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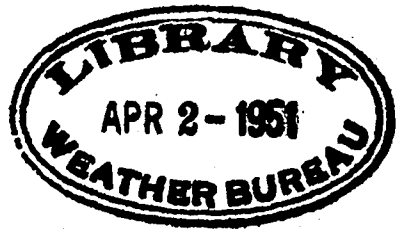

CIRCULAR N
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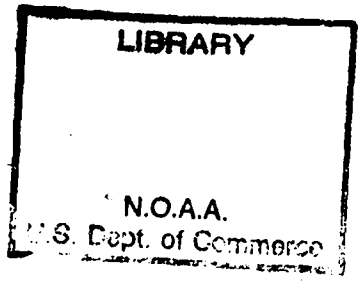

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MANUAL OF SURFACE OBSERVATIONS (WBAN)

CIRCULAR N
Sixth Edition
(Revised)

JUNE 1951

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FOREWORD

This manual was prepared by Weather Bureau personnel, with the collaboration of representatives of the Air Force and Navy, to secure uniformity in taking and recording surface observations.

The manual is supplemented by an addendum issued separately by the Weather Bureau, Air Force, and Navy. The instructions in the manual will be followed by all personnel taking surface observations; the instructions in the addendum will be followed only by personnel of the organization issuing the addendum. Amendments to this manual will be issued as revised pages for insertion in the manual in accordance with instructions accompanying them. Station copies of the manual will be corrected promptly upon receipt of each amendment. The effective date and number of each amendment and the pages or paragraphs affected will be entered on the page entitled "Record of Changes." The entries will be initialed by personnel who make them.

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INTRODUCTION

Taking observations is the primary duty of the observer. Nothing except the most pressing demands upon the observer's attention should be given precedence to this fundamental duty. Since life, property, and the convenience of travelers, as well as accurate forecasts, may depend upon his observations, the observer should make every effort to take the observations as accurately and completely as possible, and to file them in sufficient time for scheduled transmission. Every observation must be accurate in all its parts, and it must convey a complete picture of the meteorological situation existing at the station.

When computations require the disposal of decimals, the following procedure will be observed:

(1) If the decimal to be disposed of is five or greater, the preceding digit will be increased by one.

(2) If the decimal to be disposed of is less than five, the preceding digit will remain unchanged.

Algebraic signs will be disregarded - e.g., 1.5 = 2; -1.5 = -2.

CHAPTER 1. CLOUDS AND OBSCURING PHENOMENA

1000. GENERAL

1010. Code numbers for cloud forms and states of the sky are described in detail in Weather Bureau Circular S. Instructions in this chapter are confined to those necessary for observing clouds and obscuring phenomena with respect to their amount, stratification, direction of movement, height of bases, and the effect of obscuring phenomena on vertical visibility. Observations of these elements will be taken from as many points as necessary to view the entire sky.

1100. DETERMINATION OF SKY COVER

1110. DEFINITION OF SKY COVER. Sky cover is a term used to denote one of the following conditions:

(1) Amount of sky covered, but not necessarily hidden by clouds or obscuring phenomena aloft.

(2) Amount of sky concealed by obscuring phenomena on the ground.

(3) A combination of (1) and (2).

Sky cover may refer either to the amount of sky covered by a particular layer, or to the total amount covered by all layers. If the sky cover is opaque (i.e., conceals the sky), the tenths of sky cover plus the tenths of sky visible will always equal 1.0 (10/10). Sky cover observations may be taken without the use of instruments. At night it will frequently be necessary to observe the clouds and obscuring phenomena passing through the beam from a ceiling light or ceilometer projector over a period of several minutes in order to obtain a more nearly representative picture of the amount and distribution. Determine the amount of sky cover in accordance with paragraphs 1120 through 1121, and select corresponding sky-cover symbols from Table 1a.

Table 1a. Sky-Cover Symbols

Symbol and Meaning		Explanation
X	Obscuration.....	Sky completely hidden by precipitation or obstructions to vision (bases at surface).
-X	Partial obscuration.....	0.1 to less than 1.0 sky hidden by precipitation or obstructions to vision (bases at surface).
○	Clear.....	Less than 0.1 total sky cover. (This symbol is not used in combination.)
◔ *	Scattered.....	0.1 to less than 0.6 sky cover.
◑ *	Broken.....	0.6 to 0.9 sky cover.
⊕ *	Overcast.....	More than 0.9 sky cover. (This symbol will be used in combination with a lower overcast symbol only if the latter is classified thin.)

*Symbols for thin ("-") and dark ("+") will be prefixed to these symbols in accordance with par. 1511.

