of dust beneath the cursor or between the disks. For a more thorough cleaning, disassemble the calculator, wash with a soft cloth, soap and water, rinse and dry. Care should be taken to reassemble the calculator in the correct manner, with spacing washers between each moving part, and with the rotor disks on the proper faces of the base. Acetone, benzene, lacquer thinners and other solvents should not be used. Do not lubricate the pivot assembly, since oil may cause discoloration of the vinylite.
- \*A6123. Four sets of reference marks are printed near the extremities of two mutually perpendicular diameters of the calculator. On the base, each reference mark consists of three short parallel lines, while on the disk each consists of one single line. To check the centering of the disks, align a reference mark on one of the disks with the center line of a reference mark on the base. The other reference marks on the disk should then lie within the limits of the outer lines of corresponding reference marks on the base. This test should be repeated for all four possible orientations of the disk's reference marks with relation to the marks on the base. If each orientation does not satisfy the conditions of the test, do not use the calculator for official psychrometric computations. This check is required (a) upon receipt of the calculator, (b) after reassembling the device, and (c) periodically to prevent misalignment due to pivot wear.

\* Revised  
Eff. 5-15-49

A7-1

CHAPTER A7. PRESSURE

\*A7250. ERRATIC ANEROID BAROMETER CORRECTIONS. Report erratic aneroid barometer corrections immediately to the Regional Director.

\*A7400. COMPUTATION OF HEIGHT OF 850-MILLIBAR SURFACE. The term "g. ft.", as used in paragraph 7400, will be regarded to be the same as the geopotential foot, termed "gpft".

CHAPTER A-8. WIND

A8231. INSTRUMENT CORRECTIONS—S-EX TYPE. To obtain true wind speed, a correction of + 2 m.p.h. is applied to the indicated wind speed obtained from the S-EX 4-cup Marvin-Experimental type anemometer.

A8233. INSTRUMENT CORRECTIONS—DIRECT-READING.

TABLE A3. CORRECTIONS TO INDICATED WIND SPEEDS  
 (Electric Speed, Instrument Corp., and  
 Weather Bureau Design-combined unit.)

Scale	Correction
Single (Range 0-75 mph)	+ 0
Double (Range 0-150 mph)	- 2 (To be applied after the indicated wind speed has been doubled.)

TABLE A4. CORRECTIONS TO INDICATED WIND SPEEDS  
 (Bendix-Friez "Windial")

Indicated Speed	Correction
1 - 10	+ 3
11 - 20	+ 2
21 - 25	+ 1
26 - 60	+ 0
61 - 65	+ 1
66 and above	+ 2

## CHAPTER A-9. AIRWAY AND SUPPLEMENTARY OBSERVATIONS

A9012. CONTROL-TOWER VISIBILITY OBSERVATIONS. At Weather Bureau stations where CAA airport traffic control towers are situated, visibility observations will be taken in accordance with instructions contained in paragraph 9012, unless specific exception has been made by the Central Office. At stations where telautograph facilities are available to both Weather Bureau and control tower personnel, control tower personnel may record visibility observations on the telautograph tape instead of on Form 1130. Whenever this is done, the attention of the Weather Bureau observer will be brought to the observation immediately, either by buzzer or otherwise. Receipt of the observation will be acknowledged by the observer, and the observation will then be recorded on Form 1130 in the Weather Bureau office.

A9120.01. OFF-TELETYPE OBSERVATIONS. The time at which record observations at off-teletype stations are to be telephoned or telegraphed to a relay station will be specified by the Regional Office.

\*A9120.02. OMITTED OBSERVATIONS. A record observation may be omitted when a pilot balloon is being observed, provided the ceiling is above 9750 feet and the visibility is 10 miles or better. However, before the pibal is started in such cases, arrangements should be made with the CAA operator to transmit the code group "DCAVU" instead of the regular hourly observation. This code group means "Surface observation omitted on account of pibal, but ceiling is more than 9750 feet and visibility is more than 10 miles." Since at such times the ceiling and visibility would be unrestricted, safety of aviation would not be endangered. (See paragraph A11004.)

\*A9134.04 (3). TORNADO REPORTS. Station officials will make such arrangements as are practicable with local news agencies, state or local police departments, or other organizations having special communication facilities, to insure that reports of tornadoes in the vicinity will be relayed promptly to their stations.

### A9140. LOCAL EXTRA OBSERVATIONS

A9141. Local extra observations will be taken at intervals not exceeding fifteen minutes under the conditions specified in paragraph 9141. They will be taken at first-order airport stations unless otherwise specified by the Central Office, and at certain CAA stations specified by the Regional Offices.

A9142. Local extra observations of one or more elements requested for aircraft arrivals or departures will be taken upon request at all stations.

A9150. CHECK OBSERVATIONS. Check observations will be taken at all stations where scheduled broadcasts of local weather are made.

A9216. LOG OF DIFFERING LOCAL WEATHER OBSERVATIONS. A log will be maintained of differences in local weather conditions observed by a pilot in flight from those observed at the ground. The pilot's position with respect to the station and the exact time he took the observation will invariably be entered in the log, which may otherwise be as brief as is consistent with a detailed account of circumstances relevant to the differences. The log will be maintained in the station file for a period of at least one year, after which it may be destroyed.

A9217. RECEIPT OF PILOT REPORTS. In order that all pireps may become available for dissemination promptly after their receipt at the ground station, and to insure that any differences in reports of local weather may be discussed with pilots or ground personnel of commercial airlines before the relevant circumstances have been forgotten, the personnel at each station used as a terminal for commercial airlines will arrange with the ground personnel of the airlines for prompt delivery and, where necessary, discussion of the pilot's reports.

CHAPTER A-10. DISSEMINATION AND TRANSMISSION

- \* A10080. CORRECTED REPORTS - ENTRIES ON FORM WB 3069. Entries on WB 3069 will be made in the following manner (See Figure A3):
1. When a correction for a synoptic or airway record observation has not been filed for transmission in accordance with paragraph 10080, WB 3069 will be prepared and routed in accordance with instructions printed on the form. In addressing the form, include the station designator (letter or figure) of the station originating the erroneous report.
  2. When the attention of the observer has been called to an error by receipt of WB 3069 from another station, the error will be corrected in accordance with paragraph 10080. WB 3069 will be signed and routed in accordance with instructions on the form.
- \* A10240. COMMUNICATIONS FAILURE. During periods of teletype-service failure, airway and synoptic observations will be routed to an adjacent station where facilities have not failed, utilizing services still in operation, in accordance with the Federal Airway Manual of Operations. If all other services have failed, the next record observation following the breakdown will be telephoned or telegraphed to the station designated by the WBRO. Thereafter, record observations will be sent only at the times of 6-hourly synoptic observations, but all special observations will be telephoned or telegraphed promptly after they are taken. Station observational records will be kept as usual during this period. WB stations will telegraph the observation and insert "XV" in the check column to the right of the address on the telegraph blank, or telephone the observation "collect" to the designated station. CAA stations will distribute observations in accordance with instructions issued by that agency.
- A10400. FORM WB 3024B
- \* A10410. PREPARATION AND DISPOSITION (See Figure A4). At observing stations where Civil Aeronautics Administration communications personnel transmit (but do not take) airway or synoptic observations, enter coded observations on Form WB 3024B prior to filing the form with CAA personnel for transmission on scheduled teletype circuits. A single copy will be prepared unless additional copies are required locally. Exceptions may be authorized by the Regional Director wherever it is impracticable to use this form.

- \*A10411. Observations received from observing stations by telephone, telegraph, etc. for transmission on scheduled teletype circuits will also be entered on WB 3024B. File copies will be retained in the station files for six months.
- \* A10420. HEADING. Enter the date and time of filing the observation in the upper right corner. (A time stamp may be used for this purpose.) Use a six-figure group; the first two figures for the day of the month and the last four for the filing time of the observation in terms of the 24-hour clock. The group will be followed by a letter designating the time zone, e.g., 061932E, 110028Z etc. (See Table 19). The use of local or Greenwich time will be in accordance with transmission requirements.
- \* A10430. ENTRY OF AIRWAY OBSERVATIONS (Including Pilot Reports and Additive Data).
- \*A10431. In the "Station" block enter station letter identification as listed in the Civil Aeronautics Administration manual "Location Identifiers".
- \*A10432. In the "Type" block, enter "S", followed by the serial number of the observation if the observation is a special or record-special, "L" if it is a local extra, "✓" if it is a check observation. Omit entry for record observations.
- \* A10433. In the "Time" block enter a four-figure time group, followed by the appropriate time-zone designator letter, in 24-hour clock, for special, local extra, and check observations. Omit entry for record and record-special observations, except as required by instructions in paragraph 10080 concerning corrected observations.
- \* A10434. Succeeding entries will correspond to those in columns 3 - 14, inclusive, of WBAN 10A. (For coding instructions, see chapters 10 and 11.)
- \* A10440. ENTRY OF SYNOPTIC OBSERVATIONS. Enter coded messages in accordance with 1949 Synoptic Code.
- \* A10450. OBSERVER'S INITIALS. Enter initials of the observer preparing the form.

\*A10460. CORRECTED OBSERVATIONS. When transcribing corrections to observations, enter the authorized contraction for "correction" above the station designator block. Transcribe the entire corrected airway or synoptic observation. Note that although paragraph 11032 does not require an additional entry on WBAN 10A of the entire observation in which an error occurred, it is necessary that the complete corrected observation be entered on WB 3024B, since the entire observation must be transmitted to correct a single error.

A10500. CODING FOR COMMERCIAL TELEGRAPH TRANSMISSION

A10520. 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 that indicated in paragraphs 10010 - 10070. Decimal points and the word "slant" will not be transmitted. The complete value of ceiling and cloud height, sea-level pressure, and altimeter setting will be transmitted, 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 identification 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 identification, and time of the report when required, will be supplied from the heading of the telegram and coded in accordance with paragraphs 10110 - 10140.

Example

As received at San Francisco from Hollister, California:

ESTIMATED 5500 OVERCAST LOWER BROKEN 9 LIGHT RAIN 6563  
NORTHEAST 11 ESTIMATED 11000 OVERCAST 2000 SCATTERED

As prepared for teletype distribution:

HLL 0600P E55009R- 65/63x11/E1100200

WB Form 3069 (Rev. 1-1-49)

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU  
**NOTIFICATION OF OBSERVATIONAL ERRORS**

From WBAS, SNOWDRIFT, FLA. (SNW) Date JAN 12, 1949  
(include station figure or letter designator of originating station)

To CHIEF, U.S.W.B., WASHINGTON 25, D.C. The  6-hourly,  
 3-hourly,  Airway,  \_\_\_\_\_ weather report  
from (this) (~~your~~) station for 1730 (GCT) JAN. 10, 1949 (date)  
was  received late,  not received,  not transmitted,  apparently  
in error as follows:

REPORT	DATA		REPORT	DATA	
AIRWAY	<input checked="" type="checkbox"/> SENT <input type="checkbox"/> RCVD.	CORRECTION	SYNOPTIC	<input type="checkbox"/> SENT <input type="checkbox"/> RCVD.	CORRECTION
Designator			iiiT <sub>d</sub> T <sub>d</sub>		
Type of report			Nddff		
Time			VVwwW		
Ceiling			PPPTT		
Sky			N <sub>1</sub> C <sub>L</sub> hC <sub>M</sub> C <sub>H</sub>		
Visibility	2V	2	D <sub>c</sub> app		
Weather			RRR <sub>s</sub>		
Obstruction to vision			N <sub>s</sub> Ch <sub>s</sub> h <sub>s</sub>		
Pressure			S <sub>p</sub> S <sub>p</sub> S <sub>p</sub> S <sub>p</sub>		
Temperature			d <sub>w</sub> d <sub>w</sub> P <sub>w</sub> H <sub>w</sub>		
Dew point	27	23	h <sub>85</sub> h <sub>85</sub> h <sub>85</sub> h <sub>85</sub>		
Wind direction			R <sub>24</sub> R <sub>24</sub> R <sub>24</sub> R <sub>24</sub>		
Wind speed			T <sub>x</sub> T <sub>x</sub> T <sub>x</sub> T <sub>x</sub>		
Wind shift			Additional plain language data as sent <input type="checkbox"/> ; received <input type="checkbox"/> :		
Alt. setting					
Remarks sent <input type="checkbox"/> ; received <input type="checkbox"/> :					
<input type="checkbox"/> Correction:			<input type="checkbox"/> Correction:		
For correct procedure, see the following instructions:					

(OVER)

16-57700-1

FIGURE A3-a. Entries on WB Form 3069, from station making error.

WB Form 3069 (Rev. 1-1-49)

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU  
**NOTIFICATION OF OBSERVATIONAL ERRORS**

From FAWS, MIAMI, FLORIDA Date FEB. 8, 1949  
(include station figure or letter designator of originating station)  
To WBAS, SNOWDRIFT, FLORIDA (213) The  6-hourly,  
 3-hourly,  Airway,  \_\_\_\_\_ weather report  
from (~~this~~) (your) station for 1830 (GCT) FEB. 7, 1949 (date)  
was  received late,  not received,  not transmitted,  apparently  
in error as follows:

REPORT	DATA		REPORT	DATA	
AIRWAY	<input type="checkbox"/> SENT <input type="checkbox"/> RCVD.	CORRECTION	SYNOPTIC	<input type="checkbox"/> SENT <input checked="" type="checkbox"/> RCVD.	CORRECTION
Designator			iiiT <sub>d</sub> T <sub>d</sub>		
Type of report			Nddff		
Time			VVwwW	<u>48022</u>	<u>48052</u>
Ceiling			PPPTT		
Sky			N <sub>b</sub> C <sub>1</sub> hC <sub>M</sub> C <sub>H</sub>	<u>86500</u>	<u>865//</u>
Visibility			D <sub>C</sub> app		
Weather			RRR <sub>t</sub> s		
Obstruction to vision			N <sub>b</sub> Ch <sub>b</sub>		
Pressure			S <sub>p</sub> S <sub>p</sub> S <sub>p</sub> S <sub>p</sub>		
Temperature			d <sub>w</sub> d <sub>w</sub> P <sub>w</sub> H <sub>w</sub>		
Dew point			h <sub>85</sub> h <sub>85</sub> h <sub>85</sub> a <sub>3</sub>		
Wind direction			R <sub>24</sub> R <sub>24</sub> R <sub>24</sub> R <sub>24</sub>		
Wind speed			T <sub>1</sub> T <sub>1</sub> T <sub>1</sub> T <sub>1</sub>		
Wind shift			Additional plain language data as		
Alt. setting			sent <input type="checkbox"/> ; received <input type="checkbox"/> :		
Remarks sent <input type="checkbox"/> ; received <input type="checkbox"/> :					
<input type="checkbox"/> Correction:			<input type="checkbox"/> Correction:		
For correct procedure, see the following instructions:					
<u>CIRC. N, 6<sup>TH</sup> ED, PARA. 11106, LAST LINE.</u>					
<u>1949 SYNOPTIC CODE, PARA. 1805.44, 1805.54.</u>					

(OVER)

16-57708-1

FIGURE A3-b. Entries on WB Form 3069, from station detecting error.

WB Form 3024 B  
Revised 1-1-49

U. S. DEPARTMENT OF COMMERCE  
WEATHER BUREAU

WEATHER REPORT  
FOR TRANSMISSION

231335P  
DATE TIME

CQN

AIRWAY						
STATION	TYPE	TIME	CEILING	SKY	VISIBILITY	WEATHER—OBSTRUCTIONS TO VISION
YUM	S20	1330P	E85 ⊕ 150		1	R-
196	/ 76	/ 73	→ ↗ 9	/ 010	/ 50	NYREPS 50N NOG
REMARKS						
1308P TOVC 145MSL R5D / 806 72/4						
SYNOPTIC						
iiiT <sub>d</sub> T <sub>d</sub>	Nddff	VVwwW	PPPTT	N <sub>s</sub> C <sub>1</sub> hC <sub>M</sub> C <sub>H</sub>	6D <sub>C</sub> app	7RRR <sub>1,s</sub>
9S <sub>p</sub> S <sub>o</sub> R <sub>p</sub> R <sub>o</sub>	1d <sub>w</sub> d <sub>w</sub> P <sub>w</sub> H <sub>w</sub>	2h <sub>ss</sub> h <sub>ss</sub> h <sub>ss</sub> B <sub>2</sub>	3R <sub>24</sub> R <sub>21</sub> R <sub>24</sub> R <sub>24</sub>	4T <sub>X</sub> T <sub>X</sub> T <sub>N</sub> T <sub>N</sub>		
						DH

U. S. GOVERNMENT PRINTING OFFICE 10-47174-2

OBSERVER

WB Form 3024 B  
Revised 1-1-49

U. S. DEPARTMENT OF COMMERCE  
WEATHER BUREAU

WEATHER REPORT  
FOR TRANSMISSION

191426E  
DATE TIME

AIRWAY						
STATION	TYPE	TIME	CEILING	SKY	VISIBILITY	WEATHER—OBSTRUCTIONS TO VISION
DCA			W4 ⊕		1 1/2 V	R-F
129	/ 61	/ 59	→ ↘ 21+	/ 990	/ E18 ⊕	VSBY VRBL
REMARKS						
1 TO 2 G29						
SYNOPTIC						
iiiT <sub>d</sub> T <sub>d</sub>	Nddff	VVwwW	PPPTT	N <sub>s</sub> C <sub>1</sub> hC <sub>M</sub> C <sub>H</sub>	6D <sub>C</sub> app	7RRR <sub>1,s</sub>
9S <sub>p</sub> S <sub>o</sub> R <sub>p</sub> R <sub>o</sub>	1d <sub>w</sub> d <sub>w</sub> P <sub>w</sub> H <sub>w</sub>	2h <sub>ss</sub> h <sub>ss</sub> h <sub>ss</sub> B <sub>2</sub>	3R <sub>24</sub> R <sub>21</sub> R <sub>24</sub> R <sub>24</sub>	4T <sub>X</sub> T <sub>X</sub> T <sub>N</sub> T <sub>N</sub>		
						JX

U. S. GOVERNMENT PRINTING OFFICE 10-47174-2

OBSERVER

FIGURE A4. Entries on WB Form 3024B

CHAPTER ALL. ENTRIES ON WBAN 10

- \*All001. GENERAL. WBAN 10A, B, and D will be prepared in duplicate at all stations taking airway observations unless additional copies are required locally. WBAN 10D will also be used at all stations at which WB 1001B is prepared. At CAA, SAWRS and other second-order stations, entries will be omitted in WBAN 10B columns 20, 22-35, 38-40, 50-58 and 71-81.
- \*All004. PREPARATION. A well-sharpened, black-lead drawing pencil, Venus 2H or 3H or equivalent, will be used. Sufficient pressure should be used to assure legible carbon copies and ample contrast for photo-reproduction of original records.
- \*All005. DISPOSITION. Each Saturday, at CAA observing stations and first-order stations, forward original copies of WBAN 10 for the week ending with Friday to the WRPC. Similarly, on or before the second working-day of each month, forward the forms for the remainder of the preceding month. Exceptions to the preceding procedure may be authorized by the Regional Director. On or before the second working-day of each month at all other stations, forward the original copies of WBAN 10 for the preceding month to a first-order verifying station or the Regional Office Fiscal Unit as designated by the Regional Director.
- \*All005.1. At first-order stations, when Form WB 5066 (Corrections to Weather Records) has been received from the WRPC, correct all copies of WBAN 10 in red as required in paragraph All032. Upon return of the original copies of WBAN 10, file the original copies as part of the station record and forward the carbon copies to the Section Center.
- \*All005.2. Original copies of WBAN 10 will not be returned to second-order (including CAA and SAWRS) stations. However, upon receipt of Form WB 5066 retained (carbon) copies of WBAN 10 will be corrected (if required), in accordance with paragraph All032 and retained for inspection by a Regional Office representative. Copies of WBAN 10 retained at second-order stations for more than six months may be destroyed after inspection. Copies of WBAN 10 dated prior to the effective date of these instructions will be retained until they have been inspected and destruction has been authorized.

\*All006. RECORD OBSERVATIONS OMITTED DURING A PIBAL. Visual data observed at the scheduled time of an omitted record observation, and data taken from autographic records corresponding to the time of the omitted record observation will be entered on WBAN 10, for record purposes, as follows:

1. Enter "R" in column 1.
2. Enter, in columns 2 and 16, the time of the beginning of the observation sequence in which the omitted observation normally would have appeared.
3. Enter data pertaining to ceiling in column 3, sky in column 4, visibility in column 5, weather and obstructions to vision in column 6, and clouds and obscuring phenomena in columns 21-35. These data will be observed during the pibal at the time the omitted observation was scheduled to be taken.
4. Enter dry-bulb and wet-bulb temperature data in columns 8, 18, and 19. These data will be interpolated between the dry-bulb and wet-bulb values recorded in the observations immediately preceding and following the omitted observation, except that the data will be taken from thermographs or telepsychrometers at stations equipped with them.
5. Enter in columns 9 and 20 dew point and relative humidity data, computed in the usual manner from the interpolated dry-bulb and wet-bulb temperature data.
6. Enter data pertaining to sea-level pressure in column 7, altimeter setting in column 13, station pressure in column 17, pressure tendency in column 36, and net three-hour change in column 37. The basic data will be taken from the barograph trace. The dry-bulb temperature obtained in accordance with the preceding instructions will be used to obtain the 12-hour mean temperature for pressure reductions.
7. Enter surface wind direction and speed in columns 10 and 11. These data will be taken from multiple registers at stations equipped with them. At other stations, the wind data will be estimated during the pibal at the scheduled time of the omitted observation.
8. Enter any remarks noted during the pibal, and additive data if appropriate, in column 14. Enter the authorized contraction "FIBI" in parentheses in column 14.

- All021. LATE OBSERVATIONS. If an observation is taken late and no appreciable changes have occurred since the scheduled time, the entire observation will be enclosed in parentheses. If conditions have changed appreciably since the scheduled time, estimate the probable conditions at that time, using recording instruments wherever possible, and enter the observation in red pencil. In either case, the observation will be used for computation of sums and averages.
- \*All032. CORRECTION OF RETAINED RECORDS. Upon receipt of WB 5066 at all except CAA stations, make indicated corrections in red on retained (carbon) copies of WBAN 10.
- \*All050. OBSERVATIONS NOT TRANSMITTED. If an observation is filed but not transmitted on Service "A", the observation will be disseminated locally as usual. If transmission of the observation on Service "A" is delayed until time for transmission of the next observation (record or special), only the latest observation will be transmitted. The observation thus omitted from transmission on Service "A" will be identified by entry of the abbreviation "FIBI" (filed but impracticable to transmit) in column 14 (Remarks).
- \*All050.1. If a PIREPS is entered in column 14 of an observation that was filed but not transmitted on Service "A", erase the entry and add the PIREPS to the next observation.
- \*All105. VISIBILITY. (Column 5) At first-order observing stations where personnel take less than 24 record observations daily, enter the visibility value for hours when personnel are on duty but no record observation is taken. This entry will be made at 30 minutes past the hour.
- All105.3. CONTROL TOWER VISIBILITY (See Paragraph A9012).
- \*All106. WEATHER AND OBSTRUCTIONS TO VISION. (Column 6) At first-order observing stations where personnel take less than 24 record observations daily, enter the weather and obstructions to vision during hours when personnel are on duty but no record observation is taken. This entry will be made at 30 minutes past the hour.
- All111. WIND SPEED (Column 11) Enter wind speed in miles per hour.
- All114.5. ADDITIVE DATA GROUPS. Separate instructions for the coding and transmission of additive data groups transmitted with record observations at 3- and 6-hourly periods will be furnished stations requiring them.
- \*All114.6. ENTRIES IN COLUMNS 14a and 14b. Obtain authorization from the Central Office for the entry of data other than dry- and wet-bulb temperature readings in columns 14a and 14b.

\*All418. DRY-BULB. (Column 18) At first-order observing stations where personnel take less than 24 record observations daily, enter the corrected thermograph temperature indicated at thirty minutes past the hour for hours in which an hourly observation was not taken. Enter these temperatures to whole degrees. If the thermograph fails, enter in parentheses data obtained by interpolation.

\*All421. TOTAL SKY COVER. (Column 21) At first-order observing stations where personnel take less than 24 record observations daily, enter total sky cover for each hour that personnel are on duty between sunrise and sunset but no record observation is taken. This entry will be made at 30 minutes past the hour. Enter estimated total sky cover in parentheses for daylight hours that personnel are not on duty.

\*All438. PRECIPITATION. (Column 38) At first-order stations equipped with recording gages, including weighing rain gages equipped with 24-, 12- or 6-hour gears, enter corrected hourly amounts of precipitation in inches and hundredths for the period beginning with the hour printed in column 16. Enter "T" for amounts of 0.005 inch or less. Omit entry if precipitation has not occurred during the hour. If the automatic record is incomplete, enter estimated hourly amounts in parentheses.

\*All439. SUNSHINE. (Column 39) Enter corrected hourly sunshine in minutes, for the period beginning with the hour printed in column 16, as obtained from WB 1017 or 1017B. If the automatic record is incomplete or is known to be incorrect, enter estimated hourly values in parentheses.

\*All440. WIND DIRECTION AND SPEED. (Column 40) At first-order stations at which personnel take less than 24 record observations daily, enter prevailing hourly wind direction and the corrected wind speed data for the period beginning with the hour printed in column 16, e.g., SW-18, DI-1. The corrected data are obtained by applying the appropriate correction from Table 14 to the uncorrected data taken from WB 1017 or 1017B.

All449. HEIGHT OF 850-MILLIBAR SURFACE. Entries will be made on WBAN 10B at stations designated by the Central Office to compute this datum.

All451. SEA, STATE AND DIRECTION.

All455. WATER TEMPERATURE.

All456. SOIL TEMPERATURE.

All474. THICKNESS OF ICE ON WATER.

All475. FROZEN GROUND LAYER

} Entries will be made on WBAN 10B at stations designated by the Central Office to observe these data.

\* All478. MAXIMUM AVERAGE 5-MINUTE SPEED AND DIRECTION. (Column 78) Enter corrected data obtained by applying the appropriate correction from Table 14 (paragraph 8231) to the uncorrected data taken from WB 1017 or 1017B.

All479. TIME OF MAXIMUM AVERAGE 5-MINUTE SPEED. (Column 79) Enter the time of beginning to nearest minute L.S.T.

\* All480. FASTEST MILE AND DIRECTION. (Column 80) Enter corrected data obtained by applying the appropriate correction from Table 14 (paragraph 8231) to the uncorrected data taken from WB 1017 or 1017B. If these data are required locally and the station is not equipped with a multiple register, the highest 1-minute wind speed observed during the day and the corresponding direction may be entered in this column in parentheses.

All481. TIME OF FASTEST MILE. (Column 81) Enter time of beginning to nearest minute L.S.T.

\* All485. REMARKS, NOTES, AND MISCELLANEOUS PHENOMENA. (Column 90)

(a) General. At stations on the Great Lakes, enter the dates of opening and closing of navigation and of the season of wind warnings. In addition, enter available data on seiches (especially any pronounced or damaging sudden changes or fluctuations in the lake level and any periods of several hours of unusually high or low water). At stations on navigable rivers, enter the dates of the opening and closing of the navigation season. At all stations, enter notes on receipt of flood or storm warnings and advisories, and severity of damage done by floods or storms; and notes of unusual meteorological conditions, such as obstructions to vision at a distance, or wind shifts not entered on columns 10-12. Enter additional weather information not provided by the recording instruments and scheduled observations. Attach newspaper clippings of weather conditions of exceptional general or local interest. When space in column 90 is insufficient, entries will be continued on an additional sheet attached to it.

(b) Frost and Freeze. Record frost and freeze as follows:

1. In California, Southern Arizona, Florida and along the immediate coast of the Gulf of Mexico, enter date of occurrence of each frost or freeze throughout the year.

2. In those portions of Washington and Oregon west of the Cascades and at all stations south of the 35th parallel except those in item (1), enter date of occurrence of each frost or freeze after March 1 until the first killing freeze in autumn.
3. At all stations, enter date of occurrence of each frost or freeze observed (a) on and after the date the daily normal mean temperature rises to 43° F. until the first killing freeze in autumn, and (b) between May 1 and August 31.

Whenever killing freeze occurs, enter a statement of the kind of vegetation killed, degree of maturity at time of freeze, estimated percentage of loss, and any other pertinent data. If the dates of the first and last killing freeze cannot be determined, enter the first date with a minimum temperature of 32° or lower in the autumn and the latest date with a minimum temperature of 32° or lower in the spring, provided that while the temperature was 32° or lower, there was a period when precipitation was not occurring.

- (c) Excessive Precipitation. (Column 90) A rubber stamp will be used to provide spaces when necessary for the entry of excessive precipitation data in column 90. These data will be determined from WB 1017 or 1017B. When the rate of fall of precipitation for any period equals or exceeds the depths shown in Table A5, enter the maximum amount of precipitation for each period. If any of these amounts occur on parts of two days, underline the amounts concerned and enter both dates to the right of the 180-minute column. If two or more storms, each having excessive precipitation, occur on the same day, separate entries will be made for each.

TABLE A 5  
EXCESSIVE PRECIPITATION

Duration in Minutes	Depth of Precipitation in Inches	Duration in Minutes	Depth of Precipitation in Inches
5	0.25	60	.80
10	.30	80	1.00
15	.35	100	1.20
20	.40	120	1.40
30	.50	150	1.70
45	.65	180	2.00

All485.2. TORNADO. Enter an accurate description of all meteorological elements accompanying the tornado. Information on the following points is desirable:

- (1) A map showing date, hour of occurrence, and path of the tornado.
- (2) Appearance of clouds.
- (3) Character and amount of precipitation.
- (4) Description of whirl, either as seen in a cloud or as evidenced by the distribution of debris.
- (5) Number of persons killed and injured.
- (6) Rate of movement.
- (7) Estimated crop loss and property damage.

All485.4. AURORA, ETC. Enter notes concerning various optical phenomena, such as auroras, halos (solar and lunar), rainbows, and mirages. Auroral displays should be carefully described, giving the time of beginning and ending, and the altitude and azimuth of each extremity and of the crown of any arch of light that may be formed. Azimuths should be recorded with North as zero. When an aurora extends past midnight, entry will be made for both dates.

All485.6. SNOW SURFACE TEMPERATURE. Enter snow surface temperature and related data at raob stations north of the 40th parallel.

All485.9. NOTES ON TELEPSYCHROMETER OPERATION. Whenever use of the telepsychrometer is discontinued or resumed, enter the date, time and nature of the change.

CHAPTER A12. ENTRIES ON FORMS WB 1001B and C, 1081, AND 1083.

A12000. FORM WB 1001B. GENERAL

\*A12010. PREPARATION. (See Figure A5.) WB 1001B will be prepared daily in duplicate at all first-order observing stations not taking airway observations, except that at stations taking only one climatological observation (maximum temperature, minimum temperature, and precipitation measurement) daily, and where a local airport observing station is equipped with a multiple register, WB 1001B will not be prepared as an original record; instead, observed data will be entered directly on WB 1001C. Entries from WB 1017 or 1017B will be omitted at stations not equipped with a triple register. Black or blue-black ink or a moderately hard lead pencil will be used except where red ink is specified. Ditto marks will not be used.

\*A12011. DISTRIBUTION. At designated stations, where punched cards are prepared from Form WB 1001B, forward the original copies of WB 1001B for the week ending Friday to the WRPC each Saturday. Similarly, on or before the second working-day of each month, forward all remaining original copies for the preceding month. At stations where punched cards are not prepared from Form WB 1001B, forward the original copies of this form for the month to the WRPC by the second working-day of the following month. When any form cannot be mailed by the specified date, forward an explanation to the WRPC on or before that date. When the originals are returned from the WRPC, the corrected carbon copies will be forwarded to the Section Center (see paragraph A12013). The originals will be retained as part of the permanent local record. Note that WBAN 10D will be prepared at all stations where WB 1001B is prepared.

A12012. TIME. Use twenty-four-hour local standard time with 0000 as the beginning, and 2359 the ending, of the day.

\*A12013. CORRECTIONS TO RETAINED RECORDS. Upon receipt of WB 5066 (Corrections to Weather Records) from the WRPC, enter the indicated corrections in red on retained (carbon) copies of WB 1001B.

A12014. HEADING. Enter the station name and date in the spaces provided.

\*A12015. INTERPOLATED DATA. If the automatic record is incomplete, enter interpolated hourly precipitation and wind data, taken from WB 1017, or 1017B, or weighing gage forms (see paragraph A13411), in parentheses. These data will be included in the determination of daily sums, averages etc.

## A12100. FORM WB 1001B. COLUMN ENTRIES

- A12101. TIME. (Column 1) In the heading, enter the time zone indicator from Table 19.
- \*A12102. TEMPERATURE. (Column 2) Enter the corrected hourly thermograph temperature recorded at thirty minutes past the hour in whole degrees, supplying minus signs where required. For example, the entry for the hour 12-13 will be the temperature indicated at 1230. If the thermograph record is incomplete, obtain temperatures by estimation and enter them in parentheses.
- \*A12103. PRECIPITATION. (Column 3) Enter corrected hourly amounts of precipitation in inches and hundredths from the official automatic record (either tipping bucket or weighing gage - see paragraphs 4030 and A4030). Enter "T" for amounts of 0.005 inch or less. Omit entry if no precipitation has occurred during the hour. Enter the total precipitation for the day opposite "Sum ".
- A12104. WIND DIRECTION. (Column 4) Enter the prevailing wind direction, taken from WB 1017 or 1017B to eight compass points for each hour. Enter the prevailing direction for the day under "Prevailing ". Direction indeterminate (DI) will not be considered as the prevailing direction for the day. If two or more directions occur an equal number of times, select the prevailing direction on the basis of adjacent directions. Example: If SE recorded for 10 hours, S 10 hours, SW 3 hours, and E 1 hour, the prevailing direction would be South.
- A12105. WIND SPEED. (Column 5) Enter the corrected number of miles of wind for each hour. Wind speeds obtained from WB 1017 or 1017B will be corrected in accordance with Table 14. Enter the total wind movement for the day opposite "Sum" and the mean hourly speed to tenths of a mile opposite "Average ".
- \*A12106. SUNSHINE. (Column 6) Enter hourly sunshine in minutes as obtained from WB 1017 or 1017B. If an hourly value is wholly estimated, enter it in parentheses. Opposite "Sum" enter the total minutes of sunshine for the day, and under "Possible" enter the possible number of minutes as given in the Station Sunshine Tables. Obtain percentage of sunshine by dividing the total minutes for the day, multiplied by 100, by the "possible" as shown in the Sunshine Table. Enter percentage of sunshine in whole percent adjacent to "% ".

- \*A12107. SKY COVER. (Column 7)\*\* Enter total sky cover, as indicated in paragraph 11421, for the hours that personnel are on duty between sunrise and sunset. Enter the estimated values in parentheses for the daylight hours during which no personnel are on duty. These entries correspond to observations taken at thirty minutes past the hour. Opposite "Sum" enter the total of the hourly entries. To obtain the sum, add 9+ as 10 and 1- as 0. Enter the average hourly sky cover in the space provided. Do not use 9+ and 1- as averages.
- \*A12108. LOWEST VISIBILITY. (Column 8)\*\* Using the values from Table 25, enter the lowest visibility observed during each daylight hour that personnel are on duty.
- \*A12109. WEATHER AND OBSTRUCTIONS TO VISION. (Column 9)\*\* Using the symbols printed on the form, enter in the order of their predominance the meteorological phenomena occurring at the time of the visibility observation entered in column 8. Enter obstructions to vision only when the visibility is six miles or less. Use intensity symbols for precipitation as indicated in paragraph 11106.1. (Use the symbol "S" to represent any form of snow, including snow grains, snow pellets, etc. Use other symbols similarly, e.g., "F" to represent ground fog and ice fog.).
- A12110. EXTRA COLUMNS. (Columns 10-13) Enter any additional data that are required locally.
- \*A12114. BEGINNINGS AND ENDINGS OF METEOROLOGICAL PHENOMENA, REMARKS, NOTES, ETC. (Column 14)\*\* Enter in chronological order (not necessarily opposite the hour printed in column 1 corresponding to the time of the phenomena) the times (L.S.T.) of beginnings and endings of precipitation and obstructions to vision. Use the symbols indicated on the form and disregard intensities. (Use "DL" to record distant lightning.). When the time of beginning or ending is unknown, enter the estimated time in parentheses. Example: R 0305-0325; RS 0325-(0350); S (0350)-1330. Intervals of 15 minutes or less between the time of ending and beginning will not be recorded. If additional space is required, use column 61; columns 10-13 may also be used if not required for hourly data. The following data will also be entered in column 14 as indicated in paragraphs 11485-.7 and A11485-.9.

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\*\* Note: Entries in columns 7-9 and 14 are not required from city offices if there is a first-order airport observing station in the locality.

- |                              |   |
|------------------------------|---|
| 1. Hailstorms                | 6. Snow surface temperatures                |
| 2. Tornados and water spouts | 7. Frost and freeze                         |
| 3. Lightning                 | 8. Seiches                                  |
| 4. Aurora                    | 9. Navigation and wind warn-<br>ing seasons |
| 5. Harbor ice                | 10. Miscellaneous                           |

A12115. SCHEDULED OBSERVATIONS. (Columns 15-26) Enter data in these columns for scheduled observations, including synoptic, when these observations are taken.

A12116. TIME. (Column 15) Enter the time that the observation is begun, to the nearest minute (LST), e.g., 0110, 1805.

A12117. STATION PRESSURE. (Column 16) Enter mercurial or precision aneroid barometer reading to the nearest 0.001 inch.

A12118. DRY-AND-WET-BULB. (Columns 17-18) Enter these temperatures to the nearest degree and tenth, supplying minus signs where required.

A12119. DEW POINT. (Column 19) Enter the dew point to the nearest whole degree, supplying minus signs where required.

A12120. RELATIVE HUMIDITY. (Column 20) Enter relative humidity to the nearest whole per cent.

A12121. MAXIMUM AND MINIMUM TEMPERATURES. (Columns 21 and 22) At stations equipped with maximum and minimum thermometers, thermographs or telepsychrometers, enter the maximum and minimum temperatures to degrees and tenths for the period covered by the observation. Take the data from the telepsychrometer or the maximum and minimum thermometers, if available; if not, use the thermograph (see Chapters 5 and A5). Note that these temperatures must be as high and low respectively as any temperature recorded within the period covered, including the current temperature.

A12123. PRECIPITATION. (Column 23) Enter total precipitation in inches and hundredths for the period covered by the observation, e.g., 0.06. Use the gage indicated by paragraphs 4030 and A4030. When precipitation has occurred in amounts of 0.005 inch or less (trace), enter "T." When precipitation has not occurred, enter "0.00."

A12124. SNOWFALL, SLEET AND HAIL. (Column 24) Enter the depth of snow, sleet and hail (unmelted), to inches and tenths, that has fallen during the period covered by the observation. When snow, sleet or hail has fallen in amounts of 0.05 inch or less, enter "T" denoting trace. When none has occurred, enter "0.0." When snow, sleet or hail melted as it fell, enter "T" with a reference note "Melted as it fell", in column 14.

A12125. SNOW DEPTH. (Column 25) Enter the depth of snow, sleet, hail and ice on the ground to the nearest inch. When snow, etc., is on the ground and the depth amounts to 0.5 inch or less, enter "T" denoting trace. Enter "0" when none is on the ground. Ice depth, which is the depth of sheet ice formed directly or indirectly from precipitation, should not be confused with "thickness of ice on water ". If snowfall melts and refreezes, the depth of ice formed will be included in the entries in this column.

\*A12126. HEIGHT OF 850-MB. SURFACE. (Column 26) At stations designated to compute this datum, enter the height of the 850 mb. surface above sea-level in feet to the nearest ten geopotential feet.

A12127. SUMMARY OF DAY. (Columns 27-38) Enter data for the 24-hour period from midnight to midnight (LST) in these columns.

A12128. MAXIMUM AND MINIMUM TEMPERATURES. (Columns 27 and 28) Enter these data in whole degrees (see chapters 5 and A5). Note that the maximum and minimum temperatures must be at least as high and low, respectively, as any temperature recorded through the day.

A12129. AVERAGE TEMPERATURE. (Column 29) Enter the average temperature for the day, to whole degrees. This temperature is half the sum of the maximum and minimum temperatures for the day.

A12130. NORMAL TEMPERATURE. (Column 30) Enter the normal temperatures for the day, to whole degrees, when available. Use the normal for February 28 as the normal for February 29 also.

A12131. TWENTY-FOUR-HOUR PRECIPITATION. (Column 31) Enter the total amount of precipitation (water equivalent of solid types) to the nearest 0.01 inch. If precipitation has occurred in amounts of 0.005 inch or less enter "T" denoting trace. If precipitation has not occurred, enter "0.00 ". The sum of any number of "T" observations will be regarded as a trace unless recording equipment indicates the total is greater than 0.005 inch (liquid).

A12132. TWENTY-FOUR-HOUR SNOWFALL, SLEET AND HAIL. (Column 32) Enter to tenths of an inch the total amount of unmelted snow, sleet, and hail that falls during the 24-hour period. If there are separate falls, each of which melts before the following occurs, the total for the day will be the sum of the maximum depth of each fall. Record amounts in inches and tenths. When snow, sleet or hail melts as it falls, enter "T" with a reference note "Melted as it fell" in column 14. If snow, sleet or hail has fallen in amounts of 0.05 inch or less, enter "T" denoting trace. If none has fallen, enter "0.0".

- A12133. SNOW DEPTH. (Column 33) Enter the depth of snow, sleet, hail and ice on the ground at 1930 EST (0030 GCT) to the nearest inch. Enter "T" for amounts of 0.5 inch or less. Enter "0" when none is on the ground.
- \*A12134. MAXIMUM AVERAGE 5-MINUTE SPEED AND DIRECTION. (Column 34) Enter the corrected maximum average 5-minute speed and the direction. The corrected speed is obtained by applying the appropriate correction from Table 14 (paragraph 8231) to the uncorrected data from WB 1017 or 1017B.
- A12135. TIME OF MAXIMUM AVERAGE 5-MINUTE SPEED. (Column 35) Enter the time of beginning to nearest minute (LST).
- \*A12136. FASTEST MILE AND DIRECTION. (Column 36) Enter the corrected (see Table 14) fastest mile and the corresponding direction. The uncorrected fastest mile and the direction data are taken from WB 1017 or 1017B. If these data are required locally and the station is not equipped with a multiple register, the highest one-minute wind speed observed during the day and the corresponding direction may be entered in this column in parentheses.
- A12137. TIME OF FASTEST MILE. (Column 37) Enter time of beginning to the nearest minute (LST).
- A12138. RIVER STAGE. (Column 38) At stations where a river gage is read, enter this reading to the nearest 0.1 foot.
- A12139. EXCESSIVE PRECIPITATION. (Columns 39-50) Enter amount of excessive precipitation in these columns as instructed in paragraph A11485 (c).
- A12151. EXTRA COLUMNS. (Columns 51-53) Enter any additional data that are required locally.
- \*A12154. STATION PRESSURE COMPUTATIONS. (Lines 54-60) Enter data in these lines in accordance with instructions in paragraphs 11459-11465.
- \*A12161. ADDITIONAL REMARKS AND NOTES. (Lines 61) Enter the character and time (LST) of sunrise and sunset, using the terms "clear, cloudy, foggy, smoky, dusty, or hazy". Identify the entries by use of the abbreviations "SR" for sunrise and "SS" for sunset. See paragraph A12114 for additional entries.

WB FORM 1001B

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU  
SURFACE WEATHER OBSERVATIONS  
DAILY RECORD

Station TOWNVILLE, STATE Date JAN. 16, 1949

Time (LST)	Temperature (°F)	Precipitation (0.01 in)	WIND		Surface (inches)	Sky Cover (oktas 0-10)	Lowest Visibility (miles)	Weather and Obstructions to Vision	Relative Humidity	11	12	13	14
			Direction	Speed (MPH)									
00-01	46		NW	20									
01-02	47		NW	17									
02-03	47	T	NW	20				R-					R (0237)-(0350)
03-04	51	T	NW	20				R-					
04-05	53		NW	22									
05-06	54		NW	20									
06-07	56		NW	20	0	1	1						
07-08	57		SW	22	22	3	10		92				
08-09	59		NW	23	60	1	10						
09-10	61		NW	24	60	0	12		89				
10-11	62		N	26	60	2	15+						
11-12	62		NW	21	9	5	15+		88				
12-13	62		NW	20	0	10	12						
13-14	64		NW	20	0	10	12		63				
14-15	58		NW	22	0	10	12						
15-16	55		SW	20	0	10	10		54				
16-17	52	T	W	19	0	10	10	R-					R 1631-1710
17-18	50	T	SW	17	0	10	1	R-					R 1732-1750
18-19	48		SW	18									
19-20	47	.02	SW	19				R-					R (1920)-cont.
20-21	45	.13	SW	19				R-					
21-22	44	.53	SW	17				R+					
22-23	42	.71	SW	14				R+					
23-00	41	.15	SW	11				R					
Sum		1.54		471	211	78							
Average			Prevailing	19.6	67.6	6							
Misc			NW		35%								

Beginnings and endings of meteorological phenomena:  
Remarks, notes, etc

SYMBOLS USED IN COLUMN 9  
A. Hail E. Sleet K. Smoke R. Rain ZL-Freezing Drizzle  
BS-Blowing Snow F. Fog L-Drizzle S-Snow ZR-Freezing Rain  
D-Dust H-Haze N-Sand T-Thunderstorm

SCHEDULED OBSERVATIONS

Time (LST)	Station Pressure	Dry Bulb	Wet Bulb	Dew Point	Rel Humid	Temperature		Precipitation	Snowfall Sleet, Hail	Snow, Sleet, Hail or Ice on the Ground	Height 850 MB Surface
						Max	Min				
0845		59.0	57.9	57	94	59.0	44.9	T	0.0	0	
1215		62.0	59.8	64	88	63.0	58.5	0.00	0.0	0	
1645		52.4	47.3	42	68	54.3	52.4	T	0.0	0	

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

Temperature					24 Hour Precip (Water Equiv)	24 Hour Snowfall Sleet or Ice on Ground	Snow, Sleet, Hail or Ice on Ground	Wind (M.P.H.)			River Stage
24 Hour Max	24 Hour Min	Average	Normal	Max Average 5 minute Speed and Direction				Time (LST)	Forcest Mile and Direction	Time (LST)	
27	28	29	30	31	32	33	34	35	36	37	38
64	41	52	33	1.54	0.0	0	30-N	1000	34-N	1000	

EXCESSIVE PRECIPITATION

The excessive amounts for all 12 periods are entered whenever the amount for one or more periods equals or exceeds the rate of 0.1 inch per minute plus 20 inch.	Minutes											
	5	10	15	20	30	45	60	80	100	120	150	180
	39	40	41	42	43	44	45	46	47	48	49	50
.32	.63	.72	.74	.75	.88	1.01	1.07	1.13	1.30	1.40	1.47	

STATION PRESSURE COMPUTATIONS

Time (LST)	54
Attached Thermometer	55
Observed Barometer	56
Total Correction	57
Station Pressure	58
Barograph Reading	59
Barograph Correction	60

61

Additional remarks and notes,  
SR - 0642 cldy  
SS - 1702 cldy

FIGURE A5. Entries on WB 1001B. Entries in Columns 7, 8, 9, and 14 are not required at city offices where there is a local airport observing station.

## A12200. FORM WB 1001C - GENERAL

\*A12210. PREPARATION AND DISTRIBUTION. (See Figure A6.) Form 1001C will be prepared in duplicate at all first-order observing stations. Entries will be made daily in black or blue-black ink or a moderately hard pencil. Ditto marks will not be used. Not later than the second working-day of the month, designated stations will prepare a typewritten copy of WB 1001C for the preceding month and mail it to the WRPC together with the original (pencil or ink) record copy. Other stations will mail the original (pencil or ink) record copy to the WRPC and two typewritten copies to the Chief, U. S. Weather Bureau, Attention C. & H. S. Division. Several typewritten carbons may be prepared, if necessary, for immediate distribution to newspapers or other interests. A clean black ribbon should be used for typing and especial care should be taken to enter the data neatly and uniformly within the column limits. The typewritten forms should be mailed unfolded, in a large envelope, and protected by cardboard covers.

\*A12210.1. When both a city office and an airport office located in the same metropolitan area are designated to prepare typewritten copies for photo-offset printing, a typewritten copy will be prepared for each station.

\*A12211. CORRECTIONS. Upon receipt of WB 5066 (Corrections to Weather Records) from the WRPC, the indicated corrections will be made in red on the retained (carbon) copy of WB 1001C. When the original copy of WB 1001C is returned from the WRPC, it will be retained in the station files. The corrected carbon copy will be forwarded to the Section Center, unless photo-offset copies are prepared at the WRPC, in which case it may be destroyed.

\*A12212. HEADING. Enter the station name, month and year, and time zone (e.g., "Eastern") in the spaces provided.

## A12300. FORM WB 1001C - COLUMN ENTRIES

\*A12302. MAXIMUM AND MINIMUM TEMPERATURES. (Columns 2 and 3) Enter these data to whole degrees. In the footings of these columns, enter the sums to whole degrees and averages to tenths of a degree.

A12304. AVERAGE TEMPERATURE. (Column 4) Enter these data to whole degrees. The average daily temperature is half the sum of the daily maximum and minimum temperatures.

A12305. DEPARTURE FROM NORMAL. (Column 5) When normals are available, compute the departure by subtracting algebraically the normal temperature from the daily average temperature. Example: Daily average temperature, 65°; normal temperature, 60°; departure = +5°. Use the normal for February 28 as the normal for February 29 also.

- A12306. DEGREE DAYS (BASE 65°). (Column 6) Enter heating degree days to whole numbers, i.e., the difference between the mean temperature and 65°, when the daily average temperature is less than 65°. Enter "0" when the daily average temperature is 65° or higher.
- A12307. TOTAL PRECIPITATION (WATER EQUIVALENT). (Column 7) Enter the total 24-hour precipitation, midnight to midnight, in inches and hundredths, as obtained from WB 1130B or 1001B. In the footing, enter the sum of the daily amounts of precipitation.
- A12308. SNOWFALL, SLEET, HAIL. (Column 8) Enter 24-hour unmelted depth of snowfall, sleet or hail, midnight to midnight, in inches and tenths as obtained from WB 1130B or 1001B. Enter column total in the footing.
- A12309. SNOW, SLEET, HAIL OR ICE ON THE GROUND. (Column 9) Enter the depth to the nearest inch of snow, sleet, hail or ice that was on the ground at 1930 EST (0030 GCT), as obtained from WB 1130B or 1001B. In the heading, enter the local standard time corresponding to 1930E.
- \*A12310. PREVAILING DIRECTION. (Column 10) At stations where 24 record observations are taken daily, enter the prevailing direction to 16 points of the compass computed from column 10 of WB 1130A for record observations. At stations where 1 to 23 record observations are taken daily, enter the prevailing direction to 8 points of the compass computed from column 40 of WB 1130B. At all other stations, enter the prevailing direction to 8 points of the compass from the bottom of column 4 of WB 1001B ("DI" will not be considered as a prevailing direction for the day.). Prevailing direction for the month will not be entered in the footing of column 10.
- A12311. AVERAGE WIND SPEED. (Column 11) At stations where 24 record observations are taken daily, enter the average wind speed computed from column 11 of WB 1130A for record observations. At stations where less than 24 record observations are taken daily, enter this datum computed from column 40 of WB 1130B. At all other stations, enter this datum from column 5 of WB 1001B. In the footing, enter the sum of the daily average hourly speeds, and the average of these speeds as obtained by dividing the sum by the number of days in the month. All entries in this column are made to tenths of a mile.
- \*A12312. FASTEST MILE AND DIRECTION. (Columns 12 and 13) Enter the speed and direction of the fastest mile as obtained from WB 1130B or 1001B. In the footing, enter the speed and direction of the fastest mile for the month. If these data are required for local use at stations which prepare WB 1001B and are not equipped with a multiple register (see paragraph A12136), the highest one-minute wind speed observed during the day and the corresponding direction will be entered in this column with an asterisk and the following foot-note: "Datum entered in this column is obtained by visual observation since recording equipment is not available. It is not necessarily the fastest mile occurring during the period."

- A12314. TOTAL SUNSHINE. (Column 14) Enter the total sunshine in hours and minutes as obtained from WB 1130B or 1001B, e.g., 5:32; 12:03. In the footing, enter similarly the total sunshine for the month, and the possible sunshine as obtained from the Station Sunshine Tables.
- A12315. PER CENT OF POSSIBLE SUNSHINE. (Column 15) Enter these data in whole per cent as obtained by dividing the entry in column 14 by the possible sunshine indicated by the Station Sunshine Tables. In the footing, enter in whole numbers the per cent of sunshine obtained by dividing the sum of column 14 by the possible sunshine entered below it, and multiplying the quotient by 100.
- A12316. SKY COVER - SUNRISE TO SUNSET. (Column 16) Enter tenths of sky cover as obtained by averaging hourly entries on WB 1130B or 1001B for the period from sunrise to sunset. In the footing, enter the sum, and the average to tenths. Obtain averages as indicated in paragraph A12107.
- A12317. SKY COVER - MIDNIGHT TO MIDNIGHT. (Column 17) Enter data for the period from midnight to midnight, using the procedure described in paragraph A12316. Omit entry at stations where personnel are not on duty 24 hours a day.
- A12318. THUNDERSTORMS OR DISTANT LIGHTNING. (Column 18) Enter "T" for thunderstorm or "DL" for distant lightning when observed during the period from midnight to midnight. Do not enter more than one T or DL for a day. Enter DL only if thunder is not heard, except that if lightning occurs before midnight and thunder is heard after midnight, enter DL for the first day and T for the following day. Similarly, if thunder occurs before midnight and lightning after midnight, enter T for the first day and DL for the following day. Enter both T and DL if lightning only is observed in one storm, and thunder is heard from another storm.
- A12319. VISIBILITY, 1/4 MILE OR LESS, CAUSED BY-. (Column 19) Enter symbols for hydrometeors or lithometeors that reduce visibility to 1/4 mile or less. If the visibility is reduced by several phenomena, enter all in the order of their predominance, using applicable symbols. Example: F, R. Use only those symbols printed on the form; use S to represent all types of snow, including snow showers, snow grains, pellets, etc.; use other symbols similarly, e.g., F to represent both ground fog and ice fog.
- A12320. EXTRA COLUMNS. (Columns 20, 21, 22) Enter any additional data required locally.

- A12330. TEMPERATURE DATA. Enter these data as follows:
- A12331. AVERAGE MONTHLY. Enter, to degrees and tenths, one-half the sum of the average maximum and minimum temperatures for the month.
- A12332. DEPARTURE FROM NORMAL. At all stations for which normals have been computed, enter the departure of the average monthly temperatures from the monthly normal. February monthly normal temperatures will not be changed for leap years.
- A12333. HIGHEST AND LOWEST TEMPERATURES. Enter these data, as obtained from columns 2 and 3, and their dates of occurrence. In selecting the highest or lowest temperatures, consider tenths of degrees if necessary. If temperatures are identical to tenths, enter all dates.
- A12334. NUMBER OF DAYS WITH MAXIMUM  $32^{\circ}$  OR BELOW OR  $90^{\circ}$  OR ABOVE, MINIMUM  $32^{\circ}$  OR BELOW OR  $0^{\circ}$  OR BELOW. Enter these data as obtained from columns 2 and 3.
- A12335. DEGREE DAYS. Enter the sum of the entries in column 6 and the departure from normal at all stations for which normals have been computed. Enter the seasonal total, using July 1 as the beginning of the season, and the departure from normal at all stations for which normals have been computed.
- A12340. PRECIPITATION DATA. Enter these data as follows:
- A12341. TOTAL FOR THE MONTH. Obtain this entry from column 7.
- A12342. DEPARTURE FROM NORMAL. Enter the monthly departure from normal at all stations for which normals have been computed. The normal precipitation for February 29 will be the same as for February 28.
- A12343. GREATEST IN 24 HOURS. Enter this datum to the nearest hundredth of an inch with the date or dates of occurrence. If the 24-hour period begins on the last day of one month and ends on the first of the following, enter the data on WB 1001C for the month in which most of the precipitation fell. Include data for the entire period on this form, and do not repeat the compilation on WB 1001C for the other month, but enter an explanatory note on the bottom of the form.
- A12350. SNOWFALL, SLEET, AND HAIL. Enter these data as follows:
- A12351. TOTAL FOR MONTH. Obtain this entry from column 8.
- A12352. GREATEST IN 24 HOURS. Enter this datum to the nearest tenth of an inch. See paragraph A12343 above.

A12353. GREATEST DEPTH ON GROUND. Enter this datum to the nearest inch, and the date or dates of occurrence.

A12360. BAROMETRIC PRESSURE. Enter data as follows:

\*A12361. MONTHLY AVERAGE (MEAN) STATION PRESSURE. Enter one-half the sum of the average 1230 and 0030 GCT station pressures, after applying the "correction to adjust to a 24-hour mean" and the "correction to adjust to former assigned elevation" (Whenever the latter is applicable). These corrections are furnished to stations requiring them by the Central Office. Other stations will assume the correction to be zero.

Example:

29.644	= average station pressure at 1230 GCT
29.596	= average station pressure at 0030 GCT
2) <u>59.240</u>	
29.620	= average station pressure for 1230 and 0030 GCT
- .007	= correction to adjust to 24-hour mean
<u>29.613</u>	
- .016	= correction to adjust to former assigned elevation
<u>29.597</u>	= (29.60) monthly average station pressure

\*A12362. HIGHEST AND LOWEST SEA-LEVEL PRESSURES. Enter these data as obtained from the barograph trace, corrected in the manner prescribed in paragraph 7242. Reduce station pressures to sea-level in accordance with paragraphs 7320-24.

A12370. WEATHER. Enter data as follows:

A12371. NUMBER OF DAYS CLEAR, PARTLY CLOUDY, AND CLOUDY. Obtain these data from column 16.

A12372. NUMBER OF DAYS WITH 0.01, 0.10, 0.50, and 1.00 (INCH) OR MORE PRECIPITATION. Obtain these data from column 7.

A12373. DATES OF HAIL, SLEET, AND GLAZE. Obtain these data from WB 1130B or 1001B.

\*A12380. SUMMARY. Enter, in the spaces provided near the bottom of the form, notes regarding the occurrence of unusual or extreme weather conditions during the month. Include data on damaging rain, snow, glaze, hail or wind storms, unusually high or low temperatures, frosts and killing freezes, etc.

SURFACE WEATHER OBSERVATIONS  
MONTHLY RECORD

STATION WBAS Dallas, Texas MONTH January YEAR 1949  
Central STANDARD TIME

DAY	TEMPERATURE °F			PRECIPITATION (IN)					WIND			SUNSHINE		SKY COVER			VISIBILITY 1/4 MI. OR LESS CAUSED BY	REMARKS	REMARKS	REMARKS					
	MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	DEGREE DAYS (BASE 65°)	TOTAL (WATER EQUIVALENT)	SNOWFALL, SLEET, HAIL	SNOW, SLEET, HAIL OR ICE ON EXPOSURE AT	PREVAILING DIRECTION	AVERAGE SPEED (M.P.H.)	FASTEST MILE SPEED (M.P.H.)	DIRECTION	TOTAL (Hours and Minutes)	PERCENT OF POSSIBLE	SUNSHINE TO LIGHT (Scale 0-10)	TO DISTANT LIGHT (Scale 0-10)					TO NEAREST LIGHT (Scale 0-10)	ON DISTANT LIGHTING	1/4 MI. OR LESS CAUSED BY	REMARKS	REMARKS
1	58	32	45	0	20	T	0.0	0	SSE	9.8	30	S	1:42	17	9+	7									
2	70	52	61	+16	4	0	0.0	0	S	9.9	17	SE	3:21	33	8	7									
3	72	35	54	+9	11	0	0.0	0	SSE	18.0	30	NW	7:16	72	4	6									
4	37	27	32	-13	33	0	0.0	0	NNW	10.8	22	NW	0:18	3	9+	8									
5	51	26	38	-7	27	0	0.0	0	WNW	4.4	18	NW	9:20	93	2	3									
6	58	26	42	-3	23	0	0.0	0	W	3.1	8	S	7:42	76	6	3									
7	62	37	50	+5	15	0	0.0	0	S	7.0	23	SW	0:00	0	10	8									
8	72	52	62	+17	3	0	0.0	0	S	12.7	24	S	0:00	0	9	8									
9	79	37	58	+13	7	T	0.0	0	S	10.1	26	S	0:20	3	9	9+									
10	39	28	34	-11	31	.02	T	0	NNW	9.8	18	N	0:00	0	10	10									
11	34	28	31	-14	34	.02	0	0	NNW	8.7	15	NW	0:00	0	10	10									
12	38	31	34	-11	31	.13	0	0	NNW	5.3	17	NW	0:00	0	10	10									
13	46	36	41	-4	24	.04	0	0	SE	2.1	9	S	0:00	0	10	10									
14	64	46	55	+10	10	T	0.0	0	S	7.1	17	S	0:00	0	9+	9+									
15	69	52	60	+15	5	.06	0	0	S	8.4	24	S	0:47	8	9	8									
16	52	30	41	-4	24	.57	0	0	N	14.4	25	N	0:00	0	10	9+									
17	30	23	26	-19	39	.01	T	0	N	14.1	24	N	0:00	0	10	10									
18	42	27	34	-11	31	.80	T	0	W	7.8	21	W	4:50	47	4	6									
19	36	24	30	-15	35	0	0	0	N	6.0	14	N	9:18	90	3	1									
20	39	21	30	-15	35	0	0	0	SE	5.8	16	SE	0:31	5	9	7									
21	60	39	50	+4	15	.03	0	0	SSE	6.5	18	SE	3:12	31	8	8									
22	54	43	48	+2	17	.28	0	0	NE	5.5	18	SE	0:00	0	10	10								F	
23	71	54	62	+16	3	.18	0	0	SSE	11.5	24	SE	0:00	0	10	10									
24	67	24	46	0	19	5.14	0	0	NNW	14.2	26	N	0:00	0	10	10								T	
25	32	22	27	-19	38	.15	T	0	NNW	7.4	18	NW	0:00	0	10	10									
26	32	28	30	-16	35	.90	0	0	N	10.2	18	N	0:00	0	10	10									
27	52	30	41	-5	24	.46	0	0	SW	9.0	30	SW	7:09	68	3	5									
28	36	17	26	-20	39	T	T	0	NNW	14.9	29	N	0:35	6	9	6									
29	23	15	19	-28	46	T	T	0	N	17.6	31	N	0:00	0	10	8									
30	22	7	14	-33	51	.17	3.3	3	N	3.8	15	N	0:00	0	10	9+									
31	26	2	14	-33	51	0	0	2	SSE	3.3	17	S	9:03	86	2	4								F	
SUM	1523	951				8.46	3.3			279.2			65:24		252	239									
AVG	49.1	30.7								9.0			21		8.1	7.7									

TEMPERATURE DATA:

AVERAGE MONTHLY 39.9  
DEPARTURE FROM NORMAL -5.5  
HIGHEST 79 ON 9th  
LOWEST 2 ON 31st  
NUMBER OF DAYS WITH -  
MAX. 32° OR BELOW 6  
MAX. 90° OR ABOVE 0  
MIN. 32° OR BELOW 20  
MIN. 0° OR BELOW 0  
DEGREE DAYS (BASE 65°) -  
TOTAL THIS MONTH 780  
DEPARTURE FROM NORMAL +180  
SEASONAL TOTAL 1612  
DEPARTURE FROM NORMAL +88

PRECIPITATION DATA:

TOTAL FOR THE MONTH 8.46 IN  
DEPARTURE FROM NORMAL +6.07 IN  
GREATEST IN 24 HOURS 5.14 ON 24th  
SNOWFALL, SLEET AND HAIL -  
TOTAL FOR THE MONTH 3.3 IN  
GREATEST IN 24 HOURS 3.3 ON 30th  
GREATEST DEPTH ON GROUND 3 ON 30th  
BAROMETRIC PRESSURE:  
MONTHLY MEAN STATION 29.613 IN  
HIGHEST SEA-LEVEL 30.81 IN ON 29th  
LOWEST SEA-LEVEL 29.47 IN ON 3rd

WEATHER:

NUMBER OF DAYS -  
CLEAR (Scale 0-3) 4  
PARTLY CLOUDY (Scale 4-7) 3  
CLOUDY (Scale 8-10) 24  
WITH 0.01 OR MORE PRECIP 16  
WITH 0.10 OR MORE PRECIP 10  
WITH 0.50 OR MORE PRECIP 3  
WITH 1.00 OR MORE PRECIP 1  
DATES OF -  
HAIL 0  
SLEET 17, 18, 25  
GLAZE 10, 11, 12, 17, 18, 24, 25, 26, 27.

SYMBOLS USED IN COLUMNS 18-19

A-Hail  
BS-Blowing Snow  
DL-Distant Lightning  
D-Dust  
E-Sleet  
F-Fog  
H-Haze  
K-Smog  
L-Drizzle  
N-Sand  
R-Rain  
S-Snow  
T-Thunderstorm  
EL-Freezing Drizzle  
ER-Freezing Rain

Total precipitation 8.46 inches was greatest amount for any January in Dallas since 1913. Sunshine, 21% of possible, equals all time record for least amount of sunshine in any month. Severe ice storm, 24th to 27th, disrupted communications, electric lights and power, and severely damaged trees.

FIGURE A6. Entries on WB 1001C.

## A12400. FORM WB 1081

- \*A12410. PREPARATION. Form WB 1081 will be used at stations at which WB 1083 is not used in computing the height of the 850-mb. surface. Only one copy will be prepared unless additional copies are required locally.
- \*A12411. In lines 1-7, enter the data corresponding to items 1-7 respectively as required by the instructions in paragraph 7430. Entries in the columns of the form are to accord with the date and time of observation as indicated in the column headings.
- \*A12420. DISPOSITION. Completed WB 1081 forms may be destroyed after ninety days.

## A12500. FORM WB 1083 (REV. 1-1-49)

- \*A12510. PREPARATION. (See Figure A7.) Form WB 1083 (Revised 1-1-49) will be used at all second-order synoptic stations and certain other designated stations for recording and coding 3- and 6-hourly synoptic observations. The use of WB 1083 is optional at first-order stations taking only 3- and 6-hourly synoptic observations. Only one copy will be prepared unless additional copies are required locally. A moderately hard pencil will be used.
- \*A12511. Enter station name and date in the spaces provided. Note that the date corresponds to that of Greenwich Civil Time (See paragraphs 1404, 1405 of the Synoptic Code for conversion table from Local Standard Time to Greenwich Civil Time.). On the last day of the month, entries will be made on WB 1083 for all observations up to midnight Local Standard Time; beginning with the first observation at or following 0000 Local Standard Time, a separate WB 1083 will be started.
- \*A12512. When entries require the disposal of decimals, use the rule stated in paragraph 1508 of the Synoptic Code.
- \*A12513. Enter 6-hourly observations in columns headed 0030Z, 0630Z, 1230Z, 1830Z; enter 3-hourly observations in columns headed 0330Z, 0930Z, 1530Z, and 2130Z. Omit entries for observations or elements not regularly recorded. Enter slants to indicate missing data pertaining to an observation or element usually recorded.
- \*A12514. All entries in "Coded" column will include the number of digits indicated by the corresponding symbol. A dot following the symbol indicates an additional coded digit; e.g., "R. . ." indicates that four digits will be entered in the "Coded" column.

\* Revised  
Eff. 5-15-49

A12-15

\*A12515. If data are entered on the reverse side of the form, check the box at the bottom of the page entitled "Notes on Reverse Side".

\*A12520. **ROUTING.** Forward the completed forms for the month, Local Standard Time, on or before the fifth of the following month to the station designated by the Regional Director.

\*A12530. **ITEMIZED ENTRIES.** (Line, column, or group entries 1-61). All references in the following instructions are to the 1949 Synoptic Code unless otherwise specified.

WB Form 1083  
(Revised 1-1-49)

United States Department of Commerce, Weather Bureau  
ORIGINAL RECORD OF 3- AND 6-HOURLY SYNOPTIC OBSERVATIONS

Station: **JOHNSON CITY, COLORADO** Date (GOT) **JAN. 2, 1949**

Scheduled time of observation	0030Z (1830E)		0330Z (2230E)		0630Z (0130E)		0930Z (0430E)		1230Z (0730E)		1530Z (1030E)		1830Z (1330E)		2130Z (1630E)	
	Observed	Coded	Observed	Coded	Observed	Coded	Observed	Coded	Observed	Coded	Observed	Coded	Observed	Coded	Observed	Coded
(1) Observation began (LST)	1706M		2008M		2307M		0209M		0510M		0808M		1105M		1410M	
(2) Station Identification	III	999	III	999	III	999	III	999	III	999	III	999	III	999	III	999
(3) Dew-point (°F)	TdTa	41	44	44	46	50	54	61	61	57	57	57	57	57	57	57
(4) Total amount of clouds	N	10 8	X 9	X 9	X 9	X 9	10 8	10 8	10 8	10 8	10 8	10 8	10 8	10 8	10 8	10 8
(5) Direction of surface wind	dd	ENE 07	SSE 16	SE 14	SSW 20	SSW 20	S 18	SW 23	NW 32							
(6) Speed of surface wind	ff	5 04	4 04	7 06	14 12	12 12	7 06	15 13	21 18	22 19						
(7) Visibility	vv	7 56	3/4 06	3/8 03	3/16 01	2 1/2 20	8 64	10 80	15+ 81							
(8) Present weather	ww	02	58	58	51	10	02	80	01							
(9) Past weather	w	2	2	6	6	5	2	2	8							
(10) Sea-level pressure (mb)	PPP	173	156	112	015	088	125	173	227							
(11) Dry-bulb temperature (°F)	TT	47.4 47	44.8 45	45.1 46	50.3 50	54.3 54	62.0 62	64.7 65	52.1 52							
(12) Wet-bulb temperature (°F)	TT	44.3	44.5	45.0	50.0	53.9	61.3	60.0	44.5							
(13) Depression (Col. 11-12)		3.1	0.3	0.1	0.3	0.4	0.7	4.7	7.6							
(14) Amount of clouds whose height is given by "h"	Nc	10 8	X 9	X 9	X 9	X 9	6 5	7 6	8 6	3 2						
(15) Cloud types Sc, St, Cu, Cb	Ct	5														
(16) Height of cloud (ft)	h	16 4	X 0	X 0	X 0	X 0	6 2	23 5	25 5	45 6						
(17) Cloud types Ac, As, Ns	Om															
(18) Cloud types Ci, Cs, Cc	Cm															
(19) Direction of cloud	Dc	SE 3	X 9	X 9	X 9	X 9	X 9	S 4	W 6	NW 7						
(20) Pressure tendency	s	8	8	6	6	4	4	3	3	1						
(21) Amount of pressure change	pp	.040 14	.050 17	.100 34	.080 27	.040 14	.110 37	.130 44	.110 37							
(22) Amount of precipitation (6-hr)	RR	0		.03 03		.01 01		T 00								
(23) Time of precipitation	Rt			6		2		1								
(24) Depth of snow on ground	s	0		0		0		0								
(25) Special phenomena (general)	SsSg															
(26) Special phenomena (detailed)	*s*															
(27) Direction of waves	dw															
(28) Period of waves	Pw															
(29) Height of waves	Hw															
(30) Height of 850-mb surface	h <sub>850</sub>	494	490	479	470	474	500	512								
(31) Pressure tendency for 3-hr period ending 3 hrs ago	ss	5	8	8	6	8	3	3	1							
(32) Amount of precipitation (24-hr)	R24															
(33) Maximum temperature	TxTn	48.3 48.1		47.4 48.1		54.3 48.1		64.9 65.1								
(34) Minimum temperature	TnTn	45.2 43.1		44.0 43.1		44.3 44.1		53.6 44.1								
(35) Plain language data																

Computational Data

(36) Attached thermometer	72.0		71.5		74.0		75.5	
(37) Observed barometer	24.873		24.722		24.689		24.933	
(38) Total correction	-.130		-.129		-.133		-.134	
(39) Station pressure	24.743	24.695	24.593	24.515	24.556	24.670	24.799	24.910
(40) Temperature 12 hrs ago (°F)	43.8	46.2	45.2	46.1	47.4	44.8	45.1	50.3
(41) Current temperature (°F)	47.4	44.8	45.1	50.3	54.3	62.0	64.7	52.1
(42) Sum (Col. 40 and 41)	91.2	91.0	90.3	96.4	101.7	106.8	109.8	102.4
(43) Mean (Sum ÷ 2)	45.6	45.5	45.2	48.2	50.8	53.4	54.9	51.2
(44) Sea-level pressure (in.)	30.04	29.99	29.86	29.75	29.79	29.90	30.04	30.20
(45) Current temperature (°F)	47.4	44.8	45.1	50.3	54.3	62.0	64.7	52.1
(46) Current temperature (°F)	47.4	44.8	45.1	50.3	54.3	62.0	64.7	52.1
(47) Temperature 6 hrs ago (°F)	45.2	46.7	47.4	44.8	45.1	50.3	54.3	62.0
(48) Sum (Col. 45, 46, and 47)	140.0	136.3	137.6	146.4	153.7	174.3	182.7	166.2
(49) Mean (Sum ÷ 3)	47	45	46	48	51	58	61	55
(50) Correction from Table 9	+2	+2	+2	+3	+3	+4	+3	+3
(51) Algebraic sum (Col. 49 and 50)	49	47	48	51	54	62	64	58
(52) Filing time	1718	2016	2317	0216	0516	0818	1117	1416
(53) Observer's initials	FUL	TH9	S/S	TH9	S/S	FUL	TH9	S/S

Notes on reverse side

16-5000-1

FIGURE A7. Entries on WB Form 1083

LINE	OBSERVED	CODED
1. Observation began	Enter the time the observation was begun, in local standard time, followed by the time-zone indicator (E for Eastern, C for Central, etc.). Use 24-hour clock time, e.g., enter 6:00 P.M. as 1800.	
2. Station identification- iii	No entry	Enter assigned station number (paragraph 1801.1).
3. Dew point (°F.)- $T_d T_d$	No entry	Enter dew point temperature to the nearest whole degree unless dew point temperature is below 0°F., when a code figure will be entered as indicated in paragraph 1804.222.
4. Total amount of clouds- N	Enter total tenths of sky covered by clouds. Enter 0 if no clouds are present and the sky is not obscured, 1- if less than one tenth, and 9+ if more than nine tenths of clouds but with breaks. If sky is obscured by dust, fog, etc., enter X.	Select code figure from Table No. 2 in accordance with paragraph 1802.1.