1120. WITH ADVANCING LAYER. To estimate the amount of an advancing (or receding) layer, determine the angular elevation above the horizon of the forward or rear edge of the layer as seen against the sky. This will be done with a theodolite or clinometer until experience is gained in estimating vertical angles. Convert the angle to tenths of sky cover by use of Table 1.

1120.1. When the layer does not extend to the horizon, determine the angular elevation of the forward and rear edges and the tenths of sky cover corresponding to each elevation. The difference will be the required sky cover. For example: Forward edge 78° = 0.4 sky cover; rear edge 53° = 0.2 sky cover. Total sky cover is the difference between the two, or 0.2 sky cover.

Table 1. Sky cover with advancing or receding layers

Angles subtended by sky cover	Tenths of sky cover	Angles subtended by sky cover	Tenths of sky cover
Less than 37°	0.0	102° - 113°	0.6
37° - 52°	0.1	114° - 126°	0.7
53° - 65°	0.2	127° - 143°	0.8
66° - 77°	0.3	144° - 179°	0.9
78° - 89°	0.4	180°	1.0
90° - 101°	0.5		

1121. WITH CONTINUOUS LAYER SURROUNDING STATION. To estimate the amount when a continuous layer surrounds the station and extends to the horizon, determine the angular elevation of the edges, and convert to tenths of sky cover by use of Table 2.

Table 2. Sky cover with layer surrounding station

Angular elevation	Tenths of sky cover	Angular elevation	Tenths of sky cover
Less than 6°	0.0	37° - 43°	0.6
6° - 11°	0.1	44° - 52°	0.7
12° - 16°	0.2	53° - 63°	0.8
17° - 23°	0.3	64° - 89°	0.9
24° - 29°	0.4	90°	1.0
30° - 36°	0.5		

1200. DETERMINATION OF STRATIFICATION

1210. DEFINITION OF LAYER. Clouds or obscuring phenomena whose bases are at approximately the same level are regarded as a layer. The layer may be continuous or composed of detached elements. The term layer does not imply that a clear space exists between the layers or that the clouds or obscuring phenomena composing them are of the same type (see par. 1230).

1220. EVALUATION OF MULTIPLE LAYERS. Frequent observation is necessary to evaluate stratification. A series of observations will often show the existence of upper layers above a lower layer. Through thin lower layers it may be possible to observe higher layers. Differences in the directions of cloud movements are often a valuable aid in observing and differentiating cloud stratification, particularly when haze, smoke, etc., render depth perception difficult.

1230. INTERCONNECTION OF LAYERS. Cumulo-type clouds developing below other clouds may reach or penetrate them. Also, by horizontal extension, swelling cumulus or cumulonimbus may form stratocumulus, altocumulus, or dense cirrus. When clouds that are formed in this manner are attached to a parent cloud, they will be regarded as a separate layer only if their bases appear horizontal and at a different level from the parent cloud. Otherwise, the entire cloud system will be regarded as a single layer at a height corresponding to that of the base of the cumulonimbus.

1300. DETERMINATION OF DIRECTION

1310. CLOUD DIRECTION. Cloud direction is the direction from which the cloud bases are moving. This direction will be determined visually by one of the methods indicated in paragraphs 1310.1 - 1310.3.

1310.1. Observe the movement of clouds past a structure that forms a right angle in either a horizontal or a vertical plane. When the orientation of the structure is known, the direction is indicated by equal or unequal movement of clouds along both sides of the angle, or by movement of clouds parallel to either side.

1310.2. Sight a distinctive point of the cloud over a projection. Move about to keep this point in the same position with respect to the projection. The direction toward which the observer moves is the cloud direction; that is, the direction from which the cloud is moving.

1310.3. When clouds are moving slowly, their direction can be determined with reasonable accuracy by taking several observations a few minutes apart, and noting the relative positions of the clouds.

1320. DIRECTION OF OBSCURING PHENOMENA. Determine direction of movement of obscuring phenomena aloft similarly to clouds. When the base of the obscuring phenomena is at the surface, the direction will be that of the surface wind.

1400. DETERMINATION OF HEIGHTS

1410. CEILING DEFINITION. The ceiling is the height ascribed to the lowest layer of clouds or obscuring phenomena that is reported as broken, overcast, or obscuration (see Table 1a) and not classified "thin" or "partial." Note that, for obscurations, this height represents vertical visibility into the obscuring phenomena, rather than the height of the base. The ceiling is termed "unlimited" when the foregoing conditions are not satisfied. At all other times, the ceiling is expressed in feet above the surface. (See par. 1412.)

1411. VERTICAL VISIBILITY. Vertical visibility is a ceiling value used to express the distance that an observer in an obscuring medium can

see vertically upward into the medium. The sky-cover symbols "X" and "-X" (see Table 1a) are always used when vertical visibility is reported. The ceiling ascribed to "X" must be classified "W", "P" or "A." Other sky-cover symbols are used with "X" and "-X" to report visible cloud layers (see par. 1511, example 5).