LINE	OBSERVED	CODED																																				
* 5. Direction of surface wind- dd	Enter direction of surface wind to 16 points of the compass, e.g., NNW, SE. Omit entry if wind is calm.	Stations equipped with wind direction indicators calibrated in degrees will code direction to tens of degrees, e.g., 330° will be coded "33." Stations equipped with 9-light indicators only will select code figure from the following table:																																				
		<table border="1"> <thead> <tr> <th><u>Code Figure</u></th> <th><u>Direction</u></th> </tr> </thead> <tbody> <tr><td>00</td><td>Calm</td></tr> <tr><td>36</td><td>N</td></tr> <tr><td>02</td><td>NNE</td></tr> <tr><td>05</td><td>NE</td></tr> <tr><td>07</td><td>ENE</td></tr> <tr><td>09</td><td>E</td></tr> <tr><td>11</td><td>ESE</td></tr> <tr><td>14</td><td>SE</td></tr> <tr><td>16</td><td>SSE</td></tr> <tr><td>18</td><td>S</td></tr> <tr><td>20</td><td>SSW</td></tr> <tr><td>23</td><td>SW</td></tr> <tr><td>25</td><td>WSW</td></tr> <tr><td>27</td><td>W</td></tr> <tr><td>29</td><td>WNW</td></tr> <tr><td>32</td><td>NW</td></tr> <tr><td>34</td><td>NNW</td></tr> </tbody> </table>	<u>Code Figure</u>	<u>Direction</u>	00	Calm	36	N	02	NNE	05	NE	07	ENE	09	E	11	ESE	14	SE	16	SSE	18	S	20	SSW	23	SW	25	WSW	27	W	29	WNW	32	NW	34	NNW
<u>Code Figure</u>	<u>Direction</u>																																					
00	Calm																																					
36	N																																					
02	NNE																																					
05	NE																																					
07	ENE																																					
09	E																																					
11	ESE																																					
14	SE																																					
16	SSE																																					
18	S																																					
20	SSW																																					
23	SW																																					
25	WSW																																					
27	W																																					
29	WNW																																					
32	NW																																					
34	NNW																																					
6. Speed of surface wind- ff	Enter speed of surface wind in miles per hour. Enter "C" for calm.	Enter speed in whole knots, using Conversion Table B.																																				

LINE	OBSERVED	CODED
7. Visibility- VV	Enter visibility in statute miles and fractions, using intervals specified in Table 4.	Select code figure from Table 4 (Statute Miles).
8. Present weather- ww	No entry	Select code figure from Table 5 in accordance with paragraph 1803.2.
9. Past weather- W	No entry	Select code figure from Table 6 in accordance with paragraph 1803.3.
10. Sea-level pressure (mbs)- PPP	No entry	Enter sea-level pressure in tens, units, and tenths of millibars. (Paragraph 1804.1)
11. Dry-bulb temperature (°F.)- TT	Enter dry-bulb temperature to tenths of degrees, supplying minus signs as required.	Enter dry-bulb temperature to the nearest whole degree, unless temperature is 100°F. or higher, or less than 0°F., when a code figure will be entered in accordance with paragraph 1804.22.
12. Wet-bulb temperature (°F.)	Enter wet-bulb temperature to tenths of degrees, supplying minus signs as required.	No entry

LINE	OBSERVED	CODED
13. Depression	Enter difference between Lines 11 and 12.	No entry
14. Amount of clouds whose height is given by "h"- $N_h$	Enter tenths of sky covered by clouds whose height is given by "h." Enter "0" if there are no clouds at or below 8200 feet and the sky is not obscured; 1- if less than one tenth, 9+ if more than nine tenths clouds but with breaks. Enter "X" if sky is obscured at or below 8200 feet.	Select code figure from Table 2.
15. Cloud types Sc, St, Cu, Cb- $C_L$	No entry	Select code figure from Table 8 in accordance with paragraph 1805.2.
16. Height of cloud (ft.)- h	Enter height above ground of clouds at or below 8200 feet in accordance with instructions in paragraph 1805.3. Enter heights to the nearest 100 feet from 0 to 5050 feet and to the nearest 500 feet from 5051 to 8200 feet; enter all heights in hundreds of feet; e.g., 4000 feet as 40. Enter a dash if no clouds at or below 8200 feet are present. Enter "X" if height is unknown for reasons stated in paragraphs 1805.38 and 1805.39.	Select code figure from Table 9.
17. Cloud types Ac, As, Ns- $C_M$	No entry	Select code figure from Table 10 in accordance with paragraph 1805.4.

AI2-20

Revised  
Eff. 5-15-49

LINE	OBSERVED	CODED
18. Cloud types C <sub>1</sub> , C <sub>s</sub> , C <sub>c</sub> - C <sub>H</sub>	No entry	Select code figure from Table 11 in accordance with paragraph 1805.5.
19. Direction of cloud- D <sub>C</sub>	Enter direction of C <sub>M</sub> , C <sub>H</sub> or C <sub>L</sub> clouds to eight points of the compass, e.g., N, SW (paragraph 1806.2). Enter a dash when no clouds are present; X if direction is unknown or variable; and C if calm.	Select code figure from Table 12.
20. Pressure tendency- a	No entry	Select code figure from Table 13.
21. Amount of pressure change- pp	Enter to the nearest five thousandths of an inch the amount of pressure change during the past three hours.	Select code figure from Table 14. If the change exceeds 9.8 millibars (.290 inch), enter "99" with an asterisk and an additional group in Line 35 as instructed in paragraph 1806.47.

LINE	OBSERVED	CODED
22. Amount of precipitation (6-hr.)- RR	Enter total precipitation to nearest hundredth of an inch. Enter "0" if no precipitation has occurred in the past 6 hours. Enter "T" for trace if precipitation has occurred but 0.005 inch or less has fallen.	Select code figure from Table 15. If the 6-hourly amount of precipitation exceeds .99 inch, enter the hundredths of inches with an asterisk and report the number of whole inches in plain language in Line 35 as instructed in paragraph 1807.25. Omit entry if no precipitation has fallen in past 6 hours.
23. Time of precipitation- R <sub>t</sub>	No entry	Select code figure from Table 16 in accordance with paragraph 1807.3. Omit entry if no precipitation has fallen in past 6 hours.
24. Depth of snow on ground- s	Enter total depth of snow to the nearest whole inch. Enter "0" if none is on the ground. Enter "T" for trace if snow is on the ground in amounts of 0.5 inch or less.	Select code figure from Table 17 in accordance with paragraph 1807.4. Omit entry if no precipitation has fallen in past 6 hours.
25. Special phenomena (general)- S <sub>p</sub> S <sub>p</sub>	No entry	Enter special phenomena as instructed in paragraphs 1809.2 and 1809.3. If more than one special phenomena group is sent, enter additional groups in Line 35. Omit entry if no special phenomena are observed.
26. Special phenomena (detailed)- s <sub>p</sub> s <sub>p</sub>		

AL2-22

Revised  
Eff. 5-15-49

LINE	OBSERVED	CODED
27. Direction of waves- $d_w d_w$	No entry	Enter direction, period, and height of waves as instructed in paragraphs 1810.2-1810.4.
28. Period of waves- $P_w$		
29. Height of waves- $H_w$		
*30. Height of 850-mb. surface- $h_{85} h_{85} h_{85}$	No entry	Enter height of 850-mb. surface to nearest 10 geo-potential feet, omitting units digit (e.g., enter 5270 geo-potential feet as 527). (This datum is computed in Lines 45-51.)
31. Pressure tendency for 3-hour period ending 3 hours ago- $a_3$	No entry	Select code figure from Table 13.
32. Amount of precipitation (24-hour)- $R_{24} R_{24} R_{24} R_{24}$	No entry	Enter total 24-hour precipitation to the nearest hundredth of an inch, omitting decimal point. (Paragraph 1812.2) Omit entry if a trace or less has fallen during the past 24 hours.

LINE	OBSERVED	CODED
33. Maximum temperature- $T_x^T$	Enter to the nearest tenth of a degree the maximum temperature for the past six hours, supplying minus signs as required.	Enter the maximum temperature to whole degrees for the periods indicated in paragraph 1813.2, unless temperature is 100°F. or higher, or less than 0°F., when a code figure in accordance with paragraph 1813.23 will be entered.
34. Minimum temperature- $T_n^T$	Enter to the nearest tenth of a degree the minimum temperature for the last 6 hours, supplying minus signs as required.	Enter the minimum temperature to whole degrees for the periods indicated in paragraph 1813.3, unless temperature is 100°F. or higher, or less than 0°F., when a code figure in accordance with paragraph 1813.33 will be entered.
35. Plain language data	Enter record temperatures, city data, mean data, etc., in plain language (paragraph 2001-3). (These data are sent by first-order stations only.)	
36. Attached thermometer	Enter the temperature of the attached thermometer to the nearest 0.5°F. or C.	
37. Observed barometer	Enter the uncorrected observed reading to the nearest .001 inch.	
38. Total correction	Enter the sum of all corrections.	
*39. Station pressure	Enter the difference between lines 37 and 38 to the nearest .001 inch. If mercurial barometer is not read, enter station pressure from barograph.	

LINE	
40. Temperature 12 hours ago (°F.)	Enter to nearest tenth the temperature 12 hours ago (Line 11).
41. Current temperature (°F.)	Enter current temperature to nearest tenth (Line 11).
42. Sum (Columns 40 and 41)	Enter sum of lines 40 and 41.
43. Mean (Sum ÷ 2)	Enter mean obtained by dividing sum in line 42 by 2.
44. Sea-level pressure (inches)	Enter to the nearest hundredth of an inch sea-level pressure obtained from Pressure Reduction Tables.
45. Current temperature (°F.)	Enter current temperature to nearest tenth of a degree (Line 11).
46. Current temperature (°F.)	
47. Temperature 6 hours ago (°F.)	Enter to nearest tenth of a degree the temperature six hours ago (Line 11).
48. Sum (Columns 45, 46, and 47)	Enter sum of lines 45, 46, and 47.

LINE	
*49. Mean (Sum $\div$ 3)	Enter to the nearest whole degree the mean obtained by dividing the sum in Line 48 by 3.
50. Correction from Table 9	Enter the lapse rate and humidity correction obtained from Table 9 of the separate instructions issued stations computing these data.
51. Algebraic sum (Columns 49 and 50)	Enter algebraic sum of lines 49 and 50.
52. Filing time	Enter time of filing (LST). Use 24-hour clock time (e.g., enter 1:30 P.M. as 1330).
53. Observer's initials	Enter initials.
54-57. Miscellaneous notes	Enter times of beginnings and endings of fog, smoke, dust, glaze, frost, tornado, lightning, halos, and special and unusual phenomena. Enter estimated times in parentheses. Use abbreviations printed on form.
58-61. Notes on precipitation and thunderstorms	Enter character, intensity, and times of beginning and ending of precipitation and thunderstorms. Enter estimated times in parentheses. Use abbreviations printed on form.

CHAPTER A13. RECORDING INSTRUMENT FORMS

A13000. GENERAL

\*A13010. Except as authorized by the Regional Director, forward barograph, multiple register and thermograph records for the month to the WRPC not later than the second working-day of the following month. These records will include record forms for the last day of the month. Telepsychrometer records completed during the month will be forwarded to the WRPC not later than the second work-day of the following month. First-order stations will evaluate automatic records in accordance with the following instructions.

A13100. BAROGRAPH FORMS WB 1068 - 1068D (See Figure A8)

A13110. CHANGING FORMS. Forms will be changed on 4-day barographs on the 1st, 5th, 9th, 13th, 17th, 21st, 25th, and 29th of the month. Forms will be changed on weekly barographs on the 1st, 8th, 15th, 22nd, and 29th of the month. The change will ordinarily be made at the time of the 1830 G.C.T. 6-hourly observation. If for any reason the form is not changed at the accustomed time, it will not be changed before the succeeding 3-hourly pressure tendency observation at stations observing these data, since an unbroken record is required for the observation. At other stations, the forms will be changed as soon as practicable.

\*A13120. PREPARATION OF FORMS. Before placing a form on the barograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

1. In the spaces provided, enter the name of station (airport or city office), meridian of local standard time, and, on the first of the month, the time that the pen is touched.
2. Across the top of the form enter the date of each day's record on the noon line.
3. The horizontal lines appropriate to each whole inch of pressure are identified by two zeros printed on the form, which represent pressure to tenths and hundredths. Along each noon line and immediately preceding the printed zeros, enter the appropriate value of each whole inch of pressure in tens and units (e.g., 28.).

4. Above the point where the trace will begin, enter the time and the current station pressure obtained from the mercurial or precision aneroid barometer, or the altimeter setting indicator.

\*A13121. After removing the forms, proceed as follows:

1. Enter the time of any adjustment, and an arrow to indicate the point of adjustment.
2. Above the ending of the trace, enter the time of removal and the current station pressure obtained from the mercurial or precision aneroid barometer, or the altimeter setting indicator.
3. Above the time-check lines, enter the corrections from column 65 of WB 1130B or column 60 of WB 1001B. Enter corrections in red ink.
4. When adjustment for pressure is made, enter the barometer (mercurial, etc.) reading and corrections applying to both the preceding and following record, e.g.,  $-.05/.00$ , above the break in the trace.



## A13200. CEILOMETER RECORD

A13210. Enter the station name, month, year and time of removal on each expended roll of recorder paper. Expended rolls will be retained at the station for a period of five months, after which they may be destroyed. If a portion of the record is torn or otherwise detached from the roll, these data will be entered on all separate portions on the roll.

## A13300. HYGROGRAPH FORMS WB 1074 and 1074A

A13310. Evaluate hygrograph records according to local requirements. If the hygrograms are unnecessary for local use, they may be destroyed. See Thermographs (Par. A13610) for evaluation of hygrothermograph records.

## A13400. MULTIPLE REGISTER FORMS WB 1017 and 1017B (See Figure A9)

\*A13410. GENERAL. Use WB 1017B at stations where the forms are changed at midnight, and WB 1017 at stations where forms are changed at noon. On Sundays and holidays, WB 1017 may be changed one or two hours earlier than usual. After changing forms, check for proper alignment of the form by depressing the wind direction pens and noting the alignment of the resulting trace with respect to the printed reference lines of the form. At stations where 24 record observations are taken daily, data for hourly wind speed and direction, and odometer (anemometer dial) readings will not be entered on Form 1017 or 1017B. However, maximum 5-minute and fastest single mile wind speeds will be entered at all stations. When the tipping-bucket gage is not the official gage, the precipitation entries required in Para. A13411 and A13440-43 will not be made. All entries will be made in pencil unless red ink is specified. Station name and date will be stamped in the spaces provided.

\*A13411. MISSING RECORD. Whenever any portion of the record is missing or incorrect, enter appropriate explanatory notes. To prevent loss of record, avoid changing the charts during periods of excessive precipitation or high winds. Whenever the period of missing record is less than 24 hours, hourly data will be interpolated and entered in parentheses. Whenever the record is missing for 24 hours or more, enter the station name, date, odometer readings, and precipitation measurements (stick) on a blank form and forward the form with the month's records.

A13420. WIND. Wind movement and direction will be entered in accordance with the following instructions.

A13421. HOURLY WIND DIRECTION. Determine the prevailing wind direction for each hour and enter to eight points of the compass midway between the hour lines. The prevailing direction is the direction recorded most frequently during the hour. When two or more directions are recorded an equal number of times, select the prevailing direction on the basis of adjacent directions (See paragraph A12104). Enter "DI" for "direction indeterminate", when the uncorrected hourly wind speed is less than 1 mile per hour.

A13422. HOURLY WIND MOVEMENT (UNCORRECTED). Enter the total number of miles for each hour above the trace and near the end of the hour. As an aid in counting miles of wind, some anemometers have a 10-mile marker which represents two miles. If a contact is begun but not finished in the same hour, credit the mile of wind to the hour in which contact was begun. However, in the case of the 10-mile marker, credit one mile of wind to the hour in which the contact is begun and another to the hour in which the contact ends.

A13422.1. Enter the total uncorrected movements of the wind for each six hours and for the day in the spaces near the left margin.

A13423. MAXIMUM AVERAGE 5-MINUTE SPEED. Determine the uncorrected maximum average five-minute speed and its prevailing direction for the period midnight to midnight. Enter the data immediately above the corresponding trace, e.g., MAX-31-NW. To obtain an uncorrected speed, multiply by 12 the number of miles and tenths of miles recorded in five minutes. To select the proper five-minute interval, use a scale graduated in one-minute intervals or a draftsman's dividers, set to equal a five-minute interval.

A13424. FASTEST MILE. Enter the uncorrected fastest mile and its direction immediately below the corresponding trace, e.g., FAST-39-NE. A scale graduated in divisions corresponding to various wind speeds is used to select the fastest mile. In using this scale, find the division whose length most nearly corresponds to the distance between the mile marks and read the speed from the scale.

\*A13425. TOTAL WIND MOVEMENT FROM ODOMETER TYPE ANEMOMETERS. On the first day of each month and on each Monday, weather permitting, read the odometer (anemometer total wind dial) at noon, local standard time, and enter the actual odometer reading in the spaces provided. Additional readings will be taken and recorded as often as necessary to indicate the total wind movement during periods of incomplete records. To obtain the total wind movement from an odometer type (totalizing) anemometer, subtract the preceding reading of the odometer from the current reading. When the reading of the odometer at the end of the period is less than the reading at the beginning, add 990 to the

lesser reading and subtract the higher reading to obtain the total wind movement, e.g., the current odometer reading is 91, previous was 950; hence,  $91 + 990 = 1081$ ;  $1081 - 950 = 131$ , the total wind movement.

\* A13425.1. Compare the total wind movement from the odometer with the weekly total from the record. Difference must be due to errors in computation or missing record. In the latter case, estimate hourly values as indicated in paragraph A13411.

\* A13425.2. Whenever the anemometer is changed, enter a note on the margin of the form, giving the date and time of the change, the odometer readings, identifying numbers and types of both instruments.

\* A13430. SUNSHINE. Sunshine is indicated by a zig-zag trace on the record. Steps on this trace occur at one-minute intervals with the cycle completed in ten minutes. For each hour between sunrise and sunset, (a) count the number of steps (minutes of sunshine) in each hour and enter the minutes above the trace midway between the hour time lines, (b) if sunshine is observed but not recorded, include the minutes of observed sunshine in the hourly entry, (c) if the automatic record is incomplete or is known to be incorrect and no visual observation of sunshine has been taken, enter estimated minutes of sunshine in parentheses. During hours between sunrise and sunset when sunshine has not occurred, enter the figure "0".

A13431. Enter check marks on the sunshine trace indicating the exact time of sunrise and sunset. Indicate the character of sunrise and sunset just above the check, e.g., "clr", "cldy", etc.

\* A13432. Although both sunshine and precipitation are recorded on the same trace, the uniformity of the steps in the sunshine trace should distinguish it from a trace that represents precipitation. If both sunshine and precipitation occur almost simultaneously, interpret the record with the aid of observed data and enter appropriate notes.

\* A13440. PRECIPITATION. Precipitation is indicated by a zig-zag trace on the record. Each step on this trace indicates 0.01 inch of precipitation, with one complete cycle representing 0.10 inch. Hourly recorded amounts will be corrected to agree with stick measurements. Enter a caret "^" in red ink to indicate the addition, and an "x" to indicate the deletion, of 0.01 inch. Enter the corrected hourly amounts of precipitation in red ink above the trace and midway between the hour time lines.

A13441. Enter a check mark "✓" to indicate the time of beginning and a reverse "↘" to indicate the ending of precipitation, preceded by the letters "B" and "E" respectively. If these times are doubtful, enter the checks in parentheses. When precipitation is occurring at the time of the observation, make a pencil check on the precipitation trace to indicate the time of emptying the gages.



A13442. Enter 6-hourly amounts of precipitation, as determined both from the uncorrected precipitation trace and the stick measurement, in the block captioned "Precipitation at Time of Observation". Enter also the time of the precipitation measurement.

A13443. See paragraph A13432 for distinguishing the precipitation trace from sunshine.

### A13500. TELEPSYCHROMETER RECORDS

\*A13510. Each day, stamp the month, date and year on the extreme right side of the form near the noon time line. At the time the form is removed from the recorder, enter the station name and the dates of beginning and ending the record at the end of the traces and approximately midway between the margins of the form. Beneath the station name and near the end of the traces, identify the ordinates of the wet-bulb depression and dry-bulb scales by labeling them in increments of 10°F. Identify each set of labels as "1-dry bulb" and "2-depression".

### A13600. THERMOGRAPH AND HYGROTHERMOGRAPH FORMS

\*A13610. CHANGING FORMS. Forms will be changed on thermographs at 0800, local standard time, or as soon thereafter as practicable. Forms will be changed on seven-day thermographs (Forms WB 1072, 1072-A, 1076 and 1076-A) and hygrothermographs (Forms WB 1072-D, 1074-B and C) on the 1st, 8th, 15th, 22nd, and 29th of the month.

A13620. PREPARATION OF FORMS. Before placing the forms on the thermograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

1. In the spaces provided, enter the name of station (airport or city office), meridian of local standard time, and, on the first of the month, the time that the pen is touched.
2. Across the top of 7-day forms and on each noon line, enter dates of the record.
3. Above the point where the trace will begin, enter the time the form is to be placed on the instrument.

A13621. After removing the forms, proceed as follows:

1. Enter the time of any adjustment, an arrow indicating the point of adjustment, and the instrumental reading if adjustment for other than time has been made.
2. Above the ending of the trace, enter the time of removal.
3. Above the time-check lines and the times of the daily maximum and minimum temperatures, enter, as corrections, the differences, with the proper sign prefixed, between (1) the thermograph temperature and the 6-hourly dry-bulb temperatures and (2) the thermograph temperature

and the daily maximum and minimum temperatures. Enter corrections in red ink. E.g., maximum temperature, from column 66 of WB 1130B, "66° F."; maximum temperature, from thermograph trace, "68° F."; correction entered on the thermograph "-2".

#### A13700. WEIGHING GAGE FORMS (See Figure A10)

- \*A13710. GENERAL. Weighing gage forms will be evaluated and hourly precipitation amounts entered at first-order stations if the weighing gage is the official precipitation measuring gage, i.e., it is shielded and equipped with 24-, 12-, or 6-hour gears.
- \*A13720. CHANGING FORMS. Forms will be changed on 24-, 12- or 6-hour weighing gages on the first of the month, and on each Monday, Wednesday, and Friday. The change will ordinarily be made at the time of the 1830 G.C.T. 6-hourly observation. Empty the bucket when the form is changed, unless the bucket is charged with calcium chloride, in which case the bucket is emptied only if it is full. The bucket will be recharged at this time, if necessary, in accordance with seasonal practice, (see paragraph A4033.1 ).
- \*A13730. PREPARATION OF FORMS. Enter the following data with typewriter, rubber stamp, or pen and ink:
  1. Enter station name (airport or city office ).
  2. In the spaces provided, enter time, local time zone indicator and date form is placed on and removed from the gage.
- \*A13740. EVALUATING FORMS. After removing the form from the gage, enter hourly amounts of precipitation in inches and hundredths midway between the hour lines. When precipitation occurs in amounts of 0.005 inch or less, enter "T". When no precipitation occurs, make no entry. Be sure that the total hourly amounts equals the total rainfall registered on the gage.
- \*A13741. Enter a check "✓" to indicate the time of beginning, and a reverse check "↘" to indicate the ending of precipitation, preceded by the letters "B" and "E" respectively.
- \*A13750. MISSING RECORD. Whenever any portion of the record is missing, enter appropriate explanatory notes. During a period of missing record, hourly data will be interpolated if possible and entered in parentheses.

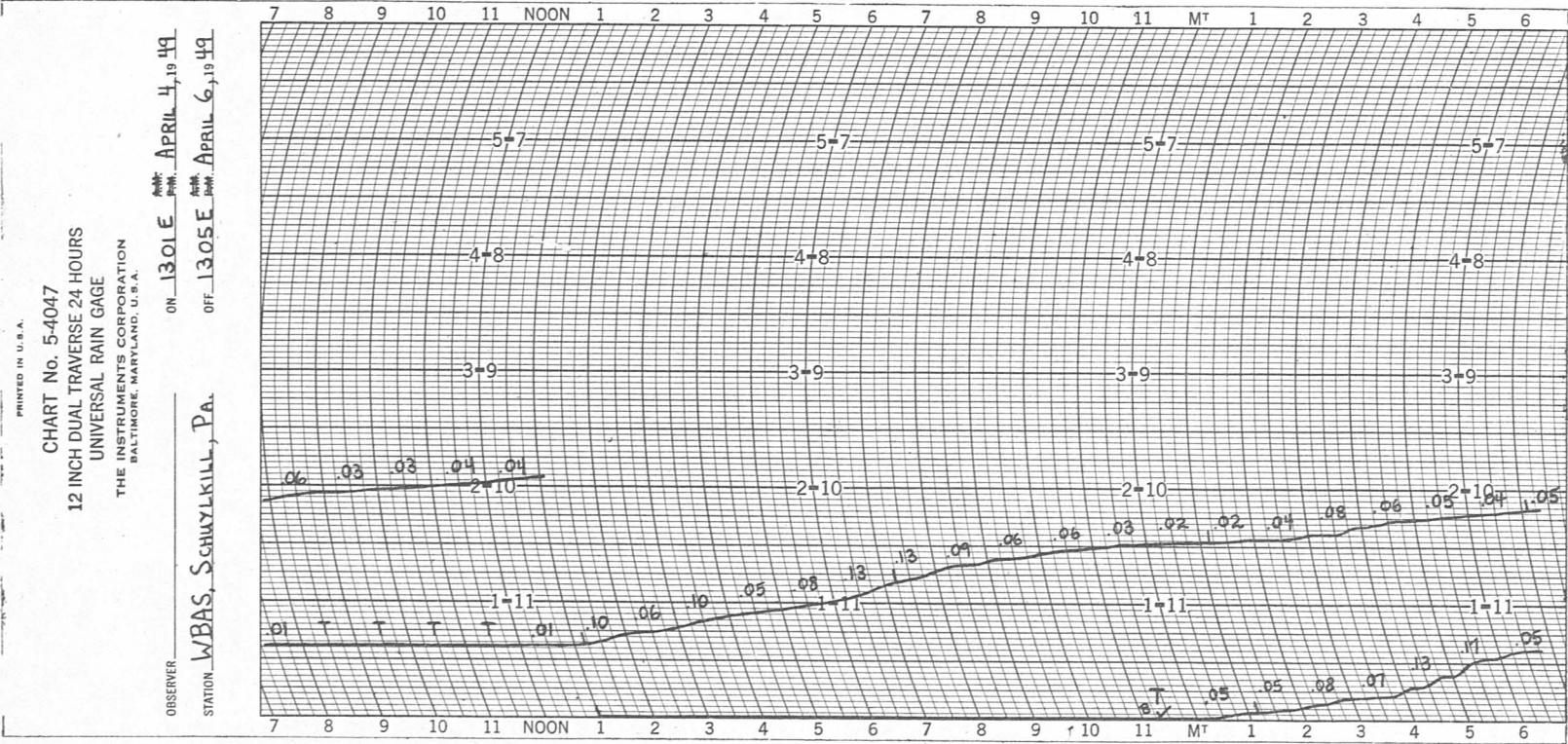


FIGURE A10. Weighing Cage Chart. Evaluated at stations where the weighing gage is used for official precipitation measurements.

CHAPTER Al4. VERIFICATION OF FORMS

Al4100. AT ORIGINATING FIRST-ORDER STATIONS

\*Al4110. All entries on observational records prepared at first-order stations will be verified by someone other than the original observer, as soon as practicable after the observation is taken. In addition, prior to mailing the forms, the Official in Charge or a designated assistant will review all such forms for completeness and general compliance with instructions.

Al4200. AT FIRST-ORDER VERIFYING STATIONS FOR FORMS PREPARED  
AT SECOND-ORDER STATIONS OTHER THAN CAA STATIONS

\*Al4210. Observational records from second-order stations other than CAA stations will be verified at first-order verifying stations as follows:

1. Verify every fifth observation as completely as possible.
2. Scan the remaining observations for consistency and general compliance with instructions (noting marked departures between consecutive values of sea-level pressure, altimeter setting, dew point, etc.).
3. Review all such forms for completeness (station name, date, etc.).

Al4300. CORRECTING RECORD FORMS

\*Al4310. MAGNITUDE OF ERRORS. Corrections to recorded data are not required unless the magnitude of errors (the difference between the observer's and verifier's evaluations) exceeds:

1. 0.01 inch (0.3 mb) in station pressure and reduced pressures (sea-level pressures and altimeter settings).
2. 1.0°F. in dew point.
3. 2% in relative humidity.

- \*Al4320. PREPARATION AND ROUTING OF CORRECTIONS TO WEATHER RECORDS, FORM WB 5066. Each month, WRPC's and first-order verifying stations will prepare WB 5066 in quadruplicate and route them monthly to stations preparing Forms WB 1001B and C, 1083, or 1130, even though no discrepancies are observed.
- \*Al4321. PREPARATION. (See Figure All.) Enter the Regional Office address, title for signature by the Regional Director, and name and address of the verifying station in the spaces provided if the form is prepared for signature at the Regional Office (see paragraph Al4322). Otherwise, enter the verifying station address, prepare the form for signature by the Official in Charge and omit entry in the space "Prepared by ". Enter additional data in accordance with paragraphs Al4321.1 - .61, except that on forms addressed to first-order stations at which punched cards are prepared, omit the entries indicated in paragraph Al4321.1 - .4 pertaining to forms WB 1130A, B, or 1101B (see paragraph Al4322).
- \*Al4321.1. In the "Form Number, Date and Time" column, enter the WB numbers of forms apparently requiring correction together with the dates and times of the corrected data. One entry of form number will suffice for consecutive entries pertaining to the same form.
- \*Al4321.2. In the "Data and Reference" column, enter identification and reference data (see figure All).
- \*Al4321.3. In the "Recorded" column, enter the uncorrected data.
- \*Al4321.4. In the "Should Be-" column, enter the apparent correction.
- \*Al4321.5. The "Observer's Initials" column is left blank for use by the observers responsible for the apparent errors.
- \*Al4321.6. Under "Remarks" enter appropriate reference to instructions and comments concerning the appearance and general quality of the cards and forms.
- \*Al4321.61. In addition, WRPC's will enter data pertaining to:
1. Improper punching of the "WBAN Transmittal and Inventory" Card (No. 7).
  2. Inventory obviously in error.
  3. Missing or duplicate punched cards.
  4. Cards punched off column.
  5. Holes improperly, or not clearly, punched.
  6. As separate entries, the total number of observational and the total number of punching discrepancies for the

W. B. Form 5066

UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU

Weather Bureau Regional Office  
Box 4718  
Atlanta 2, Georgia

Date April 12, 1949

Mr. John Doe  
Airway Weather Observer  
Doeville, Alabama

**MEMORANDUM**

WBAS, Montgomery, Ala.  
(Prepared by)

**Corrections to Weather Records**

In verifying forms from your station for March, 1949, corrections were made as set forth below. Each correction should be checked by the person who made the record or summarization. Please correct your retained records accordingly, being especially careful to include all resulting changes. The original and carbon should be initialed by the observers whose records have been corrected. The original will be signed by the Official in Charge and returned within 5 days after receipt to the office from which this memorandum was received. The carbon copy will be retained in the station files.

FORM NUMBER DATE AND TIME	DATA AND REFERENCE	RECORDED	SHOULD BE-	OBSERVER'S INITIALS
<u>1150</u> 05/1450	Col. 6 - Obstructions to Vision (Haze recorded 1350 and 1530. Visibility recorded 6 miles - Reference Circ. N., para. 11106.)	Omitted	H	
07/1550	Line 65 - Station Pressure	29.652	29.732	
25/1650	Col. 4 - Sky(Ref. Circ. N, Table 24, Item 5b.)	☉☉	☉☉	
26/1350	Col. 47 - Max. Temp. - 6-hourly observation (Dry-bulb reading at 1230, 65.4 - Ref. Circ. N, para. 11447.)	63.9	65.4	
28/0730	Col. 48 - Min. Temp. - 6-hourly observation (Dry-bulb reading at 0530, 49.0)	50.2	49.0	

REMARKS: Station name and date omitted from 1150A and B on 2nd, 11th, and 29th.

Date .....

REGIONAL DIRECTOR

All retained records have been corrected or noted on the reverse side.

\*A14322. ROUTING. The original and one copy of WB 5066 will be sent to observing stations either directly, or through the Regional Office, in accordance with Regional Office instructions, except that in the case of CAA observing stations, the forms are invariably routed through the Regional Office. One copy will be sent to the Area Training Office and one will be retained. First-order stations' punched cards which are in error (either punching or observational errors) will be attached to the original copy with the correct data clearly indicated, thus eliminating the necessity for itemizing the observational discrepancies. However, for CAA and other second-order stations, the observational errors will be itemized on the forms as required by paragraphs A14321.1 - .4.

\*A14330. FILING OF PUNCHED CARDS AND CORRECTIONS TO WEATHER RECORDS, FORM WB 5066. Upon receipt of returned punched cards (at first-order stations only) and copies of WB 5066, all copies of WB 5066 will be initialed by the observers responsible for the errors or, in the absence of the observer, by the Official in Charge. The Official in Charge, Chief Communicator (or designated assistant) will sign the original and forward in accordance with the instructions on it. The carbon copy and the punched cards (if returned) will be retained until inspected by a Regional Office representative. After inspection, cards and forms retained for more than six months may be destroyed. Verifying stations receiving completed forms will forward them at monthly intervals to the Regional Office for retention in the permanent files.

U. S. DEPARTMENT OF COMMERCE  
Charles Sawyer, Secretary  
*US* WEATHER BUREAU  
F. W. Reichelderfer, Chief

*Circ. N. 6<sup>th</sup> ed. Chap. 15*

MANUAL OF  
RADAR METEOROLOGICAL  
OBSERVATIONS



~~73492~~

Washington, D. C., August 1, 1949

## CHAPTER A15. RADAR METEOROLOGICAL OBSERVATIONS.

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## CHAPTER A15. RADAR METEOROLOGICAL OBSERVATIONS

A15010. GENERAL. Radar (radio direction and ranging) equipment consists essentially of a directional radio transmitter and a radio receiver that picks up the transmitted energy reflected by meteorological and non-meteorological phenomena. The types of radar equipment commonly used for meteorological observations employ a wave length of 3 cm. or 10 cm. The received impulses are presented in typical patterns upon an oscilloscope (termed "scope" in these instructions). The search for meteorological phenomena is termed "scanning." The reflected energy as presented on the scope is termed an "echo." Echoes are evaluated in terms of range, or distance from the station; azimuth bearings; intensity; tendency; height; width; and direction and speed of movement. These data are entered upon forms and coded either in the modified plain language RAREP code used at land stations, or the standard RAREP code used at ocean stations.

A15011. It should be noted that most radar scopes now used for weather search are calibrated in nautical miles. Conversion to statute miles prior to entry on the forms will therefore be required in these cases.

A15012. Radar equipment assists the surface observer to evaluate meteorological situations within the range of the set. Limitations of the equipment must be understood when evaluating and using radar data. Certain forms of precipitation and lithometeors may be detected by radar but wind and pressure systems associated with tornadoes, hurricanes, and thunderstorms cannot be detected. Correlation of the radar indications with the existing synoptic situation must therefore be carefully done. Furthermore, the absence of radar indications will not justify the inference that precipitation is not occurring, for water on the radar dome and precipitation may exclude indications of more distant precipitation areas, especially if 3 cm. radar is used.

A15013. The following paragraphs contain instructions for evaluating the echoes observed on the scope and for entering data on Form 3200A, "Radar Weather Observations," and Form 3200B, "Marine Radar Weather Observations." Most of the material in this section applies to Form 3200A. Observers aboard ocean station vessels will follow these instructions to the extent that they are applicable to Form 3200B. Additional instructions for entry of data not directly bearing on the observation are included in Section A15<sup>4</sup>00, together with instructions for disposition of the completed forms.

A15014. The Central Office is interested in obtaining photographs, drawings or sketches of unusual echoes, especially those of precipitation areas associated with hurricanes, frontal systems, tornadoes and thunderstorms. The following suggestions are offered to personnel who wish to attempt to photograph the radar scope:

- (1) Use fast film, similar to Kodak Super XX or Agfa Super Pan Press.
- (2) Mount the camera on a tripod or other firm mount as close to the scope as the camera can be accurately focused.
- (3) Exclude as much extraneous light as possible from the camera lens.
- (4) Make a time exposure, using an aperture of F4.5 or F5.6. The duration of the time exposure should be the exact number of seconds required for one complete revolution of the radar antenna.

The Central Office will be glad to develop the film and return it with prints to the photographer. The material will be most useful if a complete airway observation, taken at the time of the echo, is forwarded with the film or drawing. All material should be identified with reference to the exact time and date of occurrence, location of the observing station, type of radar equipment, range setting and orientation.

#### A15100. OBSERVATION SCHEDULE

A15110. GENERAL. Radar equipment is a valuable observational facility that will be used to the greatest possible extent whenever echoes are observed on the scope, and especially when hurricanes and other disturbances of unusual severity are forecast or reported in the vicinity. The scope will be observed for a minimum of three minutes. After echoes have been initially detected, the equipment will be maintained in operating or standby position until echoes are no longer observed. Unless otherwise specified, "echoes" as used in these instructions will refer to those having their origin in meteorological phenomena.

A15120. TIME OF OBSERVATIONS. Depending upon the prevailing meteorological situation, observations will be taken as follows:

1. (a) Land stations - at 0110 GCT and every three hours thereafter.
- (b) Ocean stations - immediately after each three-hourly observation.

2. In addition to (1) above, when echoes are observed, and when frontal activity or precipitation is occurring or forecast, observations will be taken at ten minutes past each hour.
3. In addition to (1) and (2) above, additional observations will be taken when:
  - (a) Echoes are noted on a previously clear scope.
  - (b) Speed of movement, after increasing by twice or more since the previous observation, equals or exceeds thirty miles per hour.
  - (c) Direction of movement changes by  $45^{\circ}$  or more since the previous observation.
  - (d) Scattered echoes become a solid line or a solid line changes to scattered echoes.
  - (e) The scope becomes clear.

#### A15200. PREPARATION OF RADAR FOR USE

A15210. GENERAL. The radar equipment will be turned on and operated in accordance with instructions appropriate to its type. The following instructions concern adjustments of the controls and evaluation of scope patterns to secure optimum performance for weather search.

A15220. TUNING PROCEDURE. Direct the antenna by manual control to a known ground obstruction that will return an echo. Adjust the antenna in azimuth and elevation for maximum return, and reduce the gain of the receiver until the echo is just discernible on the scope. This point is termed the "threshold level." Turn the A.F.C.-manual switch (automatic frequency control) to the manual position. Retune the receiver and reduce the gain as necessary to maintain the signal at the threshold level. Turn the A.F.C.-manual switch to the A.F.C. position. If an increase in echo intensity is noted, repeat the above procedure. When no difference is noted, the equipment is correctly tuned, and the switch will be left in the A.F.C. position while taking the observation. Any decrease in signal strength when the switch is turned from manual to A.F.C. indicates malfunctioning of the equipment, which will be reported immediately to the technician.

A15221. After adjustments have been made in accordance with the previous paragraph, increase the gain of the receiver to as high a point as is consistent with prevailing interference. Tilt the antenna to about  $3^{\circ}$  above the horizon or to an angle that yields the best results for the station at the range being used.

## A15300. DETECTION AND EVALUATION OF ECHOES

A15301. GENERAL. A map of permanent obstructions through 360° around the station will be prepared to aid in distinguishing echoes of meteorological from those of non-meteorological origin. It is recommended that a transparent insert, upon which are plotted echoes of all permanent obstructions in terms of azimuth and range, be constructed to fit over the face of the scope. One insert should be made for each range.

A15302. SCANNING. Scan all ranges, starting with the longest, through several angles of antenna tilt during each observation. To obtain the most accurate and the best defined presentation of an echo, use the shortest range which will include it.

A15303. SPURIOUS ECHOES. Spurious echoes may occasionally be received when meteorological conditions are such that the normal range of the ground pattern is greatly extended. This condition is often associated with inversions and is manifested by echo patterns not typical of the synoptic situation. Spurious echoes will be noted on Forms 3200 but will not be transmitted.

A15304. CHARACTER. Classify the echoes in accordance with the following list and enter the corresponding contraction on Form 3200A.

<u>Character</u>	<u>Contraction</u>
Scattered echoes	SCTD
Solid echo	SLD
Line of scattered echoes	LINE SCTD
Solid line of echoes	SLD LINE
Spiral band	SPRL BND

A15305. POSITION. The shape and size of each echo will be evaluated in terms of range, or distance from the station, and azimuth bearings. To facilitate observing in these terms, the echoes will be visualized in one of the typical patterns:

- (1) Azimuth and range of ellipse pattern (see Figures A12 and A13)
- (2) Azimuth and range of circular pattern (see Figures A14 and A15)
- (3) Azimuth and range of combinations of individual echoes (see Figures A17 and A18)
- (4) Azimuth and range of spiral bands (see Figures A19 and A20)

The echoes will be evaluated in terms of whichever pattern fits best. Each pattern is discussed below. After the azimuth and range have been observed in accordance with the following instructions, enter the data on Form 3200A under the captions Azimuth and Range. Enter azimuth to the nearest ten degrees and range to the nearest whole statute mile. The azimuth and associated range will be entered in adjacent columns. As many additional data as are necessary will be entered similarly.

A15305.1. ELLIPSE. The scope pattern will be evaluated in terms of an ellipse when the major axis (length) through an echo or group of echoes is two or more times the minor axis (width), provided that the distance between adjacent echoes in a group is the same as or less than the distance through the largest echo.

A15305.11. Read the azimuth, and corresponding range, of lines extending from the center of the scope to each end of the major axis.

A15305.2. CIRCLE. The scope pattern will be evaluated in terms of a circle when an echo or group of echoes is so situated that the major axis could lie in more than one position through the area, provided that the distance between adjacent echoes in a group is the same as or less than the distance through the largest echo.

A15305.21. Read the azimuth and corresponding range of a line extending from the center of the scope to the center of the circle.

A15305.22. When precipitation at the station causes a bright, diffuse echo that completely covers the central portion of the scope, make range readings to the edges of the echo at several points. No azimuth readings are required. The range values will not be entered on Form 3200A, but will be used for a later determination of the width of the area (see Figure A16)

A15305.3. INDIVIDUAL ECHOES. If, in a group of echoes, the distance between adjacent echoes is greater than the distance through the largest echo, the echoes will be described individually. (see Figure A17)

A15305.31. When an individual precipitation area is the same size as, or smaller than, the width of the radar beam, the echo will appear as a short line. In this case, the major and minor axes will not be determined. The azimuth and range of the echo will be reported in terms of the azimuth and range of the center of the echo with respect to the station (see Figure A18)

A15305.4. SPIRAL BANDS. Echoes reflected from precipitation areas associated with typhoons and hurricanes often approximate spiral bands. No attempt should be made to classify these echoes as ellipses or circles. Rather, azimuth and range readings will be recorded for as many points (usually at least three) on the center line of the echo as

are necessary to define its extent accurately. When multiple bands exist, separate azimuth and range readings will be recorded for each band (see Figures A19 and A20)

A15305.41. Information pertaining to the eye of the storm will be reported in remarks. (See paragraph A15312.2.)

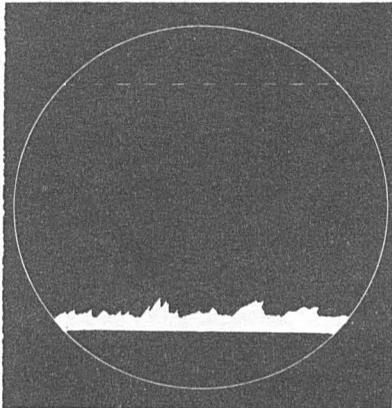
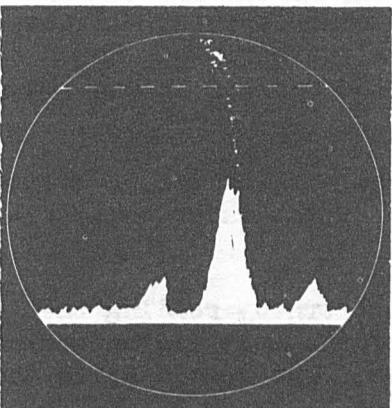
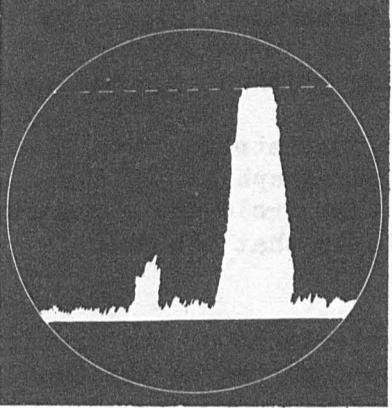
A15306. INTENSITY. Observations of intensity will be made only at stations equipped with 10 cm. radar. Whenever available, an A-scope will be used to observe intensity. When an A-scope is not available, intensity will be estimated from careful observation of the PPI scope.

A15306.1. Enter on Form 3200A, under the caption "Intensity," the appropriate contraction selected from the following list:

<u>Intensity</u>	<u>Contraction</u>
Weak	WK
Moderate	MDF
Strong	STRG

A15306.2. Use the following table to relate the appearance of the A-scope to the intensity.

TABLE A6 - RELATION OF THE APPEARANCE OF A-SCOPE TO INTENSITY

Appearance of A-scope	Intensity
 <p>Echo can be detected at or near the noise level.</p>	<p>Weak if range is less than 50 miles. Moderate if range is more than 50 miles.</p>
 <p>Echo easily distinguished above noise level but fails to reach or exceed saturation.</p>	<p>Moderate if range is less than 50 miles. Strong if range is more than 50 miles.</p>
 <p>Echo completely saturates scope.</p>	<p>Strong if range is more than 20 miles. Moderate or strong if range is less than 20 miles.</p>

A15307. TENDENCY. The tendency will be based upon consecutive observations of intensity. Enter on Form 3200A, under the caption "Tendency," the appropriate contraction selected from the following list:

<u>Tendency</u>	<u>Contraction</u>
Increasing	INCRG
Unchanging	NO CHG
Decreasing	DCRG
Slowly	SLOLY
Rapidly	RPDLY

A15308. WIDTH. The width of scope patterns will be described in terms of the diameter of a circle, the length of the minor axis of ellipse, or the mean width of spiral bands, whichever is appropriate. Enter the width to the nearest whole statute mile under the caption "Width" on Form 3200A.

A15308.1. The width of scope patterns, when the size of the precipitation area is equal to, or less than, the width of the radar beam, will not be recorded.

A15308.2. Determine the width of a circular pattern by reading the range of the nearest point of the circle and of the most distant point. Subtract the nearer from the more distant value. The remainder is the width.

A15308.3. When the minor axis of an ellipse is parallel or nearly so to a radial line from the center of the scope, determine the width similarly to that of a circle. Otherwise, estimate the distance by comparison with the distance between range markers. (see Figure A13) Note that the minor axis is equal to the maximum width of the ellipse.)

A15308.4. When a roughly circular bright echo completely covers the central portion of the scope (as described in paragraph A15305.22), the width will be reported as the diameter of the circle and a remark will be added at the end of the report to indicate that the echo is centered at the station.

A15308.5. The width of the spiral bands characteristic of the precipitation areas associated with hurricanes will be reported as the mean width of each band.

A15309. **DIRECTION OF MOVEMENT.** Direction of movement is expressed in terms of the direction from which the echo is moving, and is based upon two consecutive observations taken about fifteen minutes apart.

A15309.1. To determine the direction of movement, plot the location of the center of the echo at each observation on a plotting board or an aeronautical chart covered with transparent material. Draw a line through the centers of both echoes. Determine the bearing from the second position to the first. This bearing is the direction of movement.

A15309.2. Enter on Form 3200A, under the caption "Direction," the direction of movement to the nearest ten degrees from true north.

A15310. **SPEED OF MOVEMENT.** The speed at which an echo moves will be expressed in miles per hour by dividing the distance in statute miles between the centers of the plotted echoes by the elapsed time between observations.

A15310.1. When the movement of the echo patterns is not uniform, adjust the antenna and receiver gain controls until all but the strongest or largest echoes have been excluded from the scope. A more uniform rate of movement will usually be obtained by tracking and plotting these echoes.

A15310.2. Enter the speed on Form 3200A under the caption "Speed" to the nearest whole statute mile per hour.

A15311. **HEIGHT.** The height of echoes will be determined at stations supplied with equipment appropriate to the purpose. All values of height refer to the uppermost limit of visible moisture that may be detected by radar. Therefore, it will not be assumed that height data refer to the tops of clouds. Moreover, height data at long ranges are inaccurate because the elevation angles are very small, and corrections are not made for the curvature of the earth and for deviations of the radar beam from normal propagation. At very close ranges, the vanishing point of an echo may occur at the leading edge of a storm, whereas the actual top of the storm is higher in the center. To limit the magnitude of these inaccuracies, determinations of height will be made only between the ranges of 15 to 50 miles.

A15311.1. If the vertical angle of the antenna beam can be varied, determine the apparent height of the echoes as follows:

- (1) Using manual control, center the antenna on the most intense portion of the echo.
- (2) Tilt the antenna and read the angle when the echo first disappears.

- (3) Subtract half the vertical beam width from the angle read in (2).
- (4) Multiply the sine of the angle found in (3) by the range. The product will be the height in nautical miles.
- (5) Convert the value found in (4) from nautical miles to feet by multiplying the value by 6080. Add to the converted value the height of the station above mean sea level.

A15311.2. Enter the height on Form 3200A under the caption "Height" to the nearest hundreds of feet; e.g., 25,000 would be entered as 250.

A15312. REMARKS. Enter under "Remarks" such data as will support and amplify the observation and such additional data as has not been reported by a surface observation station. Authorized contractions will be used so far as possible in making entries. Remarks which are not transmitted will be entered in parentheses.

A15312.1. Enter data pertaining to unusual echo formations, e.g., inversions, precipitation areas centered at station, etc.

A15312.2. Enter data pertaining to echoes characteristic of the precipitation areas associated with hurricanes. The azimuth to the nearest whole degree, range, direction and speed of movement of the apparent eye will be recorded. If the eye of the storm is off the edge of the scope (out of range of the radar set), no attempt will be made to give the position of the eye. The terms "hurricane," "tropical storm," etc., will not be used in describing the echoes, either in public contacts or transmitted reports.

#### Example

Observed data: Thunderstorm reported 10 miles west of Washington National Airport moving from the southwest. Strong echo identified as tornado, azimuth 270 degrees, range 100 miles, moving from 135 degrees at 25 miles per hour.

Entry under

Remarks:

TSTM RPRTD 10 W DCA MOVG FM SW STG ECHO IDNFYD AS  
TORNADO AZRAN 27/10 MOVG FM 135/25

## A15400. FORMS

A15410. GENERAL. This section concerns instructions for entry of identification data on Form 3200A, "Radar Weather Observations," and for entries on Form 3200B, "Marine Radar Weather Observations."

A15411. Enter the month, inclusive dates for all observations entered on the form, and year, in the appropriate space in the upper right corner of the form, e.g., June 14-17, 1949.

A15412. Enter the name of the station in the space in the upper left corner of the form.

A15420. FORM 3200A. This form will be started at 0000 LST on the first day of each month. Data pertaining to more than one day may be entered on a single form. The following paragraphs are captioned to correspond with similarly captioned columns on Form 3200A. When echoes are observed but data required by the captions on Form 3200A are missing or unknown, omit entries. If the equipment is inoperative, all entries will be omitted between the reports of cessation and resumption of operation.

A15421. DATE. Enter the date of the observation.

A15422. TIME. In the blank space at the head of the column, enter a letter to indicate the standard of time in use. Enter the time of completing the observation, to the nearest minute, in terms of the 24 hour clock.

A15423. RAREP NUMBER. The first radar report (RAREP) of the day will be numbered "1." The second will be numbered "2," etc. A new series of numbers will be started at 0000 LST.

A15424. OPERATIONAL STATUS. Enter a contraction pertaining to the operational status of the equipment as required by the table below. In the following list, "PPI" refers to the scope (plan position indicator); the additional letters refer to "no echo" (NE), "out of service for maintenance" (OM), etc. These contractions may be used separately or in combination with echo reports.

<u>Status</u>	<u>Contraction</u>
Equipment performance normal, echoes not observed.	PPINE
Equipment out of service for maintenance. (Follow the contraction with a figure to indicate the number of hours that equipment is expected to be inoperative.)	PPIOM

~~SECRET~~

<u>Status</u>	<u>Contraction</u>
Equipment inoperative owing to breakdown.	PPINO
Normal operation is resumed.	PPIOK
Observation omitted for a reason other than those above.	PPINR

A15425. INITIALS. The observer's initials will be entered in this column.

A15430. FORM 3200B. Entries on Form 3200B, "Marine Radar Weather Observations," will be in terms of numbers taken from appropriate tables of the Standard Radar Storm Detection Code. A new form will be started at the beginning of each month and at the beginning of each patrol. If equipment is inoperative, all entries will be omitted between the reports of cessation and resumption of operation.

A15431. To determine the position of echoes in terms of latitude and longitude rather than of azimuth and range, plot the ranges and corresponding bearings from the station on an aeronautical or navigational chart. The units used - nautical or statute miles - must be the same as those upon which the scale of the chart is based.

A15432. When echoes are observed but data required by the captions on Form 3200B are missing or unknown, enter "X" or "9," as taken from the code tables, in the corresponding columns.

A15433. Enter the width of the echo in statute miles.

A15434. Enter the speed of the echo movement in statute miles per hour.

A15435. When performance of the equipment is normal but no echoes are observed, enter "No echoes" in the remarks column of Form 3200B.

A15440. DISPOSITION OF FORMS. At the end of each month (or each patrol), mail the completed forms to the Central Office, attention SF&MO Division.

#### A15500. TRANSMISSION OF RADAR REPORTS

A15510. FORM 3200A. RAREPS (radar reports) will be transmitted to report (1) echoes and associated data regarding location, height, intensity and movement, and (2) reports of inoperative equipment and resumption of service. When the scope becomes clear after one or more

RAREPS, transmit "no echoes" (PPINE). A RAREP will not be transmitted thereafter until echoes are observed or the equipment fails. When the equipment fails, transmit the appropriate contraction once only; when operation is resumed, transmit the contraction "PPIOK" once only.

A15511. TRANSMISSION SCHEDULES. Regular RAREPS will be transmitted on the SW teletype collection of Service A, between 27 and 30 minutes past each hour. Additional observations may be transmitted at 10 minutes of and 10 minutes past, each hour. The reports will be filed for transmission on Form 3024B or a suitable message blank.

A15512. ORDER AND CONTENT. The content of RAREPS will vary with the meteorological situation being reported. Data will be reported and transmitted in the order listed below to the extent that they are available. The arrangement of material in a RAREP indicates the nature of the data; therefore, the omission of data will not be explained by code groups or special devices. All required entries in the following list will be taken from Form 3200A on which the necessary data will have been recorded in units and phrase contractions appropriate to direct use in the code; e.g., data entered in statute miles will be coded in statute miles, and data entered in hundreds of feet will be coded in hundreds of feet, etc. Only such remarks as have not been reported by a surface observing station will be included in the transmitted report. A sample RAREP follows to illustrate the spacing and separation of the elements:

DCA 080240E RAREP3 SLD LINE MDT SLOLY INCRG AZRAN 27/25 19/20 15 MOVG FM 27/25 240 PPIOM3

Breakdown of this message for identification follows:

CONTENTS OF RAREP	CODED DATA	EXPLANATION
1. Station identification-----	DCA	Washington National Airport
2. Date and time, L.S.T.-----	080240E	Eighth day of month, 2:40 A.M., Eastern Standard Time
3. The term "RAREP" followed by a serial number-----	RAREP3	To identify the observation as the third radar report of the day.
4. Character of the echo-----	SLD LINE	Solid line of echoes
5. Intensity of the echo-----	MDT	Moderate intensity
6. Tendency of the echo-----	SLOLY INCRG	Slowly increasing
7. Identification of data-----	AZRAN	Contraction to identify immediately following data as azimuth (bearing) and range (distance) of the echo from the station.
8. Azimuth and range, separated by a slant, to each end of major axis of the ellipse---	27/25 19/20	Azimuth 270°, range 25 statute miles to one end of major axis; 190°, 20 miles to other end. Note that if the scope pattern had been circular instead of elliptical, only one azimuth-range datum (which would refer to the center of the circle) would be coded.
9. Width-----	15	15 statute miles as width of ellipse (or diameter of circle, if circle was coded in immediately preceding group).
10. The direction from which, and speed with which, the echo is moving. Direction and speed separated by a slant.-----	MOVG FM 27/25	Moving from 270° at 25 mph.
11. Height-----	240	24,000 feet MSL
12. Remarks-----	-----	As appropriate, see par. A15312
13. A contraction to report in-operative equipment or resumption of service-----	PPIOM3	Equipment out of service for maintenance for next three hours.

Eff. 8-1-49

A15-15

A15520. FORM 3200B. RAREPS will be transmitted from ocean stations in accordance with current instructions.

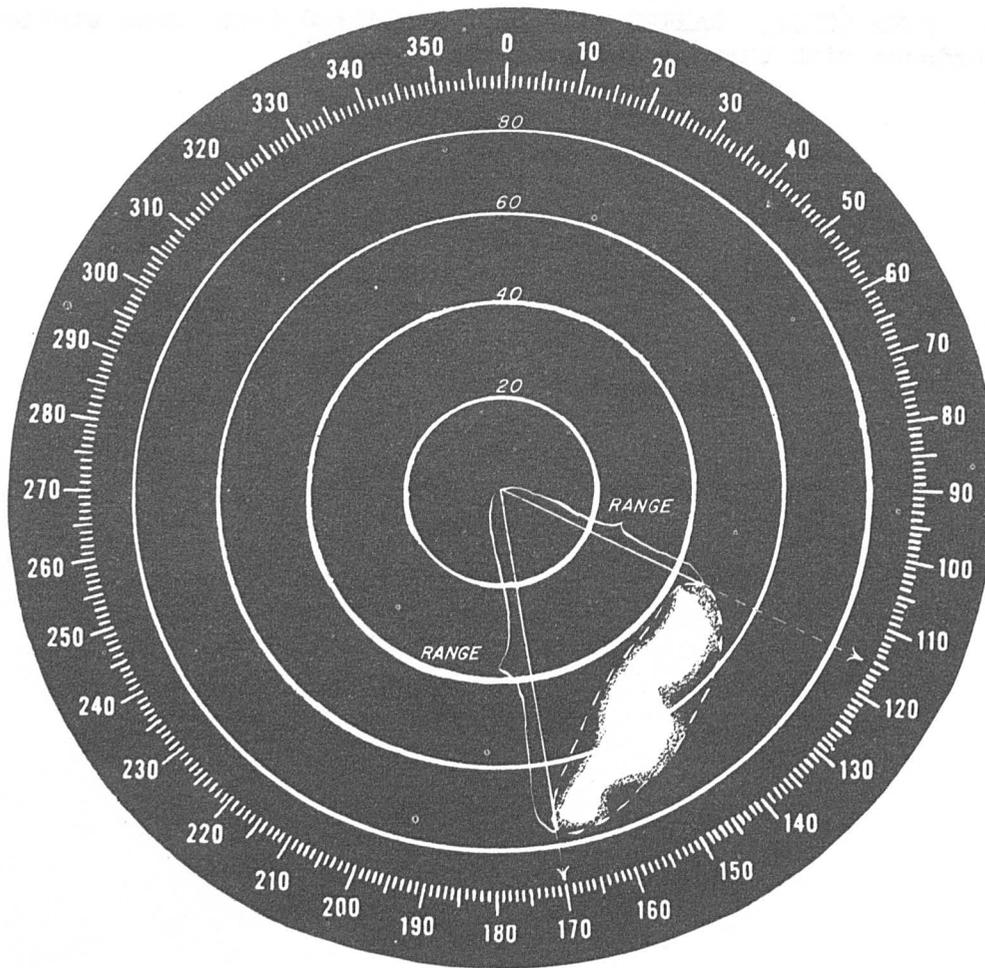


Fig. A12

The solid echo line is visualized as an ellipse. Ragged edges are not enclosed. The range is the distance from the center of the scope to each end of the major axis of the ellipse. The width is the length of the minor axis. When the direction and speed of movement, and the type of radar in use, permit measurement of intensity and height, this echo would be evaluated as:

Solid line of moderate echoes, no change in tendency; azimuth and range readings (AZRAN) to the ends of the echo 120 degrees, 47 miles, and 170 degrees, 78 miles; width 22 miles, moving from 140 degrees at 20 miles per hour; height of the tops of the echoes 28,000 ft. MSL.

This would be coded as:

DCA 150810E RAREP3 SLD LINE MDT NO CHG AZRAN 12/47 17/78 22 MOVG  
FM 14/20 280.

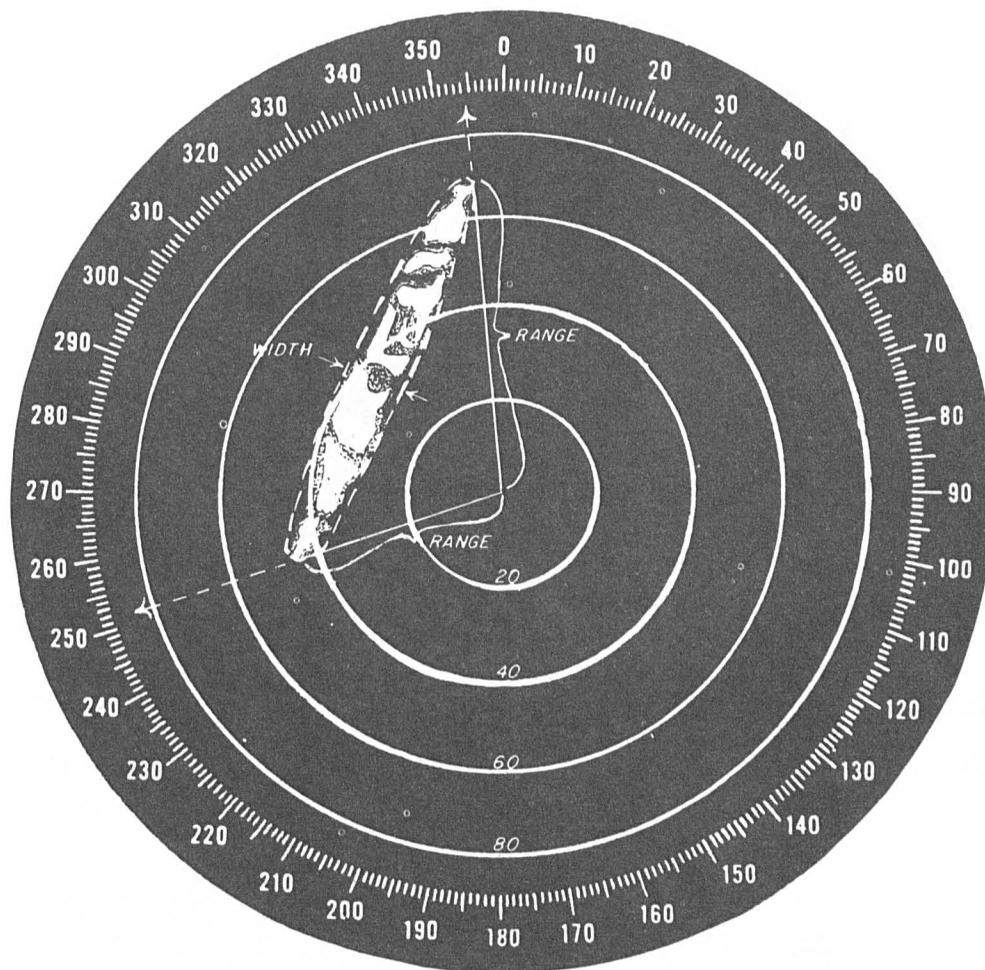


Fig. A13

The line of scattered echoes is visualized as an ellipse, since the distance between adjacent echoes in the group is less than the distance through the largest echo, and since the major axis is more than twice the minor axis. The azimuth bearings are recorded to the nearest 10 degrees and range readings to the nearest statute mile. The report of this echo would be evaluated as:

Line of scattered echoes of moderate intensity; tendency - increasing slowly; azimuth and range readings (AZRAN) 250 degrees 45 miles, 350 degrees 69 miles; width 15 miles; moving from 310 degrees at 30 miles per hour; top of echoes 20,000 ft. MSL; Remarks, pilot of a DC-3 reports line of thunderstorms 40 miles northwest of the station at 1430C.

This would be coded as:

ICT 201510C RAREP2 LINE SCTD MDT INCRG SLOLY AZRAN 25/45 35/69  
15 MOVG FM 31/30 200 PIREP 1430C LINE TSTMS 40 NW STN DC-3.

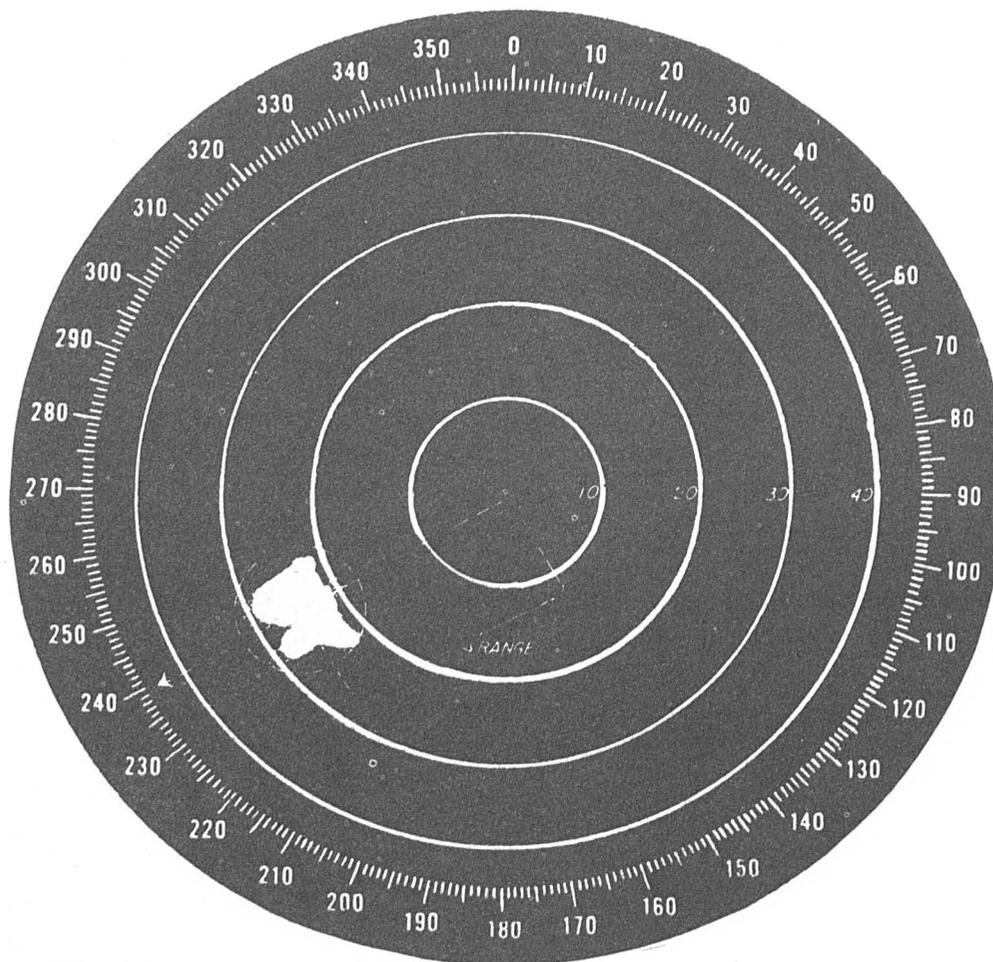


Fig. A14

The single echo is visualized as a circle, since the major axis might lie in several directions. The azimuth and range pertain to the center of the circle. This report would be evaluated as:

Solid, weak echo; tendency - decreasing; azimuth and range 240 degrees, 25 miles; diameter 16 miles, moving from 120 degrees at 15 miles per hour, height of tops of echo 12,000 ft. MSL.

This would be coded as:

ICH 010910C RAREP6 SLD WK DCRG AZRAN 24/25 16 MOVG FM 12/15 120.

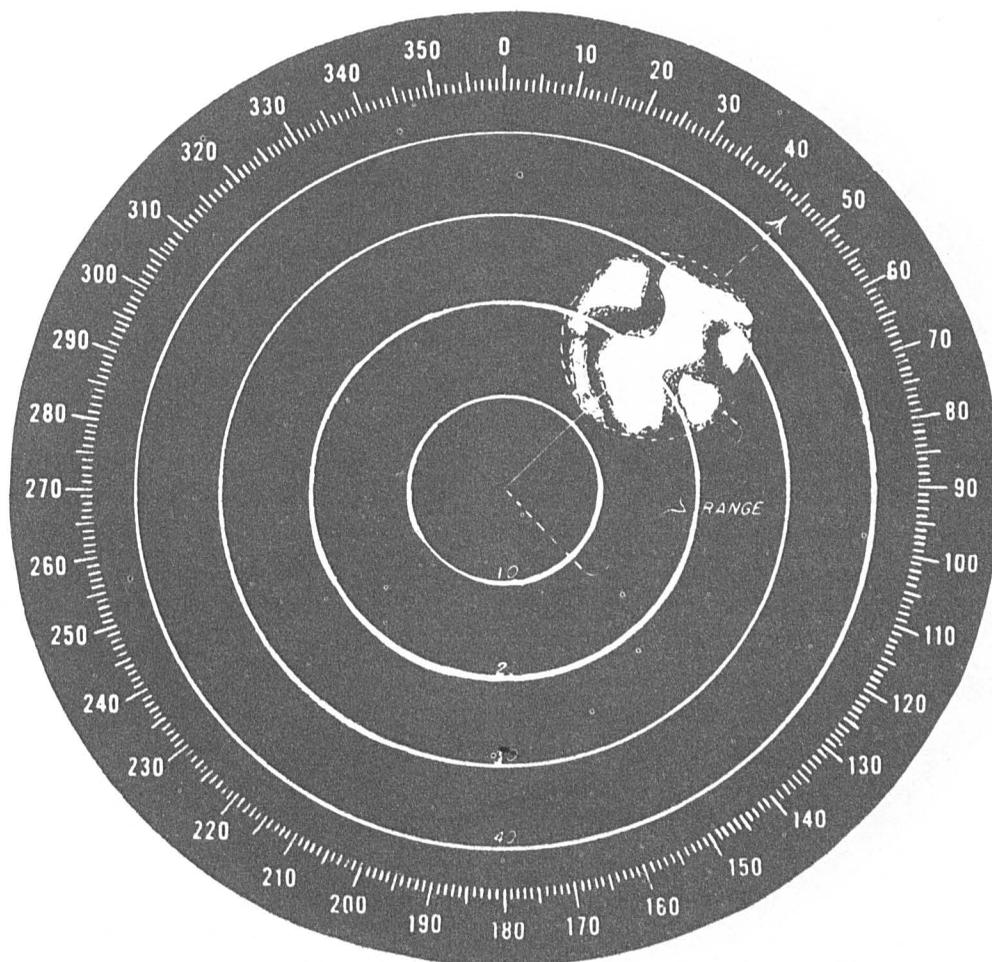


Fig. A15

The echo is visualized as a circle. The distance between the echoes in the group is less than the distance through the largest echo, and the major axis could lie in several directions through the group. Ragged edges of the echo may extend beyond the circle. This echo would be evaluated as:

Scattered echoes of moderate intensity; tendency - increasing rapidly; azimuth and range 50 degrees, 22 miles; diameter 20 miles; moving from 60 degrees at 25 miles per hour; height of tops of the echo 30,000 ft. MSL.

This would be coded as:

AOE 100410C RAREP8 SCTD MDT INCRG RPDLY AZRAN 05/22 20 MOVG FM  
06/25 300.