1412. SURFACE. "Surface" as used here is a horizontal plane, whose elevation above sea level equals the field elevation. At stations where the field elevation has not been established, "surface" will refer to the ground elevation at the point of observation.

1420. VARIABLE CEILING. The term "variable ceiling" describes a condition in which the ceiling rapidly increases and decreases by one or more reportable values during the period of observation. It will be reported only for ceilings less than 3000 feet. The average of all values secured will be used as the ceiling. Rapid fluctuation of the spot produced by a ceiling-light projector will indicate an irregular base whose height will be regarded as measured but variable. Distinguish this type of fluctuation from that which is due to multiple layers (see par. 1441.3).

1430. CEILING CLASSIFICATION. The ceiling is classified in accordance with Table 2a.

Table 2a. Ceiling-Classification Symbols

M	Measured	W	Indefinite
A	Aircraft	P	Precipitation
B	Balloon	E	Estimated

1431. MEASURED CEILING. A ceiling is classified as measured whenever it pertains to clouds or obscuring phenomena aloft and is determined by means of:

(1) A ceiling light or ceilometer, provided penetration of the beam is not in excess of that normally experienced for the height and type of layer (see par. 1441.2).

(2) A raob or rawin balloon whose height is computed.

(3) The known heights of unobscured portions of objects, other than natural landmarks, within 1-1/2 miles of any runway of the airport.

1432. AIRCRAFT CEILING. A ceiling is classified as an aircraft ceiling when it is determined by a pilot while in flight over, or within 1-1/2 miles of, any runway of the airport. Aircraft ceilings may refer to vertical visibility (see par. 1411), or clouds, or obscuring phenomena aloft.

1433. BALLOON CEILING. A ceiling is classified as a balloon ceiling whenever it pertains to clouds or obscuring phenomena aloft and is determined by means of ceiling or pilot balloons. (See par. 1442.)

1434. INDEFINITE CEILING. A ceiling is classified as indefinite whenever it pertains to hydrometeors, other than precipitation, or lithometeors whose bases are at the surface. All indefinite ceilings are estimations, but the height corresponding to the upper limit of a ceilometer reaction, the top of a ceiling-light projector beam, or the height at which a balloon completely disappears will be used as a guide.

1435. PRECIPITATION CEILING. A ceiling is classified as a precipitation ceiling when precipitation obscures the cloud base and prevents a determination of its height. All precipitation ceilings are estimations, but the guides indicated in par. 1434 should be used. These guides will usually indicate values that are lower than the actual vertical visibility.

1436. ESTIMATED CEILING. A ceiling is classified as estimated:

(1) Whenever determined by means of the "Convective Cloud-Base-Height Diagram" (Fig. 1) under conditions appropriate to, and in accordance with instructions for, its use. (See par. 1447.)

(2) Whenever penetration of the ceilometer or ceiling-light beam is in excess of normal for the particular height and type of layer (see par. 1441.2).

(3) Whenever determined from the known heights of unobscured portions of natural landmarks, or of objects more than 1-1/2 miles from any runway of the airport.

(4) Whenever determined on the basis of experience provided that the sky is not obscured by surface-based hydrometeors or lithometeors, and other guides are lacking, or considered unreliable.

1440. METHODS OF DETERMINING CEILING AND CLOUD HEIGHTS. The methods indicated in pars. 1441 to 1447.2 will be used in determining heights. Heights of 5000 feet or less will be determined to the nearest 100 feet; heights of more than 5000 feet but less than 10,000 feet to the nearest 500 feet; and heights of 10,000 feet or more to the nearest 1000 feet. When the ceiling is halfway between two reportable values, select the lower value (e.g., 50 feet will be reported as "0"). Unless otherwise specified, all heights are with reference to height above surface, not above sea level.

1441. CEILING LIGHT (OR CEILOMETER PROJECTOR). The ceiling light

will be used in determining heights as follows:

(1) Turn on the ceiling light.

(2) Sight through the clinometer, and center the intersection of the cross hairs upon the lower part of the most clearly defined portion of the spot.

(3) When the pendant has come to rest, clamp it in position, without moving the clinometer.

(4) Read the angle to the nearest whole degree.

(5) Repeat steps 2 - 4 three times and obtain an average angular reading.

(6) Turn off the ceiling light.

(7) Obtain the height from prepared tables appropriate to the baseline. (See Table 3 for heights computed for baselines of 500, 1000, and 1500 feet.)