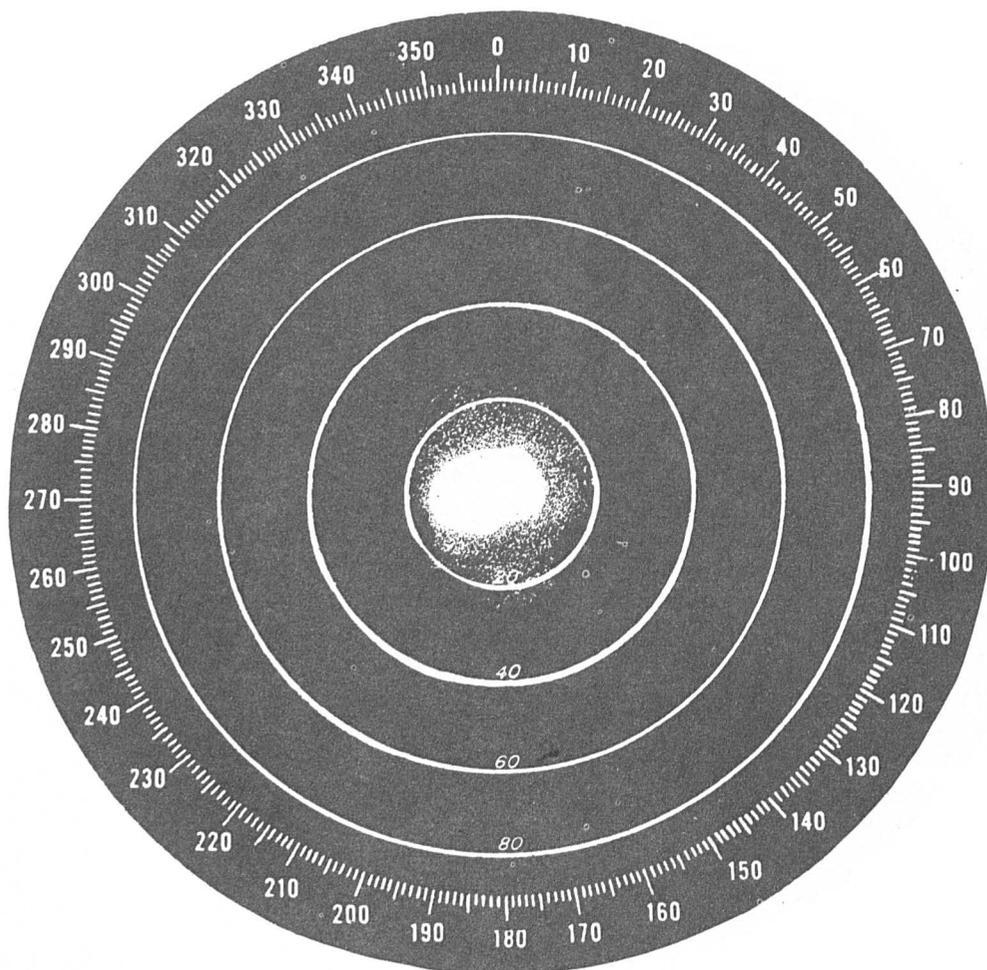


Fig. A16

The echo is typical of one observed at a station equipped with 3 cm. radar when heavy precipitation is occurring at the station. It is possible that more distant echoes are blocked from the radar view by attenuation from moisture on the radome and by the precipitation. The circle in this case includes all the echo except the ragged edges. This echo would be evaluated as:

Solid echo; width 40 miles; centered at the station.

This would be coded as:

LGA 211112E RAREP4 SLD WDPH 40 CNTRD AT STN.

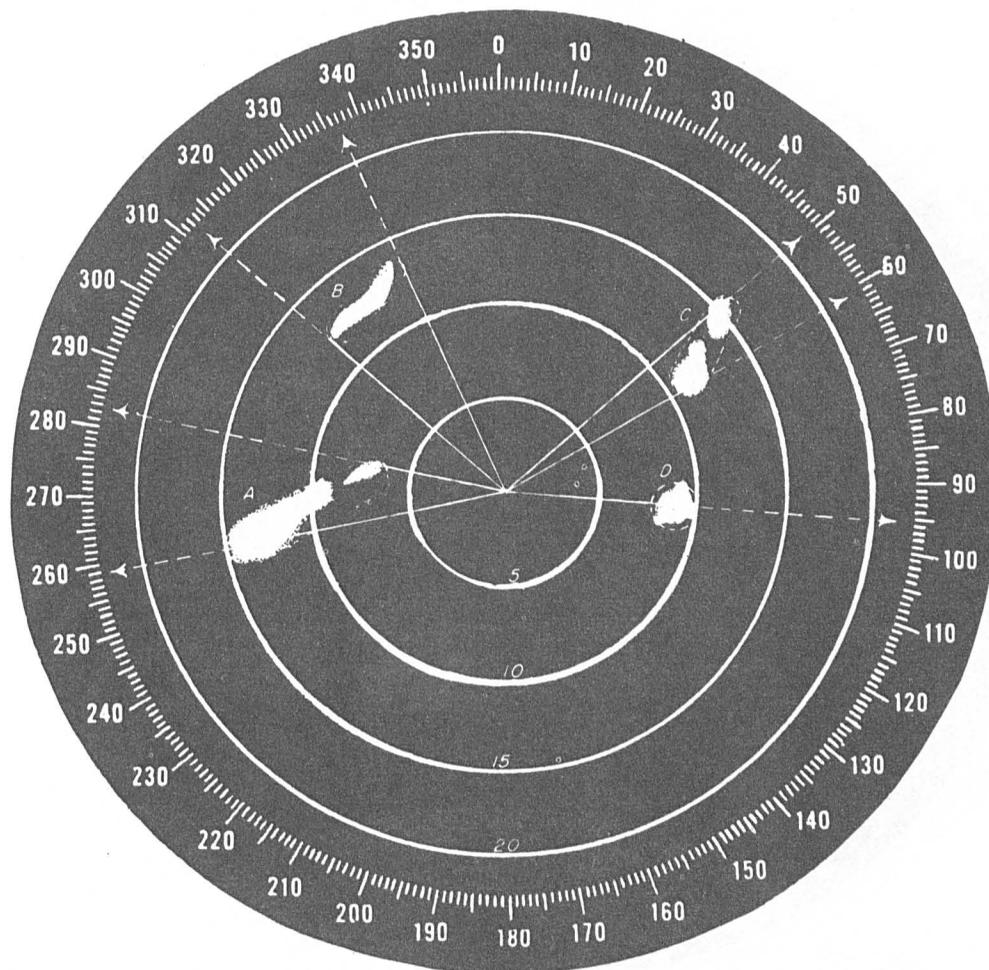


Fig. A17

Echoes A, B, and C are visualized as ellipses; and echo D is visualized as a circle. These patterns must be evaluated separately, since the distance between them in each case is more than the distance through the largest echo.

This report would be coded as:

CRP 141310C RAREP3 SCTD MDT NO CHG AZRAN 26/15 28/06 3 SLD MDT  
 INCRG 31/12 34/14 2 SCTD STRG NO CHG 05/16 06/11 2 SLD STRG NO  
 CHG 10/09 2 MOVG FM 24/20 SCTD SHWRS VSBL NW AND NE QUADS.

(see Figures A12 through A15 and paragraph A15512 for decoding instructions)

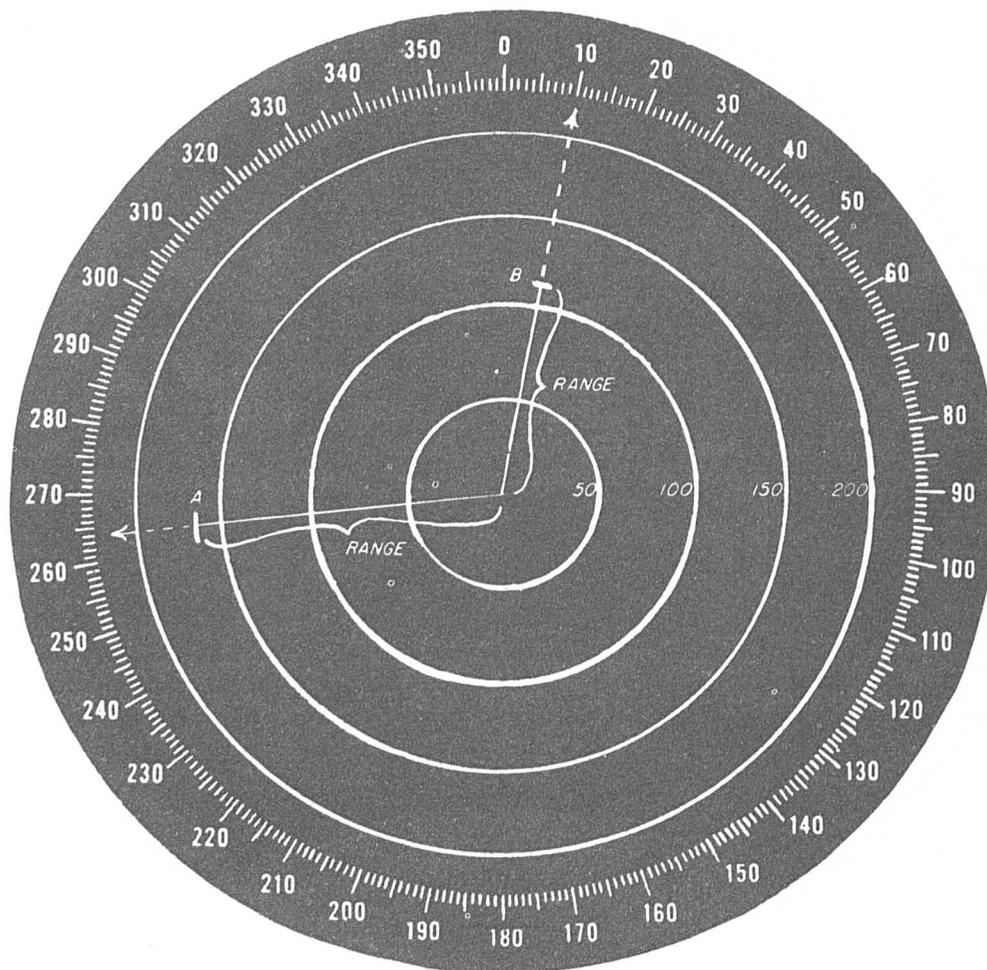


Fig. A18

The short dashes at A and B are the echoes of small, isolated precipitation areas having a dimension the same as, or less than, the width of the radar beam. The bearing and range to the center of the echo are observed. Width is not observed. These echoes would be evaluated as:

Solid weak echo; intensity - decreasing; azimuth and range 260 degrees, 170 miles. Solid weak echo; intensity - decreasing; azimuth and range 10 degrees, 120 miles.

This would be coded as:

AOE 312347C RAREP2 SLD WK DCRG 26/170 SLD WK DCRG 01/120.

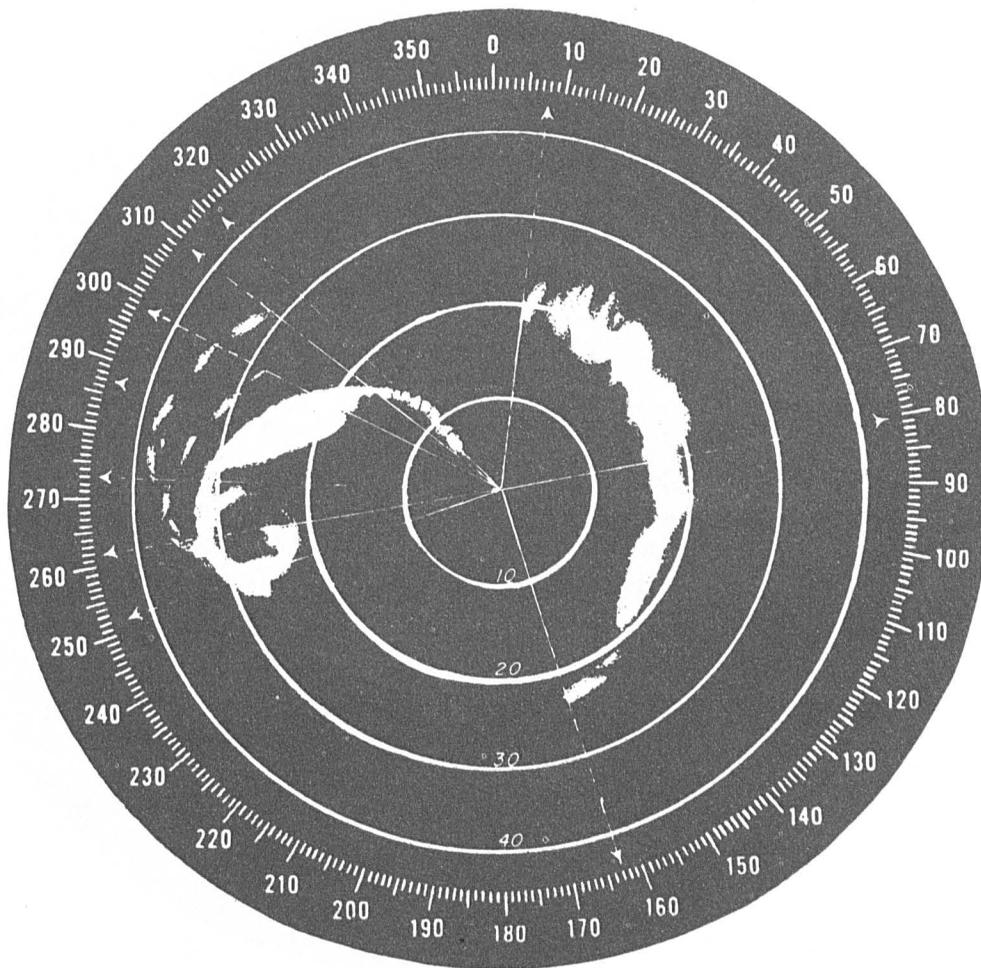


Fig. A19

Echoes of spiral precipitation bands similar to these sometimes result from typhoons or hurricanes. The position, diameter, direction and speed of movement, of the center, or "eye" of the storm, are reported in Remarks.

This echo would be coded as:

BRO 100510C RAREP9 SPRL BND STRG NO CHG AZRAN 26/23 25/26 29/24  
 32/06 3 SCTD SPRL BND AZRAN 26/33 27/35 30/28 1 SCTD SPRL BND  
 AZRAN 27/37 29/37 31/32 1 SPRL BND STRG no NO CHG AZRAN 01/20  
 08/17 16/22 4 CNTR AZRAN 262/27 DIA 8 MOVG FM 22/30 400.

(See paragraph A15512 for decoding instructions.)

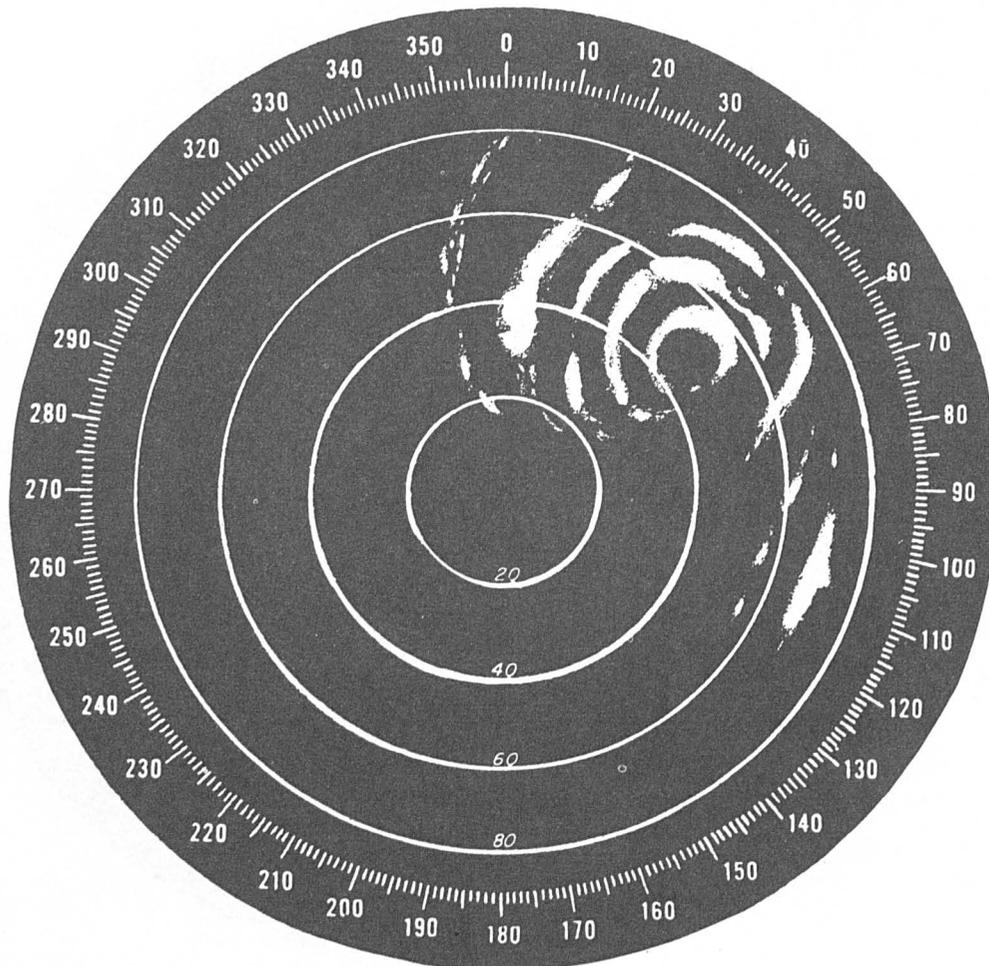


Fig. A20

Echoes of spiral precipitation bands similar to these sometimes result from typhoons and hurricanes. The center may not be as well defined as this; however, the apparent center is observed if it is on the scope.

This echo would be coded as:

BRO 20115C RAREP12 SPRL BND STRG NO CHG AZRAN 06/40 04/50 06/50  
 5 SPRL BND AZRAN 06/38 03/50 04/65 06/61 6 SCTD SPRL BND AZRAN  
 06/25 02/50 04/75 08/55 5 SCTD SPRL BND AZRAN 04/18 01/50 02/80  
 8 SCTD SPRL BND AZRAN 00/18 35/55 00/79 5 SCTD SPRL BND AZRAN  
 08/68 12/56 3 SPRL BND 09/70 12/68 5 CNTR AZRAN 054/48 DIA 7 MOVG  
 FM 12/28 450.

(See paragraph A15512 for decoding instructions.)

*Change*

Change No.  AI

U. S. Department of Commerce  
Weather Bureau

# ADDENDUM TO CIRCULAR N

( WBAN Manual of Surface Observations )

6th Edition

( This page may be discarded )

January 1, 1951

D7 01.1  
U587C  
N-1949

Example

Given: Station Longitude,  $77^{\circ}35'W$ .  
Time, 5:00 a.m., 75th meridian time.  
Date, January 1.

Determination of true solar time for the station:

- (a)  $77^{\circ} 35'$  minus  $75^{\circ} 00'$  equals  $2^{\circ} 35'$  W.
- (b)  $2^{\circ} 35'$  corresponds to  $2-1/2^{\circ}$  (Table A16-1).
- (c) The correction for January 1 at  $2-1/2^{\circ}$  W from Table A16-2 is  $-14$  minutes.
- (d) 5:00 L.S.T. minus 14 minutes is 4:46 T.S.T.

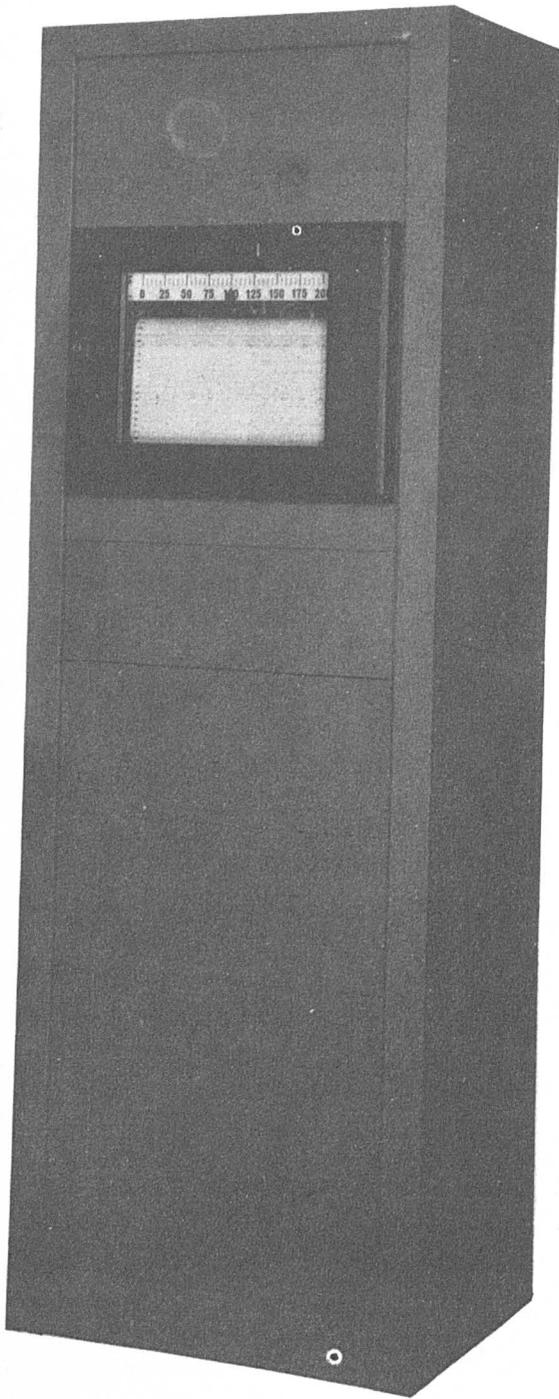


Fig. A16-1. Roll-chart recorder  
(full length)

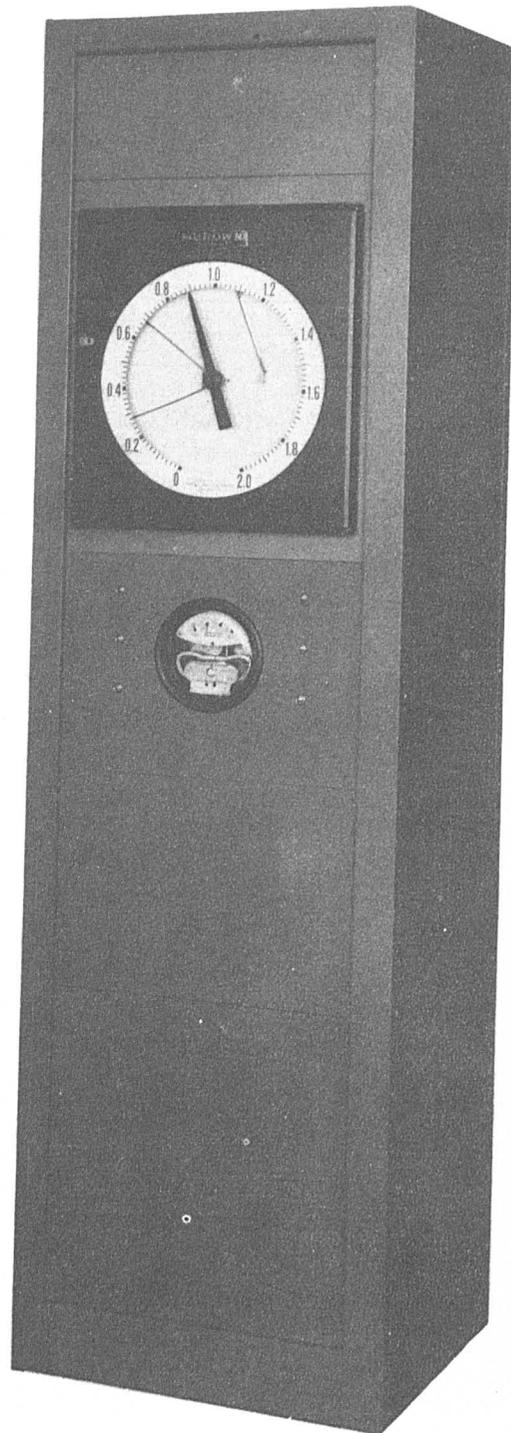


Fig. A16-2. Circular-chart recorder  
(full length)

Table A16-2. Number of minutes to be added algebraically to local standard time to obtain true solar time.

Equation of time values (Apparent-Mean) based on figures taken from the 1942 American Ephemeris and Nautical Almanac (for Washington Apparent Noon).

Date	Number of Degrees WEST of Meridian.									Number of Degrees EAST of Meridian.								Date	
	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8		
Jan.																			Jan.
1-3	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28		1-3
4-5	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27		4-5
6-7	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26		6-7
8-9	-39	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25		8-9
10-12	-40	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24		10-12
13-15	-41	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23		13-15
16-18	-42	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22		16-18
19-21	-43	-39	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21		19-21
22-25	-44	-40	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20		22-25
26-30	-45	-41	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19		26-30
31	-46	-42	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18		31
Feb.																			Feb.
1-23	-46	-42	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18		1-23
24-28	-45	-41	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19		24-28
Mar.																			Mar.
1-5	-44	-40	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20		1-5
6-9	-43	-39	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21		6-9
10-13	-42	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22		10-13
14-17	-41	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23		14-17
18-20	-40	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24		18-20
21-23	-39	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25		21-23
24-27	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26		24-27
28-30	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27		28-30
31	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28		31
Apr.																			Apr.
1-2	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28		1-2
3-6	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29		3-6
7-9	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30		7-9
10-13	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31		10-13
14-17	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32		14-17
18-22	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33		18-22
23-27	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34		23-27
28-30	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35		28-30

Table A16-2 - continued. Number of minutes to be added algebraically to local standard time to obtain true solar time.

Equation of time values (Apparent-Mean) based on figures taken from the 1942 American Ephemeris and Nautical Almanac (for Washington Apparent Noon).

Date	Number of Degrees WEST of Meridian.									0	Number of Degrees EAST of Meridian.								Date
	8	7	6	5	4	3	2	1	1		2	3	4	5	6	7	8		
<b>May</b>																			<b>May</b>
1-6	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	1-6	
7-21	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	7-21	
22-31	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	22-31	
<b>June</b>																		<b>June</b>	
1-6	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	1-6	
7-11	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	7-11	
12-16	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	12-16	
17-20	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	17-20	
21-25	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	21-25	
26-30	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	26-30	
<b>July</b>																		<b>July</b>	
1-5	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	1-5	
6-12	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	6-12	
13-31	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	13-31	
<b>Aug.</b>																		<b>Aug.</b>	
1-8	-38	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	1-8	
9-14	-37	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	9-14	
15-19	-36	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	15-19	
20-23	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	20-23	
24-27	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	24-27	
28-30	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	28-30	
31	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	31	
<b>Sept.</b>																		<b>Sept.</b>	
1-2	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	1-2	
3-5	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	3-5	
6-8	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	6-8	
9-11	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	9-11	
12-14	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	12-14	
15-17	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	37	15-17	
18-20	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	38	18-20	
21-22	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	39	21-22	
23-25	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	40	23-25	
26-28	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	37	41	26-28	
29-30	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	38	42	29-30	

Table A16-2 - continued. Number of minutes to be added algebraically to local standard time to obtain true solar time.

Equation of time values (Apparent-Mean) based on figures taken from the 1942 American Ephemeris and Nautical Almanac (for Washington Apparent Noon).

Date	Number of Degrees WEST of Meridian.									0	Number of Degrees EAST of Meridian.									Date
	8	7	6	5	4	3	2	1			1	2	3	4	5	6	7	8		
Oct.																		Oct.		
1	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	38	42	1		
2-5	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	39	43	2-5		
6-8	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	40	44	6-8		
9-12	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	37	41	45	9-12		
13-16	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	38	42	46	13-16		
17-22	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	39	43	47	17-22		
23-31	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	40	44	48	23-31		
Nov.																		Nov.		
1-14	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	40	44	48	1-14		
15-19	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	39	43	47	15-19		
20-23	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	38	42	46	20-23		
24-26	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	37	41	45	24-26		
27-29	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	40	44	27-29		
30	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	39	43	30		
Dec.																		Dec.		
1-2	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	39	43	1-2		
3-4	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	38	42	3-4		
5-7	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	37	41	5-7		
8-9	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	40	8-9		
10-11	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	39	10-11		
12-13	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	38	12-13		
14-15	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	37	14-15		
16-17	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	36	16-17		
18-19	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	35	18-19		
20-21	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	34	20-21		
22-23	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	33	22-23		
24-25	-32	-28	-24	-20	-16	-12	-8	-4	0	4	8	12	16	20	24	28	32	24-25		
26-27	-33	-29	-25	-21	-17	-13	-9	-5	-1	3	7	11	15	19	23	27	31	26-27		
28-30	-34	-30	-26	-22	-18	-14	-10	-6	-2	2	6	10	14	18	22	26	30	28-30		
31	-35	-31	-27	-23	-19	-15	-11	-7	-3	1	5	9	13	17	21	25	29	31		

A16030. Adjustments for Time.—Check and adjust the chart for time between sunrise and sunset as frequently as necessary to maintain the position of the pen within + two minutes of the true solar time (see par. A16020). Time lines on roll charts are printed on the chart at ten-minute intervals. The wider of these lines are spaced thirty minutes apart. Adjust this type of chart so that the beginning of an hour corresponds to one of the wider time lines. Adjust circular charts so that the time of the records corresponds to the appropriately-labeled, radial time line. At each point of adjustment, and at sunrise, or as soon as practicable thereafter at stations where personnel are not on duty at that time, enter a short time check "✓" and the true solar time. When an adjustment of more than two minutes is made after the beginning of record each day, enter the amount and sign of the correction in parentheses.

A16040. Functioning of Equipment.—Inspect the record daily, and more often if necessary, to determine whether the trace is satisfactory. Test for malfunctioning of the equipment or a change in the condition of exposure of the pyrheliometer whenever the pattern described by the trace departs widely from patterns made previously under similar meteorological conditions. (See Sections A16300 and A16400.)

#### A16100. EVALUATING THE RECORD

A16110. General.—Observations of total solar and sky radiation received on a horizontal surface are evaluated in terms of langleys (gram-calories per square centimeter). Estimations of data for periods of missing or erroneous record are made in accordance with instructions for the type of recorder in use. When data cannot be estimated for periods of missing or erroneous record, entries for these periods will be omitted from the summary prepared on Form 1091A. Note that an entry may be required later in accordance with par. A16215.1.

A16111. Erroneous Records.—The following conditions are indicative of erroneous records:

- (1) A stationary pen as evidenced by a record of unvarying intensity.
- (2) Time lag in the response of the pen to cloud changes that normally cause an abrupt change in the pen position.
- (3) An abrupt increase in the indicated amount of radiation following the removal of ice or other foreign matter.

When slight accumulations of frost, ice, etc. on the bulb make it impracticable to determine whether an increase in radiation results from cleaning the bulb, enter the nature of the conditions and the time of their beginning and ending adjacent to the questionable record.

A16120. Roll Charts.—When a portion of the record is unsatisfactory (missing or appears erroneous, see par. A16111), estimate the trace corresponding to the time interval of the unsatisfactory record provided (1) the sky condition during the interval was substantially the same as it was immediately preceding and following the interval, and (2) the interval is of two hours duration or less. Sketch the estimated trace on the chart as a smoothly interpolated curve connecting the ends of the satisfactory record. When the period of unsatisfactory record includes the beginning or end of measurable radiation for the day, estimate the normal time of the beginning or end of radiation from inspection of representative records on preceding and following days. At this estimated time on the zero reference line on the chart, plot one end of the estimated trace.

A16121. Hourly Radiation.—Hourly radiation data will be computed following the evaluation of the radiation for each twenty minutes of record. The record will be evaluated with a transparent evaluator graduated from 0 to 40 in increments of one langley per twenty minutes. The evaluator may be used directly with records from 10-junction pyrhelimeters. When the evaluator is used with records from 50-junction pyrhelimeters, the readings from the evaluator must be multiplied by a factor obtained as specified in 6(b) to provide radiation values in terms of langleys per twenty minutes. Hourly radiation values in langleys will be computed for each hour of record (including hours in which all or part of the record is estimated) as follows:

- (1) Lay one side of the evaluator lengthwise along a time line corresponding to the beginning of a 20-minute period. Note that the width of this scale is such that when one side coincides with the time line at the beginning of a 20-minute period, the other side coincides with the time line at the end of the period.
- (2) Move the evaluator parallel to the two time lines until, on each side of the 0.0 line of the scale, equal areas are bounded by the trace, the respective time lines, and the 0.0 line of the scale. (See Fig. A16-3).
- (3) Draw a line across the entire 20-minute period, coincident with the 0.0 line, after adjustment (2) has been made.
- (4) With the evaluator in the position described in (2), read the scale to the nearest tenth of a division at the intersection of the scale with the zero-radiation line on the chart.
- (5) When a 10-junction pyrhelimeter is used, the hourly radiation is the sum of the three scalar readings for the hour.

- (6) When a 50-junction pyrhelimeter is used, (a) compute the sum of the scalar readings in each hour, (b) divide the calibration constant for the 10-junction pyrhelimeter by the constant for the 50-junction pyrhelimeter, and (c) multiply the quotient obtained in (b) by the sum obtained in (a). The result is the radiation for the hour in langley. The calibration constants are entered on the standardization sheet furnished with each instrument.

Example

Given: Sum of the 3 scalar readings during a solar hour; 112.7  
Calibration constant for 10-junction pyrhelimeter of 2.16  
Calibration constant for 50-junction pyrhelimeter of 6.52

Computation:  $\frac{2.16}{6.52} \times 112.7 = 37.3$  langley

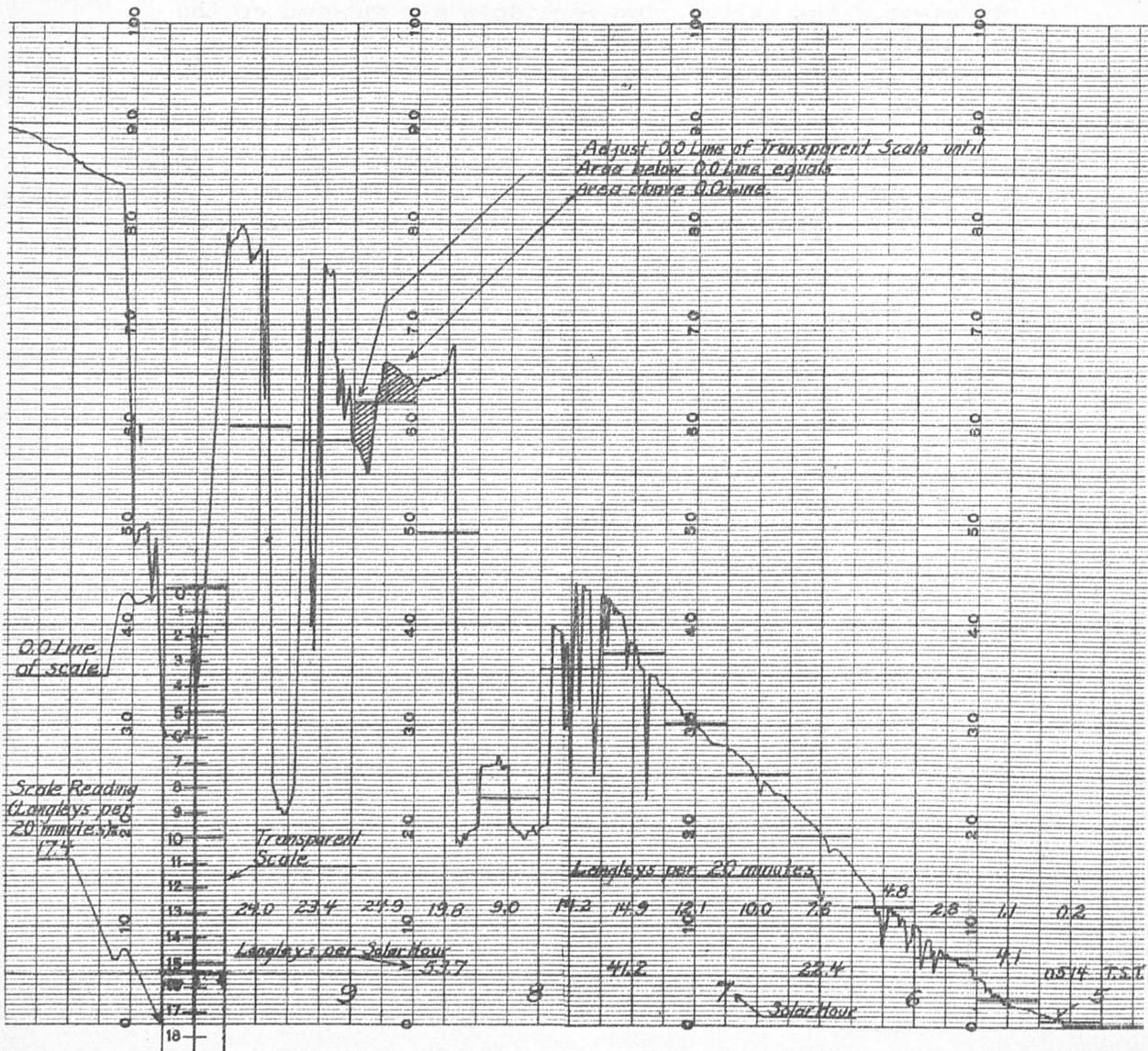


Fig. A16-3. Roll-chart record (section - with evaluator)

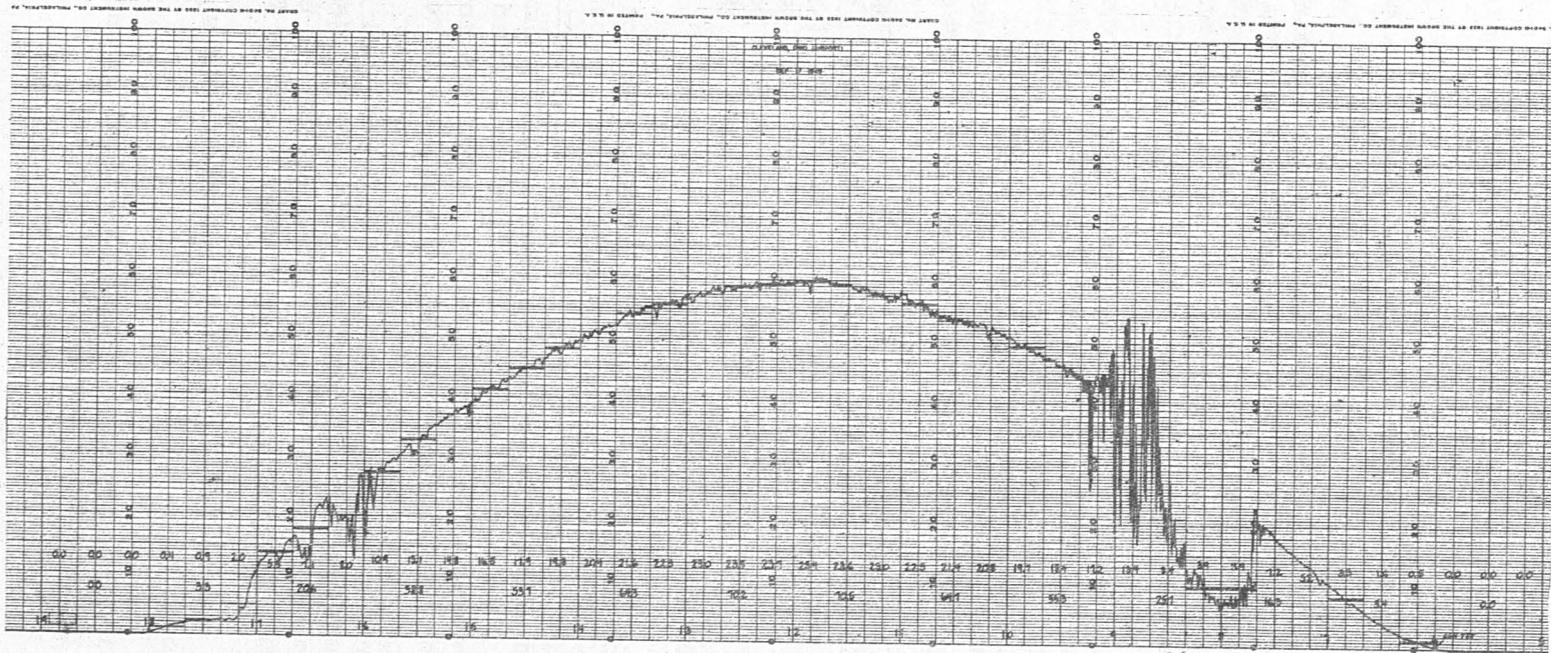


Fig. A16-4. Roll-chart record

A16122. Chart Entries (See Fig. A16-4).—Entries are made as follows:

- (1) Between the 0-line and 5-line, enter the true solar hour on the corresponding time line.
- (2) Parallel to, and between the 90- and 100-lines, and near each noon-line, enter the station name and date.
- (3) Between the 10- and 20-lines and near the midpoint of each 20-minute interval, enter the appropriate scalar readings. Enter readings obtained entirely or in part from an estimated record in parentheses. Make no entry for periods for which radiation has not been computed in accordance with par. A16121.
- (4) Between the 5- and 10-lines, and near the midpoint of each solar hour interval, enter the corresponding value of hourly radiation. Enter, in parentheses, values that include any estimated data. When the entry of radiation for one or more of the 20-minute periods of a given hour has been omitted as in (3), omit the entry of radiation data for the corresponding hour.

A16130. Circular Charts.—When malfunctioning of the equipment is indicated, data for the days affected will be regarded as missing. The daily total read from the watt-hour meter will be regarded as "missing" only if it appears reasonably certain from the characteristics of the trace that the indicator reading is incorrect (see par. A16111). When the faulty record results only from mechanical failure of the pen, such as depletion of the ink supply, the reading of the meter will be assumed correct.

A16131. Reading the Indicator.—Read the indicator to tenths, nightly, between sunset and sunrise. The indicator consists of four circular dials (see Fig. A16-5). From left to right, the four dials indicate thousands, hundreds, tens, and units, respectively. Tenths are estimated from the fourth dial. Note that the indexes of the first and third dials rotate counterclockwise, whereas the indexes of the second and fourth dials rotate clockwise. When an index is between two numbers, the lower value is taken as pertaining to the dial reading. A complete revolution of the index on one dial will advance the index on the left adjacent dial by one division. When reading the meter, reconcile readings of adjacent dials, e.g., if the index on one dial were close to six and the index on the next dial on the right close to eight, the reading of the former would be five and not six.

A16131.1 To avoid errors in reading the indicator meters, observe the following precautions:

- (1) If practicable, have the reading verified by another observer; if not, recheck the reading.

- (2) Compare the data for consistency with data on preceding days when cloud conditions were similar. When an inconsistency is noted, examine the recorder record to ascertain whether the inconsistency was actually caused by variations in radiation, or by an erroneous reading.

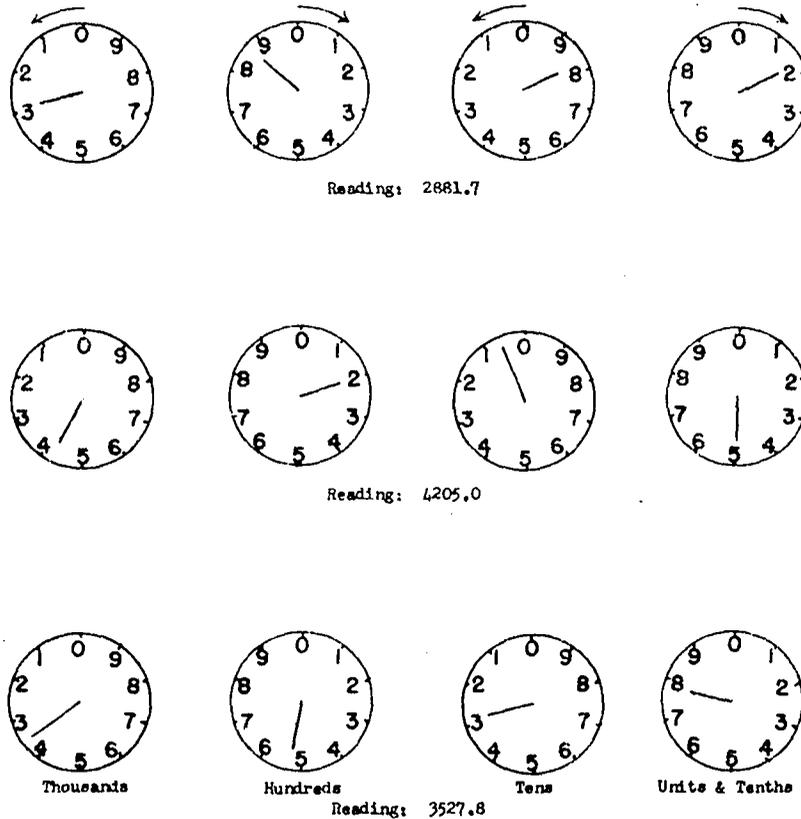


Fig. A16-5. Watt-hour meter

A16132. Chart Entries (See Fig. A16-6).—Entries are made adjacent to the midnight time lines as follows:

- (1) Concentric with and below the 50-line enter:
  - (a) The integrating-indicator reading for the day.
  - (b) The difference between the indicator reading recorded in (a) and the indicator reading for the preceding day.
  - (c) The total solar radiation for the day to tenths of langley (see par. A16133 and A16134).
  
- (2) Concentric with and between reference lines 70 and 90, enter the station name and date.

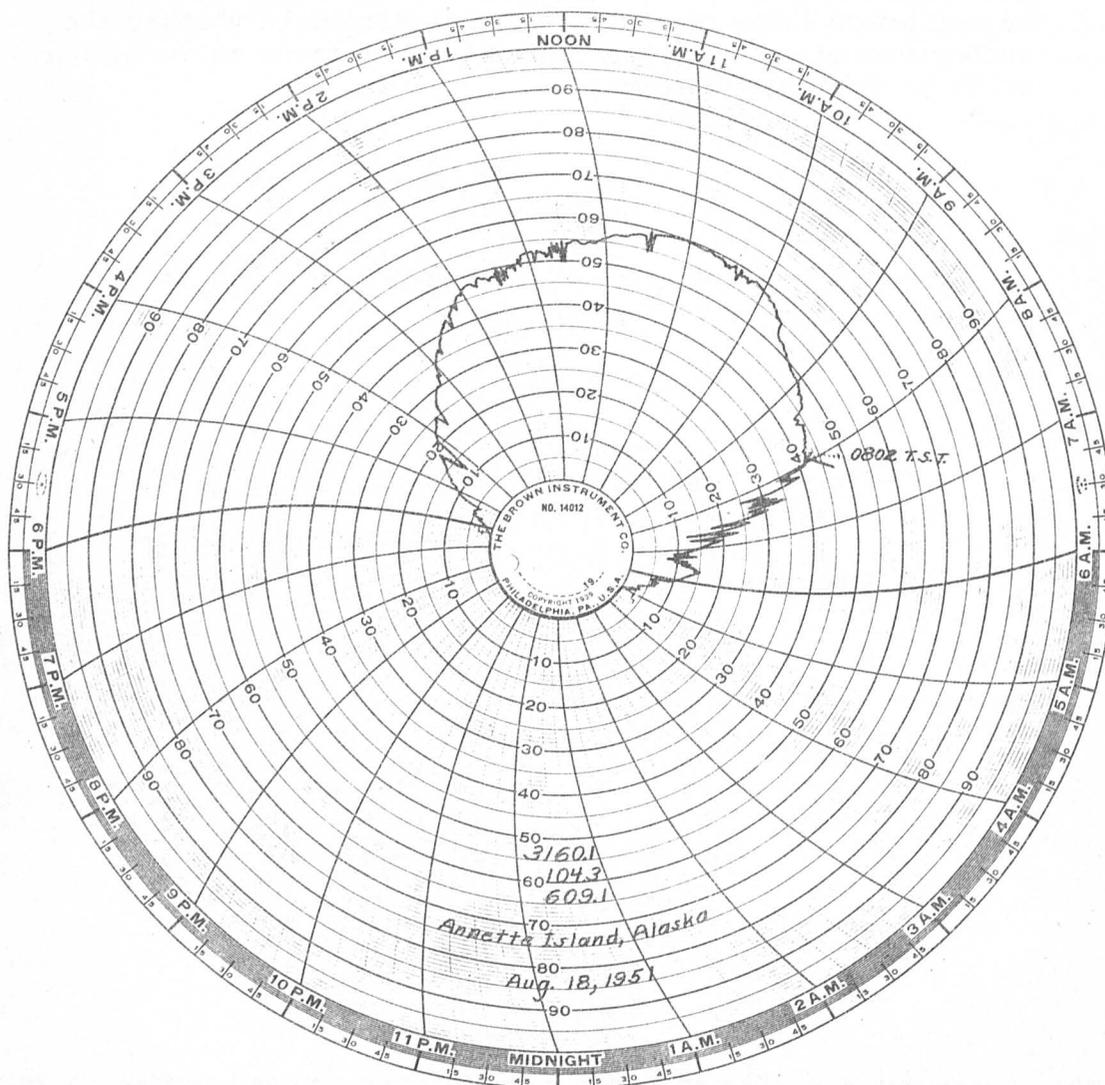


Fig. A16-6. Circular-chart record

**A16133. Computation of Total Solar Radiation - 10-Junction Pyrheliometers.**—  
When a 10-junction pyrheliometer is in use, obtain the total solar radiation in langley's by multiplying the difference referred to in par. A16132 (1(b)) by the conversion factor usually stamped on a plate beneath the dials of the meter.

Example

Given: Daily reading of 9291.3  
 Readings on preceding day of 9274.7  
 Conversion factor 6.787

Computation: 9291.3 minus 9274.7 = 16.6  
 16.6 multiplied by 6.787 = 112.7 langley's

Chart Entries: 9291.3  
 16.6  
 112.7

A16134. Computation of Total Solar Radiation - 50-Junction Pyrheliometers.---  
 When a 50-junction pyrheliometer is in use, obtain the total solar radiation in langley's as follows:

- (1) Multiply the difference referred to in par. A16132 (1(b)) by the conversion factor specified in par. A16133.
- (2) Multiply the product obtained in (1) by the calibration constant of the 10-junction pyrheliometer.
- (3) Divide the result obtained in (2) by the calibration constant of the 50-junction pyrheliometer. The quotient is the total solar radiation in langley's.

Note: The calibration constant is entered on the standardization sheet furnished with each pyrheliometer.

Example

Given: Daily reading of 7647.2  
 Reading on preceding day of 7546.2  
 Conversion factor of 6.243  
 Calibration constant for 10-junction pyrheliometer of 2.16  
 Calibration constant for 50-junction pyrheliometer of 6.52

Computations: 7647.2 minus 7546.2 = 101.0  
 101.0 multiplied by 6.243 = 630.5  
 $\frac{2.16}{6.52}$  multiplied by 630.5 = 208.9 langley's

Chart Entries: 7647.2  
 101.0  
 208.9

A16200. SUMMARY DATA

A16210. General.—Solar radiation data will be entered on Form 1091A, Solar and Sky Radiation Measurements. Entries will be made with a 3H drawing pencil or equivalent and the form will be prepared in triplicate. The entries are grouped into periods of seven days, except that the summary for December and, during leap year, for June, will comprise data for three seven-day periods and one eight-day period.

A16210.1. Mean Data.—When the computation of the mean value of a group of entries is required, compute the sum of the entries in the group and divide the sum by the number of entries in the group. Include entries of estimated data in the computation of mean values. Mean values that include estimated data will be entered in parentheses. Mean values of hourly radiation that are also entered as estimated hourly radiation for hours of unsatisfactory record in accordance with par. A16215.1 will not be entered in parentheses when entered as mean values. When means cannot be computed because of missing data, enter an "M" in lieu of a numerical entry.

A16210.2. Eight-Day Periods.—Entries for the eighth day of an eight-day period will be entered on the line labeled "Means". Enter the date in the space labeled "Means" and delete "Means". Label the next lower line "Means" and enter the mean data for the period on that line.

A16210.3. Verification of Computations.—At stations equipped with roll chart recorders, verify each computation of the mean value of total-daily-radiation entries by computing the sum of the corresponding entries of mean hourly radiation.

A16211. Station Name and Date.—Enter the station name and the dates of the first and last entries in the spaces provided at the top of the form.

A16212. Dates of Entries.—The periods covered by the summaries accord as nearly as possible with calendar months. The date of the first entry on each summary form will be determined from Table A16-3.

Table A16-3 - Starting Dates of Summaries

Month	Date of First Entry (Common Years)	Date of First Entry (Leap Years)
Jan.	Jan. 1	Jan. 1
Feb.	Jan. 29	Jan. 29
Mar.	Feb. 26	Feb. 26
Apr.	Apr. 2	Apr. 1
May	Apr. 30	Apr. 29
June	June 4	June 3
July	July 2	July 2
Aug.	July 30	July 30
Sept.	Sept. 3	Sept. 3
Oct.	Oct. 1	Oct. 1
Nov.	Oct. 29	Oct. 29
Dec.	Dec. 3	Dec. 3

A16213. Hourly Radiation.—Hourly radiation entries are made at stations equipped with roll-chart recorders. In the spaces provided, enter the date and, to tenths of a langley, the corresponding hourly radiation values from the evaluated record charts (see par. A16122) for the hour ending at the time indicated at the top of each column. Enter estimated data in parentheses. Omit entries for hours for which data are missing except as specified in par. A16215.1. If the data for an entire day are missing, enter the reason for the missing data in lieu of the data.

A16214. Daily Total Radiation.—At stations equipped with roll-chart recorders, enter, to tenths, under the caption "Daily Total", the sum of all the hourly data (recorded and estimated) for each day. If the sum for any day contains more than three percent estimated data (i.e., hourly data entered in parentheses) enter the sum in parentheses. When hourly radiation entries for any portion of a day are omitted in accordance with par. A16213, enter an "M" in lieu of a daily total.

A16214.1. At stations equipped with a circular-chart recorder and an integrating indicator, enter daily-total-radiation values, to the nearest tenth of a langley, in chronological order under the caption "Daily Total"; and enter the corresponding dates similarly under the caption "Dates". If the daily total is missing, enter an "M" (see par. A16130) and the reason for omission of the total.

A16215. Means of Hourly Radiation.—Means of hourly radiation will be computed only for such periods as satisfy the following conditions:

- (1) Form 1091A must include numerical entries of daily total radiation for four or more days of the period.
- (2) Total daily radiation pertaining to each of at least four days must not include more than three percent of estimated hourly data (as entered in parentheses) for any single day.

A16215.1. If sufficient data are available for the computation of means, but hourly radiation values for a portion of one or more days are missing, and cannot be estimated in accordance with par. A16120, enter, in lieu of an hourly radiation value, the mean for that hour, and enclose the value in parentheses to indicate that it is estimated.

A16216. Means of Daily Totals.—Compute the mean of all the daily totals for each period in which each of four or more daily totals contain not more than three percent of estimated data (i.e., hourly values entered in parentheses). Enter the mean on the line titled "Means" and under the caption "Daily Total".

A16217. Computers and Verifiers Initials.—To the right of the "Daily Total" entries, enter the initials of the computer, a slant, and the initials of the verifier of the daily entries and of the means.

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

Solar and Sky Radiation measured at Jonesville, Texas from July 30, 1949 to September 2, 1949

Table with columns for Date, A.M. (1-12), Noon, P.M. (1-12), and Daily Total. Rows include dates from July 30 to Sept 2, with various radiation values and notes like 'Relocation of Station'.

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

Solar and Sky Radiation measured at Annette Island, Alaska from June 3, 1952 to July 1, 1952

Table with columns for Date, A.M. (1-12), Noon, P.M. (1-12), and Daily Total. Rows include dates from June 3 to July 1, with radiation values and units like 'AL/FK' and 'CEM/FK'.

Fig. Al6-7. WB Form 1091A

A16220. Distribution of Forms.--Assemble recorder records for the period of record of each summary in chronological order with the earliest date on top and forward to the Central Office, attention C&HS Record Section. Roll-charts for each day will be separated before submission, and will cover the period from one hour before sunrise to one hour after sunset. The separated portion may be folded for mailing.

A16221. The original copy of Form 1091A will be mailed not later than the tenth of the following month to:

Weather Bureau Office  
Solar Radiation Field Testing Unit  
Boston 9, Massachusetts

One carbon copy will be forwarded to the Central Office, attention Scientific Services Division, while the second carbon copy will be retained at the station. Stations outside continental United States will airmail their copies to the Boston Office.

#### A16300. PYRHELIOMETER

A16310. General.--Solar radiation installations for the measurement of total solar and sky radiation consist of a pyr heliometer installed in a suitably exposed position and a recorder usually installed in the office. Any abnormal functioning of the equipment that cannot be corrected in accordance with the following instructions will be reported promptly to the Regional Office.

A16320. Types.--Thermoelectric 180° pyr heliometers are used in measuring total solar and sky radiation. Two types are in use: a "10-junction" type in general use (Fig. A16-8), and a more sensitive "50-junction" type used at selected northern stations (above approximately 55°N. latitude) during months when solar radiation is less intense (see par. A16324).

A16321. Exposure.--The ideal exposure site for the pyr heliometer is one that is free from any obstructions above the horizontal plane of the sensing element, and that is readily accessible for maintenance of the instrument. If it is impossible to obtain such an exposure, the site must be as free from obstructions as possible, especially in the northern hemisphere, from east-northeast through south to west-northwest; or in the southern hemisphere, from east-southeast through north to west-southwest. If practicable, the pyr heliometer should be so located that (1) a shadow will not be cast on it at any time, (2) it is not in proximity to light-colored walls or other objects likely to reflect sunlight directly on the sensing element of the pyr heliometer, and (3) it is not subject to radiation from other sources.

A16322. Installation.--The pyr heliometer is mounted on a pedestal, the top of which is horizontal. Orient the pedestal so that the pyr heliometer

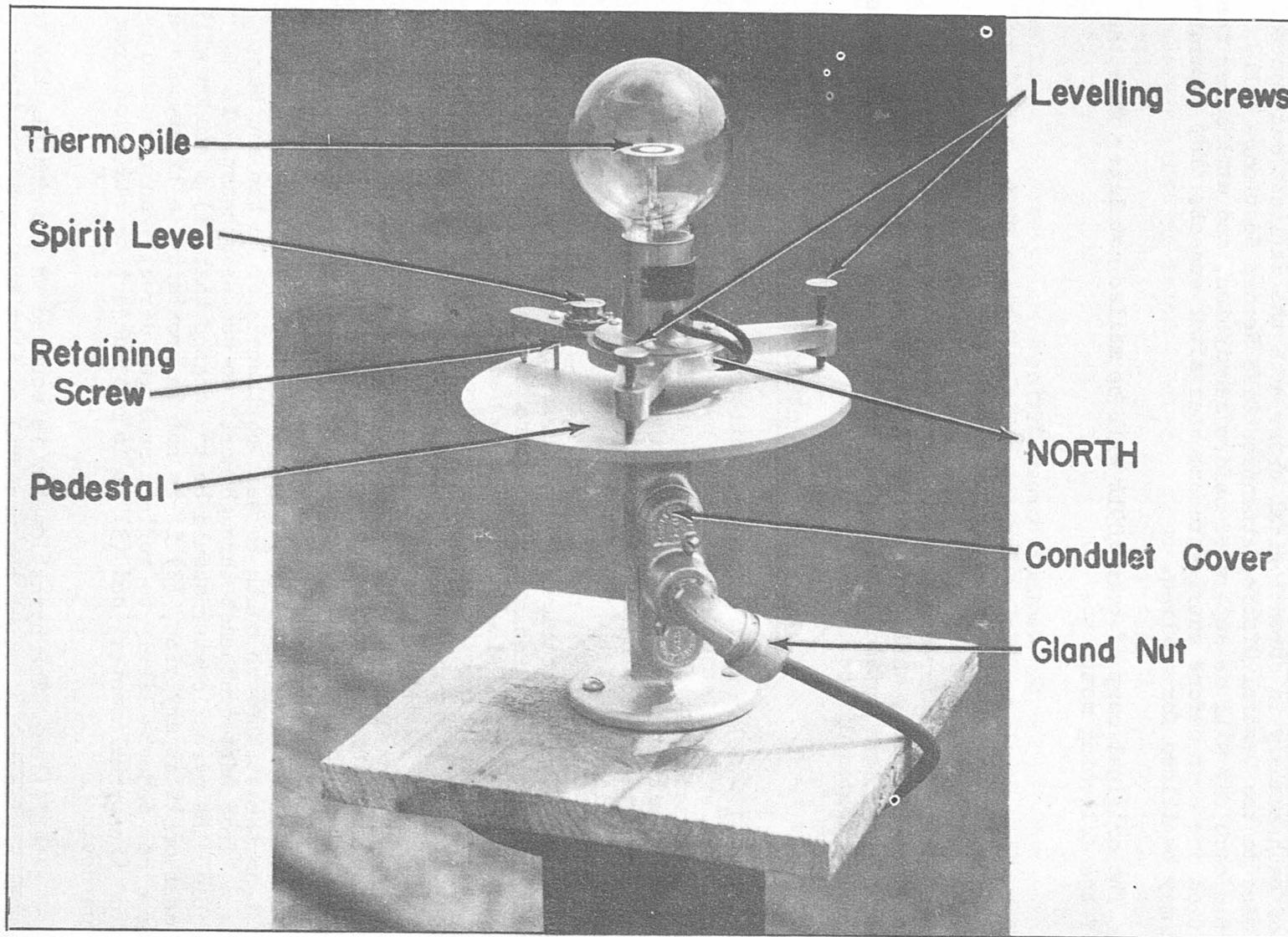


Fig. A16-8. Pyrliometer - 10-junction

retaining screw is located directly south of the center of the pedestal. Center the pyr heliometer on the pedestal, and secure the instrument lightly with the retaining screw. Level the instrument with the leveling screws and with the spirit level that is mounted on the south leg of the instrument. Tighten the retaining screw, but not sufficiently to change the level setting of the instrument. When properly exposed, the sensing element is horizontal and the leads emerge from the north side of the instrument. At northern stations where the 50-junction pyr heliometer is used in winter to replace the 10-junction instrument (see par. Al6324), care must be exercised to obtain a permanent copper-to-copper junction between the short leads from the pyr heliometer and the cable to the recorder; i.e., a junction that will not introduce thermal effects resulting either from temperature differences between the two connections or from gradual growth of an oxide film between the spliced wires. When disconnecting the pyr heliometer, melt the solder and remove as much of it as possible by striking the hot joint sharply against a firm object. Carefully straighten and separate the stranded leads, repeating the heating and striking process as necessary to separate the strands and to remove all but a thin film of solder. When connecting the pyr heliometer, scrape the strands to be twisted and soldered until a clean copper-to-copper union is possible. Solder each splice with a minimum of free-running solder. Tape each splice, first with rubber tape and then with friction tape, and then tape the two together with friction tape. Replace the pedestal conduit cover, being careful not to pinch the splices, and tighten the gland nut on the squeeze connector.

Al6323. Obstructions Above Free Horizon.—WB Form 1092, "Obstructions to Pyr heliometer or Illumination Cell" will be prepared (1) when the pyr heliometer is installed, (2) whenever the location of the instrument is changed, or (3) if a significant change occurs in the surrounding obstructions; i.e., obstructions likely to cast a shadow or reflected light on the pyr heliometer for even a brief period of the day. The form will be prepared in triplicate in accordance with the following instructions and in the manner illustrated in Fig. Al6-9:

- (1) Enter the elevation of the instrument to the nearest whole meter, msl.
- (2) Plot the angular elevation above the pyr heliometer and the angular range in azimuth of all obstructions throughout the full 360° around the pyr heliometer. Obtain the elevation and range data by means of a theodolite set up as closely as possible to the pyr heliometer.
- (3) On the same form, plot the path of the sun across the sky at the winter and summer solstice. The path of the sun is interpolated from a plot of the elevation and azimuth angles of the sun at (a) sunrise, (b) sunset, and (c) at hourly intervals between sunrise and sunset measured in whole hours from true solar noon. The time interval between the true solar noon and the time corresponding to a particular position of the sun is termed the "hour

angle" of the sun. During a.m. hours, the azimuth angle is said to be east and is obtained directly from Table A16-4. During p.m. hours, the azimuth angle is said to be west and is obtained by subtracting the east azimuth angle for the corresponding hour angle from 360 degrees. In table A16-4, only angles in azimuth are given for sunrise and sunset, since the altitude angle is zero regardless of the latitude. For hour angles between zero (true solar noon) and either sunrise or sunset, tabular values are given in pairs. The upper value is the solar altitude and the lower value is the east azimuth angle for any given set of arguments. The horizontal arguments are the hour angles to the nearest whole hour; the vertical arguments are values of latitude to the nearest five degrees. Tabular values are given to the nearest whole degree. Use as arguments latitude to the nearest whole degree and hour angle to the nearest whole hour. Interpolate as necessary to obtain values of solar altitude and azimuth to the nearest whole degree.

A16323.1. Values for  $0^{\circ}$  to  $4^{\circ}$  south latitude are identical with those for corresponding northern latitudes, except that azimuth values are computed from south instead of north and, in the case of the solstices, the seasons are reversed. For instance, in determining the solar altitudes and solar azimuths for the hour angles on the day of the southern winter solstice, consult the table for the corresponding hour angles for the day of the northern summer solstice.

A16323.2. The following example of the determination of the elevation and azimuth angles at a given hour angle at a northern latitude station is taken from the data shown in Fig. A16-9:

Example: Station latitude -  $38^{\circ}56'N$  ( $39^{\circ}$ ). Time - 1500 T.S.T.  
(hour angle three, west azimuth) at the time of the northern summer solstice.

- (1) From Table A16-4, the altitude and east azimuth angles corresponding to a latitude of  $39^{\circ}N$  and an hour angle of three are  $49^{\circ}$ ; and  $99^{\circ}$ , respectively.
- (2) The west azimuth angle is obtained by subtracting 99 from 360; i.e., 261 degrees.

A16323.3. The hour angles and corresponding altitudes, and the east and west azimuth angles, are entered in the appropriate space on Form 1092. For each hour angle, plot the position of the sun on the chart and complete the path of the sun between sunrise and sunset by interpolation. On the chart, solar altitudes are represented by concentric ordinates, and east and west azimuth

angles (measured clockwise from zero) are represented by radial ordinates.

A16323.4. As soon as the form is completed, mail the original copy to:

Weather Bureau Office  
Solar Radiation Field Testing Unit  
Boston 9, Massachusetts

Forward one carbon copy to the Central Office, attention Scientific Services Division and retain the other copy. Airmail copies from stations outside the continental United States.

Table A16-4. Solar Altitudes and Azimuths at the Time of the SUMMER Solstice  
(Expressed to the nearest whole degree)

Latitude	Hour Angle												Sunrise or Sunset		
	0	1	2	3	4	5	6	7	8	9	10	11	12	Hour Angle (h. m.)	Azimuth (degrees)
0	67 0	62 31	53 49	40 58	27 63	14 66	0 67							6:00	67
5	72 0	67 37	56 55	43 62	29 66	16 67	2 67							6:09	66
10	77 0	70 45	58 61	45 67	31 69	18 68	4 67							6:17	66
15	82 0	74 57	61 69	47 72	33 72	19 70	6 67							6:26	66
20	87 0	76 73	62 77	48 77	35 75	21 72	8 68							6:37	65
21	88 0	76 77	62 79	48 78	35 75	21 72	8 68							6:39	65
22	89 0	76 81	62 81	49 79	35 76	22 72	9 68							6:40	65
23	90 Z	76 85	62 83	49 80	35 77	22 73	9 68							6:43	64
24	89 180	76 89	63 85	49 81	36 78	22 73	9 68							6:45	64
25	88 180	76 93	63 87	49 82	36 78	23 74	10 69							6:47	64
30	83 180	75 113	63 97	50 88	37 82	24 76	11 69							6:58	63
35	78 180	73 127	62 106	49 94	37 86	25 78	13 70	2 62						7:10	61
40	73 180	69 138	60 114	49 100	37 89	26 80	15 72	4 63						7:25	59
45	68 180	65 145	57 122	48 105	37 93	27 83	16 73	7 63						7:43	56
50	63 180	61 151	55 128	46 110	37 97	27 85	18 74	9 64	1 53					8:05	52
55	58 180	57 155	51 133	44 115	36 101	28 88	19 76	11 65	4 53					8:33	46
60	53 180	52 157	48 137	42 119	35 104	28 90	20 78	13 65	7 53	1 40				9:14	37
65	48 180	47 160	44 140	39 123	34 107	27 93	21 80	15 67	10 54	5 41	1 27	0 0		10:42	20
70	43 180	43 161	40 143	37 126	32 110	27 96	22 82	17 68	13 55	9 41	6 28	4 14	3 0	--	--
75	38 180	38 163	36 145	34 129	30 113	26 98	23 84	19 69	15 56	13 42	10 28	9 14	8 0	--	--
80	33 180	33 164	32 147	30 131	28 116	26 101	23 86	21 74	18 57	16 43	15 28	14 14	13 0	--	--

Interpolate for values of solar altitude and azimuth corresponding to the nearest whole degree of latitude. The upper value of each pair of tabular values is the solar altitude and the lower value is the east azimuth angle. To find a west azimuth for a given hour angle, subtract the corresponding east azimuth angle from 360 degrees. Azimuths are east in the morning and west in the afternoon. North = 0°; Z = zenith.

Table A16-4 (continued). Solar Altitudes and Azimuths  
at the Time of the WINTER Solstice  
(Expressed to the nearest whole degree)

Latitude	Hour Angle						Sunrise or Sunset	
	0	1	2	3	4	5	Hour Angle (h. m.)	Azimuth Angle (degrees)
0	67 180	62 149	53 131	40 122	27 117	14 114	6:00	113
5	62 180	58 153	49 135	38 125	25 119	12 115	5:51	114
10	57 180	53 157	46 139	35 128	23 121	9 116	5:43	114
15	52 180	49 159	42 142	32 130	20 122	7 117	5:34	114
20	47 180	44 161	38 145	28 133	17 124	5 117	5:23	115
25	42 180	39 162	33 147	25 134	14 125	3 118	5:13	116
30	37 180	35 163	29 148	21 136	11 126	0 118	5:02	117
35	32 180	30 164	25 150	18 137	8 127		4:50	119
40	27 180	25 165	21 151	14 138	5 127		4:35	121
45	22 180	20 165	16 152	10 139	2 127		4:17	124
50	17 180	15 166	12 152	6 139			3:55	128
55	12 180	11 166	7 153	3 140			3:27	134
60	7 180	6 166	3 153				2:45	142
65	2 180	1 166					1:26	160

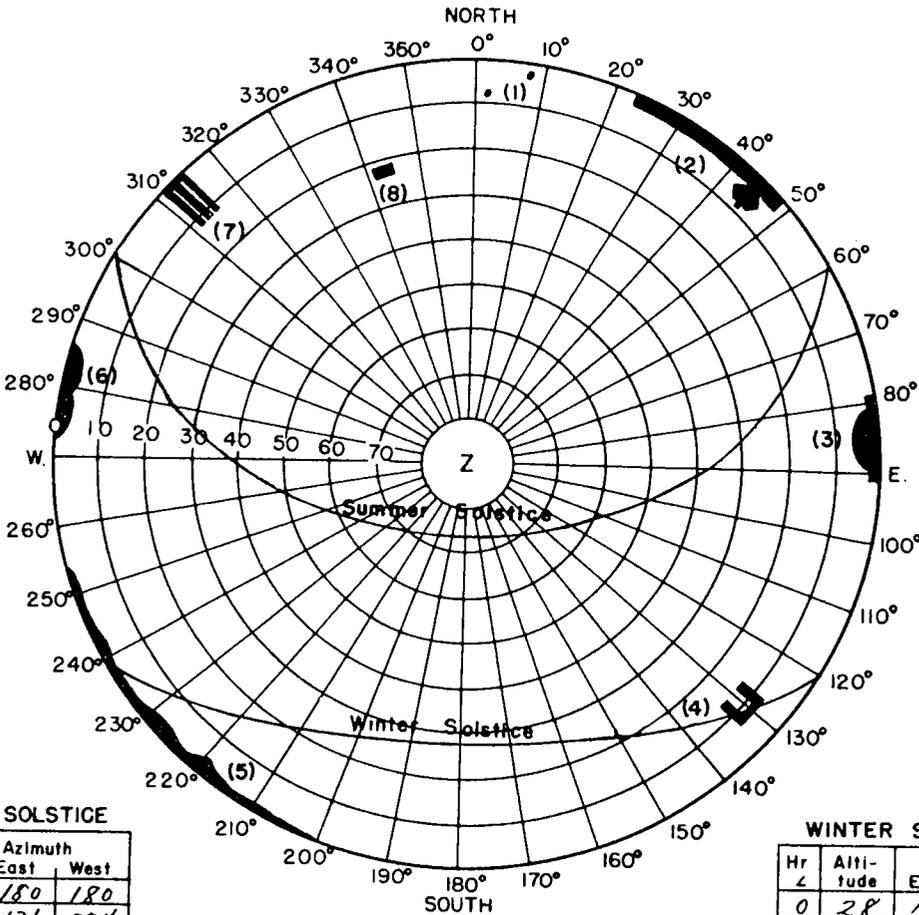
Interpolate for values of solar altitude and azimuth corresponding to the nearest whole degree of latitude. The upper value of each pair of tabular values is the solar altitude and the lower value is the east azimuth angle. To find a west azimuth for a given hour angle, subtract the corresponding east azimuth angle from 360 degrees. Azimuths are east in the morning and west in the afternoon. North = 0°.

W.B. FORM 1092

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

# OBSTRUCTIONS TO PYRHELIOMETER OR ILLUMINATION CELL

STATION Nameville, State      LATITUDE 38 ° 56 ' NORTH  
 DATE February 15, 1950      LONGITUDE 77 ° 05 ' WEST  
 ELEVATION OF INSTRUMENT 10 METERS, MSL.



**SUMMER SOLSTICE**

Hr	Altitude	Azimuth East	West
0	74	180	180
1	70	136	224
2	60	112	248
3	49	99	261
4	37	88	272
5	26	80	280
6	15	72	288
7	4	63	297
SR	0	59	—
SS	0	—	301

**LIST OF OBSTRUCTIONS**

1. ANTENNA POLES
2. ADMINISTRATION BUILDING
3. HANGAR
4. APARTMENTS
5. HILLS
6. TREES
7. STEEL MILLS
8. COAL CHUTE
9.
10.
Prepared by <u>CDE</u>

**WINTER SOLSTICE**

Hr	Altitude	Azimuth East	West
0	28	180	180
1	26	165	195
2	22	151	209
3	15	138	222
4	6	127	233
SR	0	121	—
SS	0	—	239

Fig. A16-9. WB Form 1092

Al6324. Changing Pyrheliometers.—At northern stations supplied with both 50-junction and 10-junction pyrheliometers, the 50-junction pyrheliometer will be used during the fall, winter and spring. In the fall, after the sun has reached a low solar altitude such that the maximum deflection (amplitude) of the recorder pen at noon on a clear day is small, remove the 10-junction pyrheliometer and install the 50-junction instrument. The exchange should be made when the maximum deflection has decreased to a scalar reading of less than the ratio of the calibration constant for the 10-junction instrument to the constant for the 50-junction instrument multiplied by a factor of 100, e.g., if the constant for the 10-junction instrument is 2.5 and the constant for the 50-junction instrument is 7.5, the 50-junction instrument would be installed after the maximum amplitude of the trace on a clear day has decreased to less than  $\frac{(100 \times 2.5)}{7.5}$ , or 33.3 units as read on the graduated chart. In the spring, the 10-junction instrument will be installed after the maximum amplitude of the 50-junction trace reaches 90 to 95 units on a clear day. Enter the date and the true solar time of each exchange as a note on the record. Regardless of whether the 10- or 50-junction instrument is in use, the calibration dial on the recorder will not be changed from the calibration value in millivolts appropriate to the 10-junction instrument (see par. Al6411).

Al6325. Maintenance.—Clean the bulb daily or more frequently if pollution is excessive or frost or ice accumulates on the bulb. Use a soft, clean cloth and water if necessary. Remove frost or ice-coatings with warmed cloths or any other device that will not scratch the glass. Wipe the glass dry immediately following the removal of the ice.

Al6325.1. Stations in areas where sandstorms occur are furnished with covers to protect the bulb of the pyrheliometer from sandblasting. The covers are equipped with drawstrings, which enable the cover to be tightly fitted to the bulb. Place the cover over the bulb at the beginning of each storm. During the season when storms are likely to occur at night, the cover will be left on all night and removed before sunrise.

#### Al6400. RECORDERS

Al6410. General.—Two types of Brown recorders are in general use: (1) a roll-chart type and (2) a circular-chart type which is used with a four-dial watt-hour meter as an integrating indicator. An I&N (Leeds and Northrop) recorder is also used at a few stations. All recorders are of the modified, commercial, self-balancing potentiometer type. Each recorder is calibrated by a technician to record over a range of 0 to 2.0 gm. cal./sq. cm./min. corresponding to the range of the individual 10-junction instrument to be used with it. The recorder is not recalibrated when a 50-junction is substituted for a 10-junction instrument (see par. Al6324).

A16411. The circular calibration dial inside the recorder will be set by the technician to the value in millivolts indicated by the calibration sheet accompanying the station 10-junction pyr heliometer. Once set, the dial will be adjusted only by technicians during subsequent calibrations.

A16412. The location of the recorder should conform with the requirements stated in the manufacturer's manual of instructions that is supplied with each instrument. Any unavoidable changes that tend to make the location unsatisfactory, e.g., excessive dustiness, ambient temperatures above 110°F. or below 32°F. will be reported to the Regional Office.

A16413. Each observer should become familiar with the characteristics of the trace normally obtained under various meteorological conditions. The trace will vary constantly in amplitude between sunrise and sunset. The changes may be smooth or abrupt, but periods of record of 10 to 15 minutes or more without any change in amplitude, or a series of step-like changes in amplitude (brief periods of no change followed by abrupt increases or decreases), generally indicate malfunctioning of equipment. The slight curvature of the trace obtained near noon on a clear day should not be mistaken for a trace in which there is no change of amplitude. If faulty operation of a Brown recorder is suspected because of abnormalities in the trace or for other reasons, substitute spare tubes, one at a time, for the two 7F7 and the two 7N7 tubes in the recorder amplifier. One set of spare tubes should be kept available for replacement purposes, and used tubes should be retained for disposition by a technician.

A16420. Operation of Roll-Chart Type Recorder (Brown ElectroniK Recorder - See Fig. A16-10).—

(1) To start the recorder:

- (a) Swing the chassis out of the case and turn on the power switch on the back of the chassis.
- (b) After the amplifier tubes have warmed up for two minutes or more, turn on the chart-drive switch.
- (c) Standardize the dry cell manually (see manufacturer's manual of instructions).
- (d) Check the legibility of the trace.

(2) To stop the recorder:

- (a) Turn off the chart-drive switch. CAUTION: If the recorder is in a standardization cycle, do not turn off the switch until the cycle is completed.

- (b) If use of the recorder is being discontinued for servicing, or for more than 24 hours, turn off the power switch located on the back of the chassis.

A16421. Standardization.—When the recorder is in operation it initiates a standardization cycle automatically every thirty minutes. The cycle lasts for about thirty seconds. To avoid turning off the recorder chart-drive during a standardization cycle, standardize the instrument manually in accordance with the manufacturer's instructions until the audible and visual indications that accompany each cycle become familiar. A characteristic sound occurs during the cycle and another at the end of the cycle. Frequently, instability of the pen will be observed during the cycle as "pips" on the trace. These are brief changes in amplitude of about 30 seconds duration followed quickly by return of the pen to approximately the amplitude at the beginning of the cycle. The amplitude and direction of the change will depend upon the condition of the dry cell (see manufacturer's manual of instructions). Frequently a very slight readjustment in the amplitude of the trace will result from the standardization process.

A16422. Maintenance.--

- (1) Dry-Cell Renewal.--Instructions for installing the dry cell (a 1.5-volt, Columbia Gray Label dry cell or equivalent) are given in the manufacturer's manual of instructions. The special flexible-resistor type lead from the negative "BAT" terminal must be handled carefully and must not be replaced except with the same type of lead. The dry cell should be renewed at least every eight months and whenever the red, dry-cell-condition index drops to the "Renew" line, or the net change in the amplitude of the trace during the standardizing cycle becomes greater than normal.
- (2) Slidewire.--The slidewire will be serviced by a technician.
- (3) Chart Renewal.—Each roll of chart paper has a life of about thirty days of continuous operation at the chart-feed speed of two inches per hour. Renew the paper between sunset and sunrise in accordance with the manufacturer's manual of instructions when it becomes evident that the remaining paper is not sufficient for for the following day, or at any other time if necessary to avoid loss of record.
- (4) Pens.—Refill the pen whenever the chart is replaced, and more frequently if necessary to avoid loss of record. Clean the pen as frequently as necessary to insure a legible, uninterrupted record. Further instructions

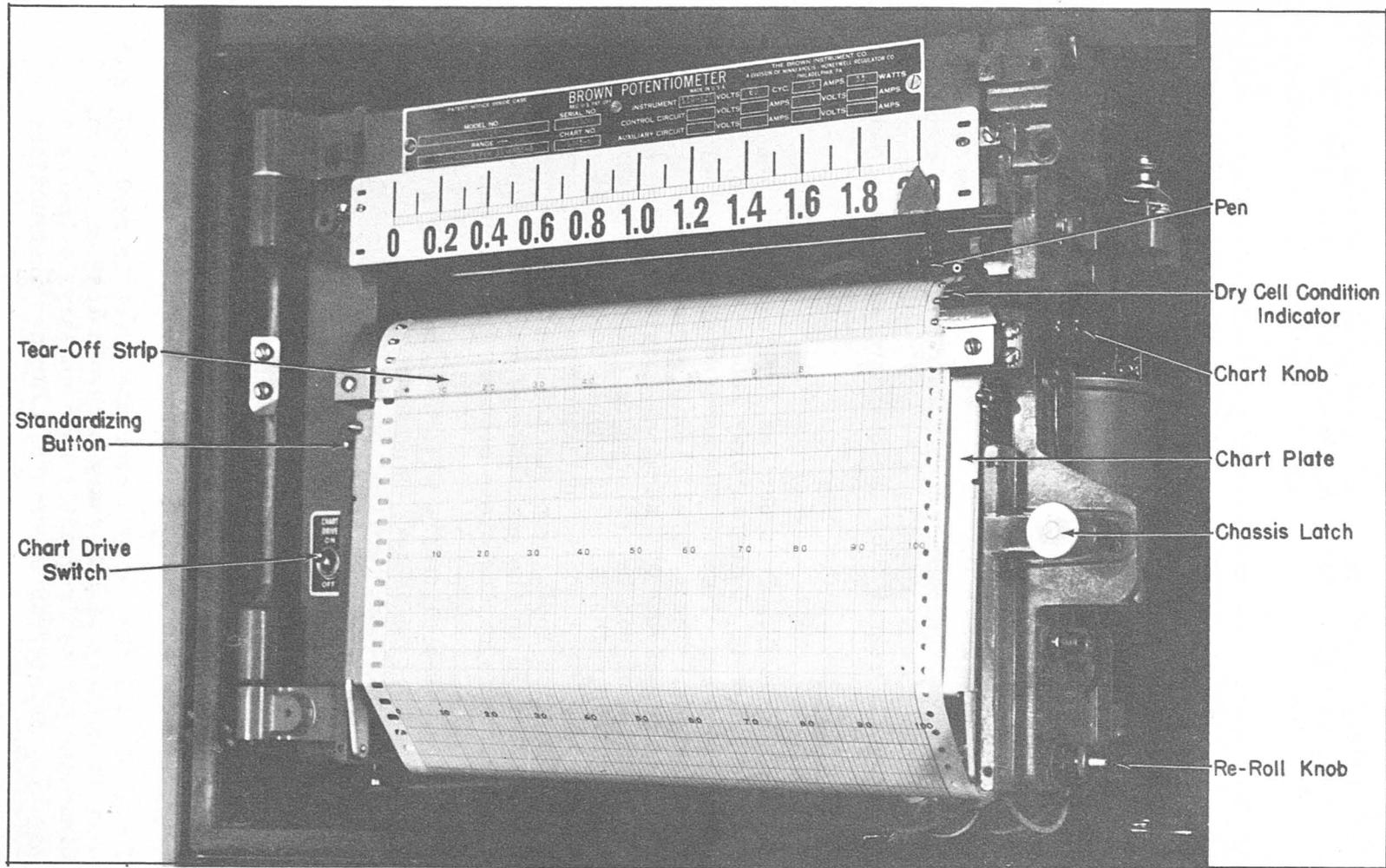


Fig. A16-10. Roll-chart recorder

for installing, filling, and cleaning the pen are contained in the manufacturer's manual of instructions.

- (5) Lubrication and Cleaning.--Clean and oil the recorder each month in accordance with the manufacturer's manual of instructions under "Monthly Maintenance."
- (6) Continuous Balance Unit.--Instructions for adjusting the sensitivity of the unit, and instructions supplementary to those in par. A16413 for replacing defective amplifier tubes, are furnished by the manufacturer.

A16430. Operation of the Circular-Chart Type Recorder (Brown ElectroniK Recorder - See Fig. A16-11).--

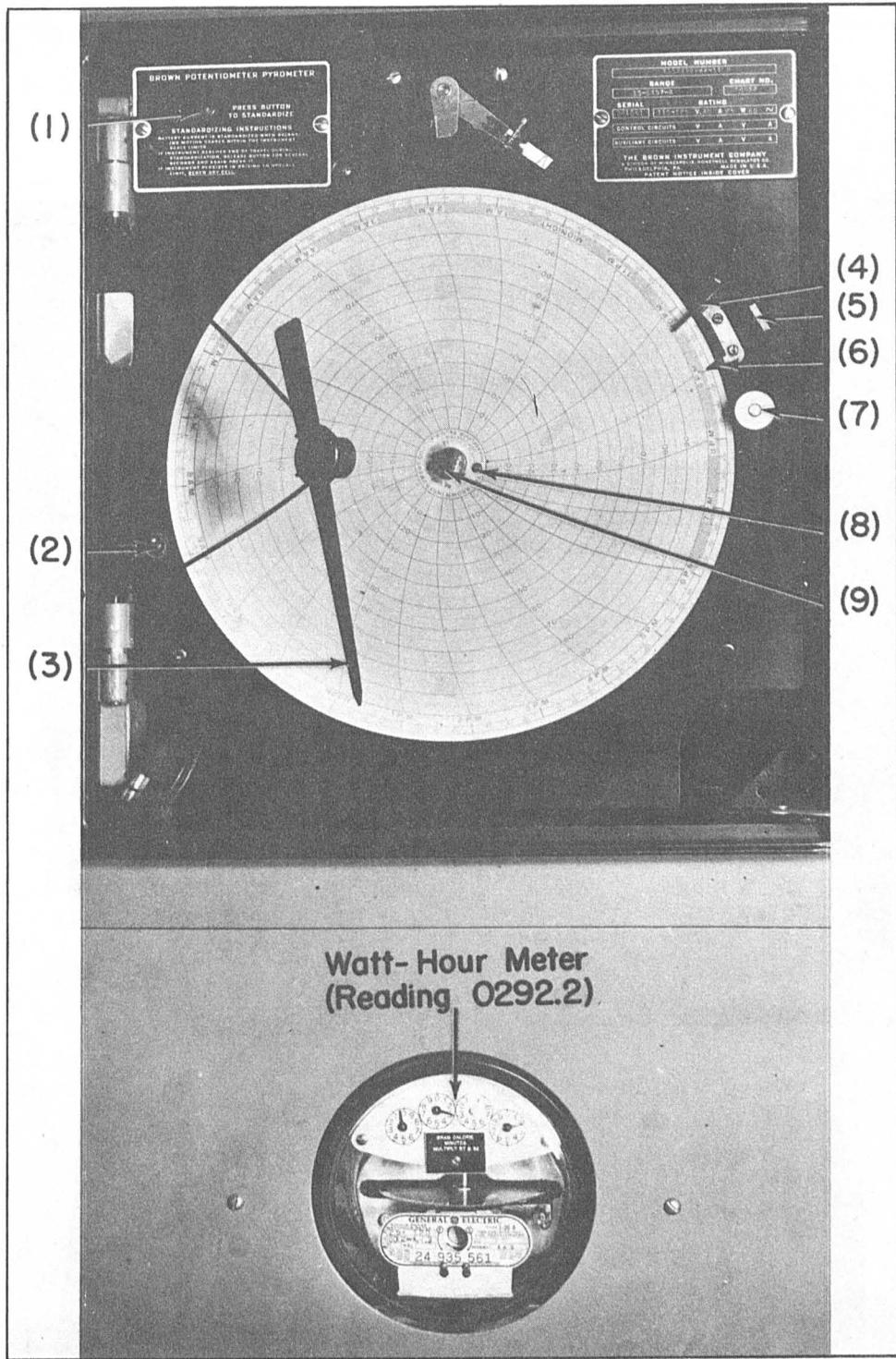
- (1) To start the recorder:
  - (a) Turn on the instrument power switch on the lower left side of the face plate.
  - (b) After the amplifier tubes have warmed up for two or three minutes, standardize the dry-cell current in accordance with the manufacturer's manual of instructions for "Standardizing the Battery Current".
  - (c) Re-standardize the dry-cell current after the instrument has been operating approximately two hours.
- (2) To stop the recorder, turn off the power switch on the lower left side of the face plate (the recorder should be stopped only for servicing, or when it is to be out of operation for 24 hours or more).

A16431. Routine Standardization.--Standardize the dry-cell current at approximately eight-hour intervals between sunrise and sunset. The cell should be standardized at sunrise, or as soon as practicable thereafter, in accordance with the manufacturer's manual of instructions.

A16432. Maintenance (See Fig. A16-12).--

- (1) Dry-Cell Renewal.--Instructions for installing the dry cell (a 1.5-volt Columbia Gray-Label dry cell or equivalent) are given in the manufacturer's manual of instructions. The special flexible-resistor type lead from the negative "-BAT" terminal must be handled carefully and must not be replaced except with the same type of lead. Replace the dry cell at least every eight months and whenever the current can no longer be standardized.

- (2) Slidewire.—The slidewire will be serviced by a technician.
- (3) Chart Renewal.—Circular charts will be replaced daily in accordance with the manufacturer's instructions.
- (4) Pens.—Fill the pen each day at the time the chart is replaced. Clean the pen as frequently as is necessary to insure a legible record. Clean and fill the pen in accordance with the manufacturer's manual of instructions using ink provided for this instrument.
- (5) Lubrication.—Oil the recorder each month in accordance with the manufacturer's manual of instructions under "Monthly Maintenance."
- (6) Continuous-Balance Unit.—Instructions for adjusting the sensitivity of the unit, and instructions supplementary to those in par. A16413 for replacing defective amplifier tubes, are specified in the manufacturer's manual of instructions.



(1) Standardizing button, (2) Power switch, (3) Indicating pointer, (4) Pen holder, (5) Pen, (6) Time index, (7) Chassis latch, (8) Time index pin, (9) Chart hub.

Fig. A16-11. Circular-chart recorder (front)

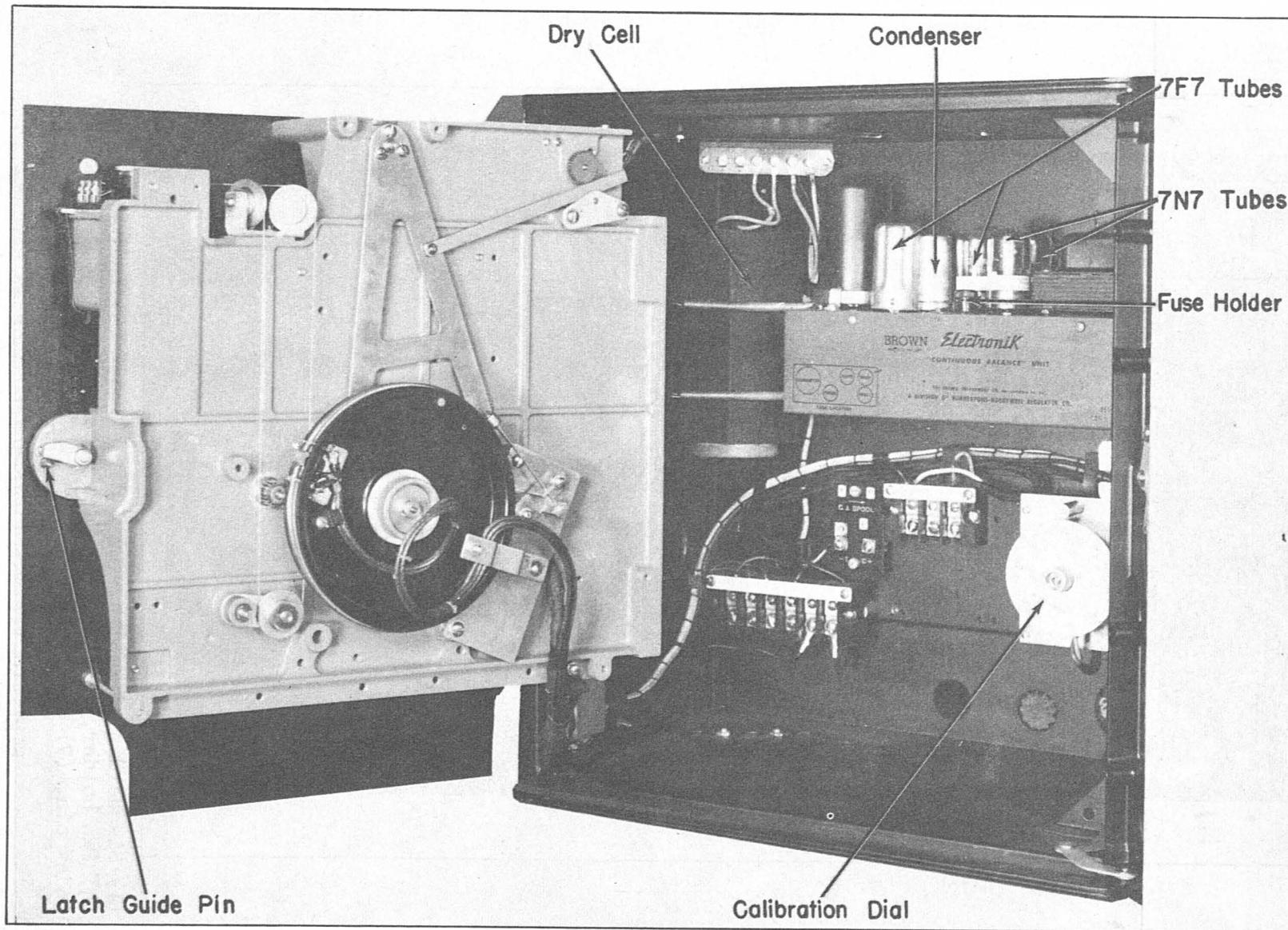
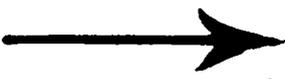


Fig. Al6-12. Circular-chart recorder (inside)

Change No.  2

U. S. Department of Commerce  
Weather Bureau

# WBAN MANUAL OF SURFACE OBSERVATIONS

6th Edition

( This page may be discarded )

January 1, 1951

## CHAPTER 9. AIRWAY AND SUPPLEMENTARY OBSERVATIONS

### 9000. GENERAL

**9010.** An observation is an evaluation of the meteorological situation at the point where the observation is taken. The component parts of an observation, when referred to in a general sense, are termed elements. The evaluation of the state of the various elements consists in observing them. Meteorological elements observed at or from the surface are usually limited to clouds, visibility, atmospheric phenomena, wet- and dry-bulb temperatures, precipitation, pressure, wind, and duration of sunshine.

**9011.** The terms "airway observation" and "synoptic observation" connote the assemblage of specified observational elements in a manner designed to satisfy meteorological and operational requirements. The instructions in this chapter are concerned principally with the various types of airway observations. Pilots' reports of meteorological phenomena encountered in flight are used to supplement airway observations.

**9012.** The observation of elements will be taken in the order given below, unless the sites of instrumental equipment require deviation:

- |                           |                               |
|---------------------------|-------------------------------|
| (1) Sky                   | (5) Precipitation measurement |
| (2) Visibility            | (6) Humidity                  |
| (3) Atmospheric phenomena | (7) Pressure                  |
| (4) Temperature           | (8) Wind                      |

Observation of the elements listed above will be taken in accordance with applicable instructions elsewhere in this manual. At designated stations visibility observations will be taken at the control tower or the approximate level of the control tower, as well as at the usual point of observation, whenever the visibility at the usual point of observation is less than three miles. Under these circumstances, visibility observations taken at the control tower will be used for all purposes, such as record, coding and summary that require visibility data (paragraph 11105.3). The observer will inform himself of the nature of the visibility-restricting phenomena at the control tower level.

**9013.** All scheduled observations will be started just sufficiently in advance of the time of transmission to permit accurate evaluation of all the elements.

### 9100. AIRWAY OBSERVATIONS

**9110. GENERAL.** Airway observations are primarily intended to provide (a) immediate weather information for aviation interests, and (b) data for climatologists. The observations are classified as record, special, record-special, local extra, and check. The time and conditions under which the observations are taken, and the elements observed, are specified in the following paragraphs. When two or more types of observations coincide, all the elements observed for each type will be included in the observation, with the exception specified in paragraph 9142.

**9120. RECORD OBSERVATIONS.** A record observation is taken at scheduled hourly intervals and will be prepared for teletype transmission at least two minutes prior to the time of entrance into the sequence in which it first appears. An observation at an off-teletype station will be telephoned or telegraphed to a relay station at a time to be specified in separate instructions.

**9121.** The elements listed below will be observed insofar as the instrumental equipment of the station permits:

- |                           |  |
|---------------------------|--|
| (1) Ceiling               | (7) Temperature                                  |
| (2) Sky                   | (8) Dew Point                                    |
| (3) Visibility            | (9) Wind direction, speed, character, and shifts |
| (4) Weather               | (10) Altimeter setting                           |
| (5) Obstruction to vision |  |
| (6) Sea-level pressure    |  |

9130. SPECIAL OBSERVATIONS. A special observation is taken to provide information on significant developments in meteorological conditions occurring at other than scheduled periods.

9131. The number of elements included in a special observation depends on the conditions being reported. The special observation may consist of only one element (e.g., tornado) or of most of those included in a record observation. Each of the elements that may be included in a special observation is listed in paragraph 9134.01 to 9134.10. Following each element is listed the magnitude or nature of the change in it that would require a special observation. Any element listed in paragraph 9132 may be reported alone as a special observation. When a change in one or more of the elements listed in paragraph 9133 requires a special observation, the additional elements listed beside them must also be included in the observation. When changes in two or more elements individually satisfy the criteria for a special observation, the elements will be included in a single special observation. In all cases, remarks will be added as required.

\*9132. When a change in one of the following elements satisfies the criteria for a special observation, it may be reported alone as a special observation.

- (1) Tornado or waterspout
- (2) (Cancelled)
- (3) (Cancelled)
- (4) Wind shift and increases in wind speed

\*9133. When a change in one or more of the following elements satisfies the criteria for a special observation, the observation will include all the elements listed to the right of them:

Elements, a specified change in any one of which requires a special observation.

- (1) Ceiling
- (2) Sky
- (3) Visibility
- (4) Weather
- (5) (Cancelled)

All elements below to be reported with any element in opposite column.

- Ceiling
- Sky
- Visibility
- Weather
- Obstructions to vision
- Wind

9134. CRITERIA FOR TAKING SPECIAL OBSERVATIONS. A special observation will be taken whenever one or more of the elements listed below have changed in the amount specified. The amount of change is with reference to the preceding record or special observation.

\*9134.01. CEILING.

- (1) (Cancelled)
- (2) (Cancelled)

- (3) The ceiling decreases to less than 1,500 feet, or increases to 1,500 feet or more.
- (4) The ceiling decreases to less than 1,000 feet, or increases to 1,000 feet or more.
- (5) The ceiling decreases to less than 500 feet, or increases to 500 feet or more.
- (6) A ceiling below 500 feet changes by 100 feet or more. †
- (7) The ceiling decreases to a value lower than the highest airline operating minimum for the airport. †
- (8) The ceiling increases to a value equal to or higher than the highest airline operating minimum for the airport. †

\*9134.02. SKY CONDITION.

- (1) (Cancelled)
- (2) A layer is observed below:
  - (a) 1,000 feet or
  - (b) the highest airline operating minimum for the airport, no layer having been previously reported below this altitude. †

\*9134.03. VISIBILITY.

- (1) (Cancelled)
- (2) (Cancelled)
- (3) The visibility decreases to less than:
  - (a) 3 miles
  - (b) 1 mile
  - (c) 3/4 mile } †
  - (d) 1/2 mile } †
  - (e) 1/4 mile } †
- (4) The visibility increases to equal or exceed:
  - (a) 3 miles
  - (b) 1 mile
  - (c) 3/4 mile } †
  - (d) 1/2 mile } †
  - (e) 1/4 mile } †
  - (f) (Cancelled)

9134.04. TORNADO.

- (1) Is observed
- (2) Disappears from sight
- (3) Is reported by the public to have occurred within the preceding six hours.

---

† Effective only at stations having scheduled air-carrier operations.

## 9134.05. THUNDERSTORM.

- (1) Begins
- (2) Increases in intensity
- (3) Ends. (Special observation 15 minutes after thunder is last heard at station.)

## \*9134.06. PRECIPITATION.

- (1) Hail begins or ends, or changes in intensity.
- (2) (Cancelled)
- (3) Freezing precipitation begins or ends, or changes in intensity.
- (4) Sleet begins or ends, or changes in intensity. (Beginning or ending of other types of precipitation will be reported in remarks in the next succeeding record observation, but will not be reported by means of special observations; e.g., "RWB45E15" in remarks will indicate that rain shower began at 45 minutes past the previous hour and ended at 15 minutes past the current hour.)
- (5) (Cancelled)

## \*9134.07. FOG. (Cancelled)

## \*9134.08. SAND-STORM, DUST-STORM. (Cancelled)

## 9134.09. WIND AND WIND SHIFTS.

- (1) Sudden doubling of speed (over a one-minute interval) to more than 30 miles per hour (26 knots).
- (2) Wind-shift.

## \*9134.10. ALTIMETER SETTING. (Cancelled)

\*9134.11. The foregoing will be regarded as the minimum requirements for taking a special observation. In addition, any meteorological situation that, in the opinion of the observer, is of importance to the safety or efficiency of aircraft operations will be reported in a special observation. At military stations, additional criteria may also be specified by military directive.

9140. LOCAL EXTRA OBSERVATIONS. Local extra observations are taken, at designated stations, for local distribution only. The changes requiring a local extra observation are within

(Continued on next page)

narrower limits than changes requiring a special observation. When a local extra observation reveals a change in conditions that requires a special observation, the local extra observation will be classified as a special observation and treated accordingly.

**9141.** At designated stations, local extra observations will be taken at intervals not exceeding 15 minutes, beginning whenever:

- (1) Ceiling or visibility decreases to a value equal to or less than the highest airline minimum applying to the airport.
- (2) The ceiling decreases to 500 feet or less.
- (3) The visibility decreases to one mile or less.

**9141.1.** Local extra observations will be discontinued when values above these minimums have been reported. Record or special observations coming within the 15-minute interval will also serve as the local extra observation. The 15-minute interval will begin at the time of the record or special observation.

**9141.2.** Except when taken in accordance with paragraph 9142 and 9143 the observation will include the following elements:

- (1) Ceiling
- (2) Sky
- (3) Visibility
- (4) Weather
- (5) Obstructions to vision

Remarks will be added as required.

**9142.** Local extra observations of one or more elements requested for aircraft arrivals or departures will be taken and recorded at designated stations, in the usual manner, even though weather conditions do not warrant taking a special observation.\* In this case the name of the agency requesting the local extra observation will be noted under "Remarks."

**9143.** Local extra observations will be taken whenever ceiling or visibility changes to a value above, equal to, or below

- a. the minimum prescribed for the airport, or
- b. any air carrier minimum applicable to the local airport.

This requirement is applicable only when takeoffs and landings impend. Suitable arrangements will be made at each station to keep informed of scheduled arrivals and departures as well as of operations involving delayed schedules.

**9144.** An observation of all elements ordinarily included in a record observation will be taken immediately following any aircraft accident in the vicinity of an airport at which a weather-observing station is situated. (See Fig. 8.)

**9150. CHECK OBSERVATIONS.** Check observations will be taken at specified stations where scheduled broadcasts of local weather are made. The local schedule of broadcasting will determine the time of taking them. The check observation will be taken within 20 minutes of the scheduled time of local broadcast, preferably as near to the time of the broadcast as practicable. The 20-minute requirement is waived when a pilot balloon observation is being taken. (See paragraph 10220.) If the broadcast equipment is inoperative, check observations will not be taken. A notation indicating the period of and reason for the suspension of check observations will be entered on WBAN 10.

**9151.** The check observations will include the following elements:

- |                |                            |
|----------------|----------------------------|
| (1) Ceiling    | (5) Obstructions to vision |
| (2) Sky        | (6) Wind                   |
| (3) Visibility | (7) Altimeter setting      |
| (4) Weather    |                            |

**9160. CORRECTED REPORTS.** A corrected observation will be coded and disseminated in accordance with instructions in paragraph 10080.

\*If a special observation is also required, a local extra observation of the one or more elements requested will be filed, after which the other elements required for the special observation will be evaluated, and the special filed.

! *Integration!*

R-3.3 Library

UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU  
Washington 25, D. C.

March 4, 1949

WBAN MANUAL OF SURFACE OBSERVATIONS  
CIRCULAR N, 6TH EDITION

INTERPRETATIONS -- SERIES NO. 1

Note: This is the first of a series of interpretations to be issued in accordance with Circular Letter No. 103-48. Interpretations will be bound in Circular N immediately following the Record of Changes. The number of the interpretation will be entered in the left-hand margin opposite the reference paragraph in Circular N; e.g., "1/1" will be entered in the margin opposite paragraph 1010.

- 1/1. Par. 1010. When instructions in Circular S and the 1932 edition of the International Cloud Atlas disagree, the instructions in Circular S will be followed. A new edition of the International Cloud Atlas is being prepared.
- 1/2. Table 4. The 45-gram free lift pertains to balloons inflated with helium, and the 40-gram lift pertains to balloons inflated with hydrogen. The 75-gram free lift previously authorized for use with helium will no longer be used.
- 1/3. Par. 5140. Corrections to thermometer readings should invariably be applied in accordance with these instructions in order to avoid large errors in psychrometric computations. Many stations have found it useful to prepare graphs of these corrections. In the future, it may be possible to issue the correction cards in graphical form. Example of possible resultant error (28" pressure):

Dry-bulb temperature	7.6°F.	
Correction	+0.6°	
Corrected dry-bulb temperature	8.2°	
Wet-bulb temperature (wick ice-covered)	6.8°	
Correction	-0.5°	
Corrected wet-bulb temperature	6.3°	
Using corrected temperatures: ( $t - t' = 1.9^\circ$ )	Dew point	- 7°
	Relative Humidity	50%
Using uncorrected temperatures: ( $t - t' = 0.8^\circ$ )	Dew point	0°
	Relative Humidity	71%
Error:	Dew point	7°
	Relative Humidity	21%

- 1/4. Par. 7260. When an altimeter setting indicator is used in accordance with these instructions, the mercurial barometer need not be read for 6-hourly synoptic observations, but a reading will be made weekly as required by Instructions for Altimeter Setting Indicators, dated August 8, 1947. The corrected altimeter setting is either (a) the actual reading when the correction at the weekly comparison does not exceed .03 inch, or (b) the reading corrected as indicated by the aforementioned instructions when daily comparisons are necessary.
- 1/5. Par. 7410. Summaries of 850-mb. surface data, formerly required by Circular Letter No. 30-47, are no longer necessary.
- 1/6. Par. 8320. Whenever squalls are reported, gusts must also be reported since the peak speed of gusts is the intensity criterion for squalls. Squalls may be reported when precipitation is not occurring, since the occurrence of squalls (a wind phenomenon) is independent of the occurrence of precipitation or other atmospheric phenomena.
- 1/7. Par. 8335. The second category in Table 18 should be used when (1) precipitation occurs without a decrease in cloud heights, (2) a decrease in cloud heights occurs without precipitation, or (3) neither of these phenomena occurs. The wind speeds indicated in this table are the peak gusts.
- 1/8. Par. 11105.3. Visibility at the usual point of observation is that existing in a horizontal plane at this point, and is not necessarily the visibility at ground level. Examples of visibility at different levels:

Observed: Ground visibility zero; control tower visibility 40 miles; ground fog 20 feet deep; sky condition from control tower level is clear, but sky condition from the ground is -X.

Recorded: Col. 4: -X; Col. 5: 40; Col. 6: no entry; Col. 14: SFC VSBY 0 GFDEP 20.

Observed: Ground visibility 1/4 mile; visibility from the roof (the usual point of observation) is 10 miles; ground fog 10 feet deep.

Recorded: Col. 5: 10; Col. 6: no entry; Col. 14: SFC VSBY 1/4 GFDEP 10.

1/9. Par. 11465. The barograph correction should be determined from the pressures entered in columns 63 and 64 of WBAN 10B. These pressures should not be changed to hundredths before the correction is determined. For example:

Correct Method	Station Pressure (Col. 63)	29.956	
	Barograph (Col. 64)	29.965	
	Correction (Col. 65)	- .01	
Incorrect	Station Pressure (Col. 63)	29.956	(29.96)
	Barograph (Col. 64)	29.965	(29.96)
	Correction (Col. 65)	.00	

1/10. Add to note following par. 11485.8.

Fig. 4, line 13, 0428 observation, Col. 14: Correct "0000" to read "////."

Fig. 4, line 38, 1028 observation, Col. 14: Correct "5076/2" to read "5076."

Fig. 5, 1007 observation, Col. 64: Correct "29.943" to read "29.945."

Fig. 9, line 7, Col. 21: Correct "7" to read "10."

UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU  
Washington 25, D. C.

May 23, 1949

WBAN MANUAL OF SURFACE OBSERVATIONS  
Circular N, 6th Edition

INTERPRETATIONS - SERIES NO. 2

(To be bound in Circular N following Series No. 1, dated March 4, 1949)

- 2/1. Paragraph 1210(a) Clouds covering less than 1/10 of the sky should be reported in remarks whenever their presence is considered significant. Since clouds covering less than 1/10 of the sky do not constitute a layer, their presence above a lower layer will not be reflected by means of the sky condition symbols.

Example

Given: 9/10 stratocumulus clouds, height estimated  
5,000; less than 1/10 altocumulus castellatus  
clouds, height estimated 10,000.

Reported: Column 3,4— E 500  
Column 14 — FEW ACC E100

(b) In the case of multiple layers, the upper layer may obscure the sun, moon, or stars, and thus prevent use of these criteria in determining whether the lower layer should be classified "thin". Under such circumstances, if the beam from the ceilometer or ceiling light projector completely penetrates the lower layer and casts a clearly visible spot on the upper layer, the lower layer should be classified "thin."

- 2/2. Paragraph 1447.2. The dew-point temperature lines in Figure 1 are with respect to ice at dew-point temperatures below freezing. When using this diagram, convert sub-freezing dew-point temperatures with respect to water to their equivalent values with respect to ice by means of Table 9, page 44, and use this converted value as indicated in Step (1) of the reference paragraph.
- 2/3. Paragraph 9134.02. Item (2) refers only to a change in sky condition below 1,000 feet, and does not refer to total sky cover. For example, if 2/10 stratus appeared at 500 feet beneath a previously reported overcast at 2,500 feet, a special would be required because the clouds below 1,000 feet increased from none to scattered.
- 2/4. Paragraph 9150. Check observations are to be taken in accordance with this paragraph at all Weather Bureau and CAA stations where scheduled broadcasts of local weather are made. This requirement applies even though there has been no significant change in weather conditions since the previous record observation.

- 2/5. Paragraph 9211. Note that, unless the currently reported ceiling value is classified "measured," pilots' reports of ceiling will be accepted as the official ceiling value and immediately disseminated, regardless of indications of instrumental equipment. Since there have been several recent indications that this basic principle for dissemination of pilots' reports of ceiling might not be completely understood, observers are requested to review the reference paragraph and the amplifying instructions in Circular Letter 83-48.
- 2/6. Paragraph 10230. When a single airport communications system is available, such as the telautograph system described in Circular Letter 47-49, observations will usually be distributed over this single system only. This does not preclude, of course, replying to special requests for particular observations by means of telephone, etc.
- 2/7. Paragraph 11105.3. Requirements for reporting variable visibility and visibility differing in various quadrants pertain both to the visibility at the usual point of observation and to that at the control tower level.

Example:

Given: (a) At control tower level: prevailing visibility 1 1/2 miles; visibility variable from 1 to 2 miles.  
(b) At usual point of observation: prevailing visibility 1 1/2 miles; visibility variable 3/4 to 2 1/2 miles

Reported: Column 5 -- 1 1/2V  
Column 14 -- VSBY VRBL 1 TO 2 SFC VSBY  
VRBL 3/4 TO 2 1/2

(Note: With reference to Item 1/8 on Interpretations, Series No. 1, concerning control tower visibility reports, it should be noted that the sky condition would be properly reported as -X only if some other obscuration in addition to the ground fog were present. If ground fog only were present, the sky condition could not be reported as -X since, by definition, ground fog covers less than 6/10 of the sky.)

- 2/8. Paragraph 11106. If the visibility value entered in column 5 is 7 miles or more, obstructions to vision will not be recorded in column 6.
- 2/9. Paragraph 11422.1. Data pertaining to clouds or obscuring phenomena entered in columns 22-27, 29-31, and 33-35 are required for climatological purposes and should represent the actual tenths of clouds in each layer. In entering data pertaining to layers that are partially obscured by a lower layer, it is not necessary that all data be observed at the actual time of the observation, but

- 2/9. (cont.)  
an estimate should be made, based on any preceding observations that are still considered representative, such as pilots' reports. Note that these procedures are not followed in entering summation totals in columns 21, 28, and 32, or in reporting sky condition in column 4; data entered in these columns are primarily for operational purposes, and must reflect the sky condition as actually visible at the time of the observation.
- 2/10. Paragraph 11422.11. When higher clouds are seen through breaks in a lower overcast, but it is not possible to identify them as to type, "U" may be entered in columns 25, 29, or 33, even though the presence of the higher clouds has been reported in column 14.
- 2/11. Paragraph 11445. Since ice crystals are a form of frozen precipitation, snowfall and snow depth data entered in columns 45, 46, 69, and 70 will include data pertaining to ice crystals.
- 2/12. Paragraph 11458. When the altimeter setting indicator is used to determine the station pressure for the synoptic observation, entries will be omitted in columns 60-62. The time of reading the altimeter setting indicator will be entered in column 59; and the station pressure, determined in accordance with paragraph 7260, will be entered in column 63 to the nearest hundredth.
- 2/13. Paragraph 11482. The time of ending of precipitation or thunderstorms, recorded in column 84, should be the actual time of cessation of the phenomenon, rather than, for example, fifteen minutes after thunder was last heard.

Example:

Given: Thunder heard at 1018E, but not heard in succeeding fifteen minutes.

- Reported: (a) Record observation at 1028E continued to report thunderstorm.  
(b) Special observation at 1033E reported ending of thunderstorm.  
(c) Time of ending of thunderstorm recorded in column 84: "1018"

- 2/14. Paragraph 11483. Entries in columns 86-88 refer only to obstructions to vision prevailing at the usual point of observation. Data pertaining only to phenomena occurring at the control-tower level will not be recorded in these columns.

2/15. Paragraph A12319. Visibility values recorded in column 19 of Form 1001C will be based on the values recorded in column 5 of Form 1130A, regardless of whether these values pertain to the usual point of observation or to the control tower level.

UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU  
Washington 25, D. C.

August 1, 1949

WBAN MANUAL OF SURFACE OBSERVATIONS  
Circular N, 6th Edition

INTERPRETATIONS - SERIES NO. 3

(To be bound in Circular N following Series No. 2 dated May 23, 1949)

- 3/1. Paragraph A6120. When making psychrometric computations, it is important to use the correct face of the calculator (i.e., the low temperature range when the wet-bulb temperature is less than 32°F., and the high temperature range when the wet-bulb temperature is 32°F. or more).

The psychrometric calculator is based on the Psychrometric Formula given on page 9 of W.B. No. 235, Psychrometric Tables, where  $t$  = dry-bulb temperature, and  $t'$  = wet-bulb temperature. In the design of the scales, the term  $(1 + \frac{t' - 32}{1571})$  was based on the constant value  $t' = 55^\circ\text{F.}$  for the high temperature range, and  $t' = 14^\circ\text{F.}$  for the low temperature range. These represent mean values for the respective range of wet-bulb temperature of each face. As a result of the different values of this term on the two faces, significant discrepancies in computed dew points may result if the high temperature side is used when the wet-bulb temperature is below 32°F. and the depression is large (see example below).

Example

Given: Dry-bulb temperature = 42.9°F.  
Wet-bulb temperature = 30.4°F.  
Depression = 12.5°F.  
(Pressure = 30.00")

Computation:

	Correct Procedure (low temperature side)	Incorrect Procedure (high temperature side)
Dew Point	-7.3°F.	-9.8°F. (error = -2.5°F.)
Relative Humidity	11%	10% (error = 1%)

- 3/2. Paragraph 7242. When the barograph correction is entered in column 64 of Form 1130B, posting of the barograph correction in the manner indicated in paragraph 7242 is not required.
- 3/3. Paragraph 7260. For convenience in obtaining station pressure from the altimeter setting indicator, a table of station pressures may be prepared, using as arguments altimeter setting readings. Such a table is, of course, the reverse of the present altimeter setting table from which altimeter settings are obtained, using as arguments station pressures. Although the Central Office is unable to prepare such tables for all stations at the present time, preparation by field personnel is recommended at those stations using the altimeter setting indicator for station pressure determinations. These tables should be carefully verified, and a copy furnished the Central Office for review.
- 3/4. Paragraph 8311. The peak gust is the highest speed momentarily indicated by the pointer on the direct reading indicator, regardless of the period during which this peak speed is maintained. The requirement that the indicator be observed for a period of one minute pertains only to the average wind speeds, which are entered in column 11 of Form 1130A, and does not pertain to peak gusts.
- 3/5. Paragraph A9012. (a) The instructions in this paragraph concerning control tower visibility observations apply also at locations where official weather observations are taken by CAA communications personnel. Arrangements should therefore be made at these locations for visibility observations from the control tower whenever the visibility at the usual point of observation is less than 3 miles.
- (b) Use of Form 1130A is not mandatory at control towers taking only visibility observations. If the control tower does not have a telautograph, and if Form 1130A is not suitable, visibility observations may be recorded on a tabulation sheet in the control tower. The minimum data to be entered on this sheet are:
1. Date and time of observation.
  2. Prevailing visibility.
  3. Remarks (such as visibility in different quadrants).
  4. Observers' initials.

These observations should be furnished immediately to the Weather Bureau Office (or the CAA observing station) and recorded there on Form 1130. The tabulation sheets prepared in the control tower may be destroyed after ninety days.

- 3/6. Paragraph A9120.02. If the sky condition changes during a pibal from scattered to overcast (or clear to broken) with clouds above 10,000 feet, the balloon should not be abandoned for the purpose of filing a special observation. However, a special should be filed after the balloon is no longer visible, provided the change in sky condition still exists.
- 3/7. Paragraph A9216. The log of differing weather observations should be kept by all stations, including CAA observing stations. No special format is prescribed for this log, but the log should contain all information that, in the judgment of the observer, is pertinent to any subsequent investigation of differing weather observations.
- 3/8. Paragraph 11001. (a) The monthly preparation of Form 1130D is not required from CAA observing stations, provided there has been no change in instrumental equipment or exposures since the previous rendition of the form. However, annual renditions will be made by these stations effective December 31 of each year.
- (b) Preparation of Form 1130B is not required from stations that would ordinarily record on this form only dry- and wet-bulb temperatures in columns 18 and 19, and total sky cover in column 21. Such stations should use only Form 1130A, entering dry- and wet-bulb temperatures in columns 14A and 14B, and total sky cover in column 14 immediately adjacent to column 14A. Note that this requirement will apply to most SAWRS, but will not apply to any station reporting pressure data.
- 3/9. Paragraphs A11005 and A12011. Stations equipped with triple registers, and at which only a limited staff can be provided on Saturday, have reported difficulty in completing the required computations on Forms 1017 and related forms in sufficient time to mail Forms 1130A and B or 1001B on Saturday. Under such circumstances, it will be satisfactory to defer mailing Forms 1001B or 1130A and B for the week ending with Friday, until the following Monday, if necessary in order to compute and check the data obtained from Form 1017. However, it is important that all forms for the month be mailed not later than the second working day of the following month.
- 3/10. Paragraph 11422. (a) Separate entries will not be made in columns 4 or 22-35 of Form 1130A and B to describe cirrus attached to cumulonimbus, even though the cirrus may cover 1/10 or more of the sky. This procedure is in accordance with instructions in Circular S, which preclude coding M6 or H3 for altocumulus or cirrus attached to cumulonimbus. Under such

circumstances, when 6/10 or more of the sky is covered by the base of a cumulonimbus in combination with the tops and sides of the same cloud, the ceiling will be considered as the height of the base, since observation of separate layers is impossible, and appropriate remarks will be made to indicate that a significant part of the sky is also obscured by the tops and sides of the cloud. Also, only one cloud layer will be recorded in columns 22-35 unless, of course, there are additional layers that are completely detached from the cumulonimbus.

Example

Given: 9+ sky covered by one cumulonimbus cloud; approximately 4/10 of the sky is covered by the base, while the remainder of the sky is covered by the sides and tops; the height of the base is estimated at 5,000 ft. and the top at 18,000 ft.

Entries on Form 1130A and B:

- (1) Ceiling and sky conditions (column 3 and 4): E500
- (2) Remarks (column 14): CB BASE NW TOP SE E180 BINOV
- (3) Clouds and obscuring phenomena (columns 22-35):
  - (i) Amount (column 22): 9+; (ii) Type (column 23): CB; (iii) Height (column 24): E50. (Note that no additional cloud layers will be recorded in succeeding columns since separate cloud layers detached from the cumulonimbus were not observed.)

(b) The ceiling classification designators defined in paragraphs 1431-1436 are primarily associated with layers constituting a ceiling, and are therefore defined in terms of ceiling measurements. However, these designators are also used in columns 24, 27, 31, and 35 to indicate heights of cloud layers that may not constitute a ceiling. Under such circumstances, the letter which is most nearly appropriate, in the opinion of the observer, should be selected. For example, in prefixing a symbol to the height of the base of a thin obscuration, which of course does not constitute a ceiling, the symbol "M" may be selected if the height of the base is determined from the known height of unobscured objects; "E" may be selected if the height of the base is determined from natural landmarks; "W" if the description in paragraph 1434(3) most nearly describes the method of determination, etc.

3/11. Paragraph A11438. In entering hourly precipitation in column 38, consider the hour identified as "00" in column 16 as beginning at 0000 LST and ending at 0059 LST; the hour identified as "01" as beginning at 0100 and ending at 0159, etc. When precipitation is reported as ending by a special observation filed on or after the hour, the amounts of precipitation entered in column 38 should be ascribed to the hour during which the precipitation actually

fell, even though the special reporting the ending of the precipitation was filed during a subsequent hour. For example, if the ending of rain was reported in a special filed at 1701, precipitation should be entered for the period identified by the figure 17 in column 16 only if precipitation actually fell after 1659. (See also paragraph 11482.)

- 3/12. Paragraph 11444. If no rain has fallen during the 6 hours preceding the actual time of the 6-hourly precipitation observation, but if rain begins shortly thereafter and before the coded synoptic observation is filed, "T" should be entered in column 44 for the synoptic observation and a trace of precipitation coded in groups 7RRR<sub>t</sub>s and appRR. If the 6-hourly observation concerned is the first one following midnight, "T" should also be entered in column 44 under the caption "midnight to." This procedure will be followed regardless of the type of precipitation gage in use at the station, or the intensity or amount of the precipitation.
- 3/13. Paragraph A11485(c). Excessive precipitation will be computed only at stations using the tipping bucket as the official precipitation gage; it will not be computed from weighing gages.
- 3/14. Paragraphs A12107, A12316 and A12317. (a) The average hourly sky cover will be entered in whole numbers at the bottom of column 7 of Form 1001B. The average daily sky cover will be entered to one decimal place at the bottom of columns 16 and 17 of Form 1001C (see figures A5 and A6).
- (b) "9+" will not be used as an average sky cover on Form 1001C. The entries of "9+" in columns 16 and 17 of figure A6 should be changed to "10;" the totals increased to 255 and 243; and the means changed to 8.2 and 7.8, respectively.
- 3/15. Paragraphs A12310 and A12311. At stations taking one to 23 hourly observations daily, entries should be made in columns 10 and 11 of Form 1001C only if the station is equipped with a multiple register.
- 3/16. Paragraph A12361. The monthly average station pressure should be entered to thousandths on Form 1001C.
- 3/17. Paragraph A13010. Gust recorder charts completed during the month should be included with the shipment of other recording instrument forms listed in this paragraph. The station name and date should be entered on the charts near the termination of the trace.

- 3/18. Paragraph A13610. At stations entering hourly temperatures on Form 1001B and 1130B, as obtained from the thermograph, the thermograph may be changed on Saturday in order that these forms may be completed and forwarded to WRPC's on the prescribed dates.
- 3/19. Paragraph A13720. At stations where records from the weighing rain gage must be evaluated before hourly precipitation values can be entered on Forms 1001B or 1130B, the rain gage chart may be changed on Saturday in order that these forms may be forwarded to the WRPC's on the prescribed dates.

UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU  
Washington 25, D. C.

October 24, 1949

WBAN MANUAL OF SURFACE OBSERVATIONS  
Circular N, 6th Edition

INTERPRETATIONS - SERIES NO. 4

(To be bound in Circular N following Series No. 3, dated August 1, 1949)

- 4/1. Paragraph 1210. The instructions in Interpretation 2/1 apply also when several cloud fragments at more than one level are observed, each covering less than 1/10 of the sky, even though the total amount of sky covered is 1/10 or more. For example, if 1- altocumulus and 1- cirrus were noted, with a total sky cover of 1/10, the sky condition in column 4 would still be reported as clear, since neither of these cloud fragments constituted a layer. If the presence of such cloud fragments appears significant, a remark such as "FEW AC AND CI" should be included.
- 4/2. Paragraph 3435. As a convenience in using Table 8, it is suggested that the equivalent values in statute miles be entered in this Table. These values are 5/8 of a mile for 1100 yards and 5/16 of a mile for 550 yards. Similar entries should be made in the Condensed Table of Critical Values.
- 4/3. Paragraph 3501. The statement in this paragraph concerning the improbability of fog formation if the temperature-dew point spread is more than 4° is intended only for guidance of observers in detecting fog. If, in the observer's opinion, fog is beginning to form, it will be reported even though the temperature-dew point spread is more than 4°.
- 4/4. Paragraph 4030. Note that, at stations having both a shielded weighing gage equipped with the proper gears and an unshielded 8-inch gage or tipping bucket, the weighing gage will be used for all official precipitation measurements except excessive precipitation, since it is the only shielded gage at the station. The statement in the legend beneath Figure A9 refers only to stations having both a tipping bucket and a shielded weighing gage equipped with suitable gears and was not intended to imply that excessive precipitation would be computed from weighing gage charts. Similarly, Interpretation 3/13 referred only to stations equipped with one or the other type of gage, not with both.

4/5. Paragraph 6010. If the dry- and wet-bulb temperatures are outside the range of the psychrometric calculator, WB Form 235 will be used to obtain relative humidity and dew point, and the corrections indicated in Tables 9 and 10 applied as necessary.

4/6. Paragraphs 9134-9134.11, and 9143.

(a) Special observations will be taken at SAWRS only under the following conditions:

- (1) To report changes in ceiling and visibility in accordance with paragraphs 9134.01 and 9134.05 during the period beginning one hour before the expected time of an aircraft's arrival and ending one hour after the aircraft's departure.
- (2) To report changes in meteorological conditions that, in the opinion of the observer, are of importance to the safety or efficiency of impending aircraft operations.
- (3) Whenever requested by operational interests.

(The above items correspond to the instructions in Circular Letter 91-48, with the exception that the paragraph references to Circular N have been changed to correspond to those of the 6th edition.)

(b) When a sliding scale of minimums applies to an airport, the "highest airline operating minimum" refers to the highest ceiling and visibility values used as minimums by any air carrier operating at the field, even though the respective values for ceiling and visibility are not companion values on the sliding scale.

Example:

Given: The following sets of minimums for an airport:

<u>Operator No. 1</u>	<u>Operator No. 2</u>
400 - 1	500 - 1 1/2
600 - 3/4	700 - 1 1/4
1000 - 1/2	1000 - 1

4/6. (cont.)

Procedure: The highest airline operating minimum in the above case is 1000 feet and 1 1/2 miles. A special observation would therefore be required at this airport when the ceiling decreased to 1000 feet or less or increased to 1000 feet or more. This provision applies only to the highest minimum, and a special observation would not be required by this rule if the ceiling decreased from 700 to 500 feet. However, local extra observations would be required in accordance with paragraph 9143.

- (c) A special observation should be taken whenever a sandstorm or duststorm is no longer in sight within 6 miles of the station. A special observation is not necessary when a sandstorm more than 6 miles from the station completely disappears from sight.
- (d) At stations not taking airway observations throughout a 24-hour period, special observations as required by these paragraphs should usually be begun following the first scheduled record observation for the operating period. For example, if the station is taking observations only during the period 0400-2000, special observations will be taken, whenever required by these instructions, following the first record observation at 0430. An exception to this procedure should be made if, during the period 0400-0430, any meteorological condition believed to be of importance to the safety and efficiency of aircraft operations is observed, in which case a special observation should be filed immediately.

4/7. Paragraph 9213. Pilots' reports of ceiling more than 1 1/2 miles from the boundaries of the field will be disseminated immediately in accordance with item (8) of this paragraph. Since such reports cannot be used for official ceiling values, they should be distributed immediately even though the ceiling at the airport is classified "measured."

4/8. Paragraphs 10322, 10325. Contractions currently authorized by the CAA manual of contractions should be used even though they differ from those in Circular N illustrations. For example, the currently authorized CAA contraction for Navy pilot reports is NAREPS, and this abbreviation should be used in current weather reports rather than NYREPS, which is used in the illustrations in these paragraphs.

- 4/9. Paragraphs 11001, 11001. The monthly preparation of Form 1130D is not required for SAWRS and other second-order airway stations. The instructions in Interpretation 3/8 apply to these stations, as well as to CAA observing stations.
- 4/10. Paragraph 11050. As a result of the introduction of automatic scanning procedures on all Service A circuits, two or more special observations may frequently be available for transmission during a scanning period. Under such circumstances, only the latest observation will be transmitted during the scanning period on Service A, and observations not transmitted will be marked "FIBI" in accordance with this paragraph. For example, if special observations were taken at 1340 and 1348, only the observation at 1348 would be transmitted during the scanning period beginning at 50 minutes past the hour.
- 4/11. Paragraph 1105.2. At stations where there are no intermediate visibility markers, it may not be practicable to estimate visibility in the intermediate ranges. For example, at certain stations in mountain areas, the only visibility markers beyond the immediate vicinity of the station are sometimes distant mountain ranges approximately 100 miles away which are visible only under very unusual meteorological conditions. Estimations of visibility in 5-mile increments in the ranges from 15 to 100 miles are therefore not practicable. In such cases, if the visibility is estimated to be more than 15 miles but a more precise estimation cannot be made because of lack of suitable markers in the intermediate ranges, the visibility should be recorded as 15+.
- 4/12. Paragraph 1106.
- (a) If rain or any other form of precipitation is recorded in column 6, it is not necessary that an obstruction to vision (Table 27) be recorded, even though the prevailing visibility is six miles or less. However, if the visibility is poor and the precipitation very light, the observer should be alert to detect formation of some additional obstruction to vision, such as fog.
  - (b) If squalls are observed, they will be reported following items (1) to (5) in this paragraph, and preceding item (6) (obstructions to vision.)

- 4/13. Paragraph 11114. The instructions in item 6 of Table 29 apply also if three scattered layers are reported, i.e., the lowest of the three layers will be reported in remarks. Note also that, in the case of multiple layers, the first sky condition symbol represents the total amount of sky covered.

Examples:

Given:

	<u>1st layer</u>	<u>2nd layer</u>	<u>3rd layer</u>	<u>Total</u>
(1)	1 Cu E25	1 Ac E85	1 Ci E150	1
(2)	5 Cu E25	1 Ac E85	1 Ci E150	6
(3)	9 Cu E25	1 Ac E85	1 Ci E150	9

Reported:

	<u>Ceiling and Sky</u>	<u>Remarks</u>
(1)	⊙85 ⊙	150 ⊙ 25 ⊙
(2)	E85 ⊙⊙	E150⊙ 25⊙
(3)	E25 ⊙⊙	E150⊙ E85⊙

- 4/14. Paragraph 11417. Readings from precision aneroid barometers, which will be made to the nearest 1/10 of a millibar if the barometer is graduated only in millibars, will be converted to thousandths of inches before entry in column 17. If a precision aneroid barometer is available, hourly and 6-hourly station pressures will be obtained from this instrument rather than from an altimeter setting indicator or a microbarograph. A special table for converting tenths of millibars to thousandths of inches is being furnished stations having precision aneroid barometers.
- 4/15. Paragraph 11450. State of the ground observations should be omitted at stations having only concrete, macadamized, or other similar hard surfaces in the vicinity of the station. Under such circumstances, a dash should be entered in column 50.
- 4/16. Paragraphs 11461-11465.
- (a) The instructions to enter pressure readings to the nearest .001 of an inch or .05 of a millibar apply only to readings from mercurial barometers. At stations equipped with precision aneroid barometers graduated in millibars, entries in columns 61-63 should be to the nearest tenth of a millibar, with the entry in column 61 being the uncorrected reading of the precision aneroid, the entry in

## 4/16. (cont.)

column 62 being the established correction, and the entry in column 63 being the corrected station pressure. (The entry in column 63 should be converted to the nearest one-thousandth of an inch, before entry in column 17.)

- (b) If the precision aneroid barometer is graduated in inches or in both inches and millibars, entries in column 61 should be to the nearest .005 of an inch.
- (c) If a precision aneroid is available, entries in these columns will invariably be obtained from this barometer, rather than from an altimeter setting indicator or a mercurial barometer.
- (d) The value entered in column 63 will be used in establishing the barogram correction for column 65. Barograph readings will be entered in column 64 to the nearest five-thousandth of an inch at all Weather Bureau stations; the provisions for entering these data in millibars apply only to military stations (where the microbarograms are graduated in millibars).

4/17. Paragraphs 11482, 11483. Obstructions to vision not restricting the visibility at the usual point of observation, and therefore not recorded in column 6, should not be entered in columns 86-88. This procedure will be followed even though distant obstructions to vision are recorded in column 14 (e.g., "K LYRS E," "GF NW," etc.). Similarly, precipitation will not be entered in columns 82-84 unless precipitation is also reported in column 6. Entries will not be made in these columns to report distant precipitation.

4/18. Paragraph A12010. City offices preparing Form 1001C in accordance with the instructions in this paragraph, but not preparing Form 1001B, will enter data as follows on Form 1001C:

- (1) Columns 2-7 will be completed from autographic records.
- (2) Columns 20-22 will contain the maximum and minimum temperatures (to the nearest 0.1°F) and precipitation, respectively, for the 24-hour period preceding the time of the climatological observation. (These data will be obtained from autographic records for days on which no climatological observation was taken.)
- (3) Temperature and precipitation summaries will be entered at the bottom of the form.
- (4) Entries in all other columns will be omitted.  
(These correspond to the instructions in C. L. 102-49)

- 4/19. Paragraph A12352. Instructions in paragraph 12343, concerning the entry of "greatest amount of precipitation" if the 24-hour period begins on the last day of one month and ends on the first day of the following month, apply also to snowfall.

Example:

- Given: (1) 5.0 inches of snow fell on March 31-April 1, with 2.0 inches falling on March 31 and 3.0 inches on April 1.
- (2) With the exception of the snowfall on March 31, the greatest snowfall in March was 1.5 inches on March 15.
- (3) The greatest amount of snowfall in April was 5.5 inches on April 5.

Entries on Form 1001C - "Snowfall - Greatest in 24 Hours"

- (1) For March, "1.5 inches on March 15." (Note that, although two inches fell on March 31, the total precipitation on March 31 must be ascribed to April 1 in accordance with paragraph 12343.)
- (2) For April, "5.5 inches on April 5."
- (3) In both instances, explanatory notes should be entered at the bottom of Form 1001C indicating that 5 inches of snow fell during the period March 31 to April 1, with 2 inches falling on March 31 and 3 inches on April 1.
- 4/20. Paragraph A12353. If the greatest depth of snow on the ground during the month is a trace, "T" will be entered in the space provided for this datum.
- 4/21. Paragraph A13720. The instructions in this paragraph concerning the time of changing charts should be followed by CAA and other second-order stations as well as by first-order Weather Bureau stations insofar as practicable. Local exceptions to this procedure may be made if personnel are not normally scheduled on duty at these periods.
- 4/22. Paragraph A14330. The permanent file of Forms 5066 will be retained at the Regional Office only if the Regional Office is also headquarters for the field aide customarily visiting the station concerned. Otherwise, the permanent file of completed

4/22. (cont.)

Form 5066 will be sent to the field aide's headquarters and included in the permanent inspection folder. In the latter case, Regional Offices are requested to furnish verifying stations the addresses to which completed Forms 5066 should be sent. Completed copies of Form 5066 may be destroyed by field aides after two years from the date of preparation.

4/23. Paragraph A15312.2. In the coded message, the AZRAN group should be "27/100" rather than "27/10."

4/24. Section A15500.

- (a) In Figure A12 for "No change in tendency," read "Tendency - no change."
- (b) In Figure A19 in the 3rd line of the coded message, delete "no."

UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU  
Washington 25, D. C.

February 1, 1950

WBAN MANUAL OF SURFACE OBSERVATIONS  
Circular N, 6th Edition

INTERPRETATIONS - SERIES NO. 5

(Note: Inspection reports have indicated that some stations have overlooked the entry of marginal notations opposite appropriate paragraphs in accordance with the note preceding Interpretation 1/1. Station officials are requested to review these instructions to insure that such numbers are entered for each item.)

- 5/1. Paragraphs 1431, 1434. Inspection reports have indicated that many low ceilings are being classified "indefinite," possibly because of the greater angular penetration of the ceilometer or ceiling light beam into low clouds as compared with higher clouds. This relatively greater beam penetration into lower clouds is not a valid criterion for determining ceiling classification. As indicated in paragraphs 1431 and 1434(1), the determination of a ceiling classification of "measured" or "indefinite" must be based on whether the beam penetration is normal for that usually experienced with the particular cloud height. For example, a penetration of 5° into a cloud base at 7500 feet would usually require a ceiling classification of "indefinite" because this penetration is in excess of that normally experienced for clouds at this height; while a penetration of 5° into a cloud base at 500 feet would usually require a classification of "measured" because this penetration is normal for clouds at this height.

Investigations are being conducted to establish objective criteria for determining ceiling classifications that will not depend largely on observer experience and judgment. In the meantime, station officials are requested to review classifications assigned locally to ceilings below 1000 feet. If most of the ceilings that are determined by a ceilometer or ceiling light are not classified "measured," it is probable that the above procedures for determining ceiling classification are not understood by all observers, and local action should be taken accordingly to insure that proper techniques are being used.

5/2. Paragraph 1442. The authorized free lifts for ceiling and pilot balloons are given in the following table. No other free lifts are authorized for these balloons when used for ceiling-measuring purposes. Ordinarily, only 10-gram balloons will be used for ceiling-measuring purposes, with 30-gram balloons furnished selected stations only. Inflation nozzles, rather than balances, will be used in inflating both types of balloon.

<u>Type of Balloon</u>	<u>Gas</u>	<u>Total Free Lift</u>
Ceiling (10-gram)	Helium	45 grams
Ceiling (10-gram)	Hydrogen	40 grams
Pilot Balloon (30-gram)	Helium	139 grams
Pilot Balloon (30-gram)	Hydrogen	125 grams

The following ascensional rates apply to 30-gram balloons inflated with either of the above lifts. Heights corresponding to intermediate time intervals should be obtained by interpolation.

<u>Min.</u>	<u>Ft.</u>	<u>Min.</u>	<u>Ft.</u>	<u>Min.</u>	<u>Ft.</u>
1/2	350	3 1/2	2320	6 1/2	4130
1	710	4	2630	7	4430
1 1/2	1030	4 1/2	2940	7 1/2	4720
2	1360	5	3250	8	5020
2 1/2	1680	5 1/2	3540	8 1/2	5320
3	2010	6	3840	9	5610

5/3. Paragraph 6120. Inspection reports have indicated that procedures for computing dew-point temperatures when the wet-bulb temperature is below 32°F. are not understood at all stations. The following important points are, therefore, being re-emphasized:

- (a) Whenever the wet-bulb temperature is less than 32°F., the index of the D-scale on the psychrometric calculator will invariably be set opposite the wet-bulb temperature on the  $T_1$  scale, regardless of the current dry-bulb temperature. If the wet-bulb wick is not obviously ice-covered, ice should be caused to form on the wick by touching it in accordance with paragraph A5131.1.
- (b) The dew-point temperature is always read on the  $T_w$  scale (i.e., with respect to water) regardless of the current dry- or wet-bulb temperatures.

- 5/4. Paragraphs 8110, 11114. Magnetic directions should be entered on Form 3024B (or the telautograph record) in parenthesis following the last element of the observation, except that this entry may be omitted at stations not needing it for broadcast purposes. (For example, the entry will not be necessary at stations where communications personnel obtain wind directions directly for all broadcast purposes from separate indicators in the communications station.) Magnetic wind directions will not be entered on Form 1130 unless this form is used directly for broadcast purposes, in which case these directions may be recorded in column 14 in parenthesis.

Magnetic directions are determined in accordance with the following instructions:

- A. From wind direction indicators calibrated in degrees:
- (1) If the magnetic declination is west, add it to the true direction.
  - (2) If the magnetic declination is east, subtract it from the true direction.
- B. From wind direction indicators not calibrated in degrees:

<u>Declination</u>	<u>Conversion Procedure</u>
<u>East:</u>	
0-11°	No conversion necessary.
12°-34°	The <u>first</u> compass point (on a 16-point scale) in a <u>counterclockwise</u> direction from the true direction (as observed on the 9-light indicator)
35°-56°	The <u>second</u> compass point in a <u>counterclockwise</u> direction from the true direction.
<u>West:</u>	
0-11°	No conversion necessary.
12°-34°	The <u>first</u> compass point (on a 16-point scale) in a <u>clockwise</u> direction from the true direction (as observed on the 9-light indicator).
35°-56°	The <u>second</u> compass point in a <u>clockwise</u> direction from the true direction.

(Apply corresponding increments for larger declinations.)

EXAMPLES

- (1) True wind direction: NW
- (2) Magnetic declination: 15° West
- (3) Wind direction (magnetic compass): NNW

- (1) True wind direction: SE
- (2) Magnetic declination: 35° East
- (3) Wind direction (magnetic compass): E

- 5/5. Paragraph A8233. Wind speeds below 2.5 miles per hour are not indicated on the Electric Speed, Instrument Corporation, or Weather Bureau-Design wind equipment. At stations using this equipment, wind speeds below this value should be estimated by observing the relative speed of rotation of the cups.
- 5/6. Paragraph 8311. A new type of direct-reading wind equipment, the F411 Wind System, has been recently distributed to selected field stations. Although this equipment physically resembles the condenser-discharge type of equipment, its performance characteristics are different. Peak speed of gusts should be determined directly from the F411 Wind System in the same manner as for other types of direct-reading wind equipment. Zero corrections apply throughout the entire scale range.
- 5/7. Paragraph 9012. The instructions in this paragraph concerning the use of control tower visibility observations for coding purposes apply only to the coding of airway observations and associated summaries. The visibility at the usual point of observation, rather than at the control tower level, will be coded in the synoptic observation. (These instructions are being included in a forthcoming revision of the synoptic code.)
- 5/8. Paragraph 9144. Local arrangements should be made for the control tower, communications station, or airport operations office to inform the observing station of aircraft accidents in order that the local extra observation required by this paragraph may be taken promptly. If notification of such an accident is not received immediately, the observation should be taken immediately after notification, unless there has been an intervening record observation. An explanatory note should be entered in column 90 of Form 1130B whenever this observation has been delayed.

- 5/9. Paragraphs 9213, 11300-11311.1. In accordance with Circular Letter 142-49, PIREPS will be entered on Service A in summary form only, with the exception of those entered by Weather Bureau stations that operate Service A send-receive facilities and have no means other than Service A to communicate with the ARTC or an adjacent INSAC. All pilots' reports, regardless of whether they are entered directly on Service A at the station of origin or are forwarded to ARTC for inclusion in the summary prepared by FAWS, will be recorded on Form 1130 by the originating station in accordance with Section 11300. The term "local extra" as used in Circular Letter 142-49 refers only to the type of distribution to be given these PIREPS, and does not alter the manner in which these observations are recorded on Form 1130. A supplementary form must still be used for PIREPS more than 1 1/2 miles from the boundaries of the field, as prescribed in Section 11300; elements will be entered in the order indicated in paragraph 10320, using the abbreviations listed in the following paragraphs, etc.
- 5/10. Paragraph A10080. Inspection reports have indicated that the purpose of Form 3069 may not be understood at all stations and that this form is therefore not being systematically rendered. Form 3069 is extensively used at the WBAN Analysis Center, as well as at some field forecast stations, for correcting manuscript maps in historical files. Since Form 5066 is not generally available to these offices, it is important to the accuracy of historical maps that Form 3069 be forwarded promptly in accordance with instructions in paragraph A10080.
- 5/11. Paragraph A11005.2. The authorization for field aides to destroy retained carbon copies of Form 1130 applies at CAA as well as at other second-order stations.
- 5/12. Paragraph 11202. This paragraph was generally applicable at all stations before the scheduled transmission time for synoptic observations on Service C was advanced to 35 minutes past the hour. Since synoptic observations are now usually transmitted following the record observation, the procedures outlined in this paragraph now apply only at those few stations where special arrangements have been made for earlier transmission of synoptic observations by telephone or telegraph.
- 5/13. Paragraph 11445. Entries in column 45 of Form 1130B are obtained by actual stick measurements, in accordance with paragraph 4230, and are not the sum of hourly values. (Hourly snowfall measurements are made at designated stations only.)

Example:

Given: Hourly measurements for the period 0115 to 0715 EST totaled 9.3 inches; no melting occurred, but stick measurement at 0715 indicated total depth on ground of new snow since 0115 to be only 7.2 inches.

Entry in column 45: 7.2 (i.e., the 6-hourly stick measurement, rather than 9.3, the sum of hourly values for the preceding 6 hours).

- 5/14. Paragraph A12316. Observations of sky cover that are made after sunset will not be considered in computing average sky cover entries in column 16 of Form 1001C. For example, if sunset occurs at 1722 EST, an observation of sky cover made at 1727 will not be included in the daily average for this column.
- 5/15. Paragraph A12362. At high altitude stations, the lowest (or highest) station pressure indicated on the barograph may not represent lowest sea-level pressure because of the temperature factor involved in the sea-level reduction. At such stations, the hourly computations of sea-level pressure should be inspected, in addition to the barograph charts, to determine that the lowest (or highest) sea-level pressure has been selected.
- 5/16. Paragraph A13110 At stations west of the 135th standard meridian time zone, missing record may result if the barometer charts are changed at 1830 GCT as specified in this paragraph. At such stations, the charts should be changed at the standard synoptic time (0030 GCT, 0630 GCT, etc.) nearest to noon, local standard time.

CORRECTIONS

- (1) Table A2, following paragraph A5544, column headed "Telepsychrometer Dry-Bulb Higher Than 20°F., Wet-Bulb 33°F. or Lower," line headed "Relative Humidity" --- change "from telepsychrometer dry-bulb and standard psychrometer wet-bulb" to read "from telepsychrometer dry-bulb and standard psychrometer dew-point."
- (2) Figure 5, second line, column 23 --- prefix a minus sign (-) to "F."

- (3) (a) Paragraph A15120, Item 1(a), change "0110GCT" to read "0135GCT."
- (b) Paragraph A15511, delete "between 27 and 30 minutes past each hour. Additional observations may be transmitted at 10 minutes of, or 10 minutes past, each hour."

(The changes in (3) above have been necessitated by the recent revision of scheduled transmission times for SW reports on Service A. Revised pages of Circular N will be forwarded for these and other changes at a later date.)