(8) Add algebraically to the value in Table 3 the difference between the height of the observation point and the official field elevation; if an official field elevation has not been established, add the height of the observation point above the ground.*

1441.1. OBSERVATIONS ON REDUCED BASELINE. When the horizontal visibility is less than the length of the baseline, pace the distance towards the projector to a point from which a spot can be observed. Use this shorter baseline to compute the height. For any given angle, the height will be proportional to the lengths of the baseline in accordance with the following equation:

$$h = \frac{b}{B} \times H \text{ or } \frac{h}{H} = \frac{b}{B}$$

where

B = normal baseline
H = height from tables at observed angle with normal baseline
b = normal baseline minus distance paced
h = height determined from short baseline and table for H.

*If a separate table has been computed for this purpose, the difference between the height of the point of observation and the field elevation should be incorporated in the table by adding it to each tabular value. If this has been done, step 8 will be omitted.

1441.2. DETERMINATION OF NORMAL PENETRATION. The average vertical extent of the brightest portion of the spot produced by a ceiling light or ceilometer projector is approximately 300 feet. This value corresponds to the period during which the ceilometer reaction remains at a maximum, and should be used as an index in determining normal penetration as specified in par. 1431. It is not an absolute criterion, since it will vary with the efficiency and exposure of instrumental equipment. In general, most heights determined by means of a ceilometer or ceiling light, including those pertaining to very low layers, should be classified "measured."

1441.3. CORRELATION WITH VISUAL OBSERVATION. Data taken from the ceilometer or ceiling light must be supported by visual observations to insure that the data are representative of the layer to which they are ascribed. For example, under conditions of multiple layers, a height value must not be reported as a ceiling when actually it is the height of a layer above or below the layer constituting the ceiling.

TABLE 3.—*Height of cloud base, feet, light projected vertically*

Angle \ Base Line	500′	1,000′	1,500′	Angle \ Base Line	500′	1,000′	1,500′
5	44	87	131	46	518	1,036	1,554
6	52	105	157	47	536	1,072	1,608
7	62	123	185	48	556	1,111	1,667
8	70	141	211	49	575	1,150	1,725
9	79	158	237	50	596	1,192	1,788
10	88	176	264	51	618	1,235	1,853
11	97	194	291	52	640	1,280	1,920
12	106	213	319	53	664	1,327	1,991
13	116	231	347	54	688	1,376	2,064
14	124	249	373	55	714	1,428	2,142
15	134	268	402	56	742	1,483	2,225
16	144	287	430	57	770	1,540	2,310
17	153	306	459	58	800	1,600	2,400
18	162	325	487	59	832	1,664	2,496
19	172	344	516	60	866	1,732	2,598
20	182	364	546	61	902	1,804	2,706
21	192	384	576	62	940	1,881	2,821
22	202	404	606	63	982	1,963	2,945
23	212	424	636	64	1,025	2,050	3,075
24	222	445	667	65	1,072	2,144	3,216
25	233	466	699	66	1,123	2,246	3,369
26	244	488	732	67	1,178	2,356	3,534
27	255	510	765	68	1,238	2,475	3,713
28	266	532	798	69	1,302	2,605	3,907
29	277	554	831	70	1,374	2,748	4,122
30	288	577	865	71	1,452	2,904	4,356
31	300	601	901	72	1,539	3,078	4,617
32	312	625	937	73	1,636	3,271	4,907
33	324	649	973	74	1,744	3,487	5,231
34	338	675	1,013	75	1,866	3,732	5,598
35	350	700	1,050	76	2,006	4,011	6,017
36	364	727	1,091	77	2,166	4,332	6,498
37	377	754	1,131	78	2,352	4,705	7,057
38	390	781	1,171	79	2,572	5,145	7,717
39	405	810	1,215	80	2,836	5,671	8,507
40	420	839	1,259	81	3,157	6,314	9,471
41	434	869	1,303	82	3,558	7,115	10,673
42	450	900	1,350	83	4,072	8,144	12,276
43	466	933	1,399	84	4,757	9,514	14,211
44	483	966	1,449	85	5,715	11,430	17,175
45	500	1,000	1,500	86	7,150	14,301	21,441

1442. BALLOONS. Observe the following procedure in determining the heights of clouds or obscuring phenomena aloft. (See par. 1434 for use of balloons as guides in determining vertical visibility.)

(1) Choose the appropriate color of balloon; red balloons are usually preferable with thin clouds and blue or black balloons under other conditions.

(2) Watch the balloon continuously, determining with a stop watch (or any watch having a seconds hand) the length of time that elapses between release of the balloon and entry into the base of the layer. The point of entry will be considered as midway between (a) the time at which the balloon begins to fade and (b) the time of complete disappearance. If there is doubt as to the accuracy of the balloon's indications (such as might occur if the balloon did not enter a representative portion of the cloud base, or if its ascensional rate might have been affected by precipitation), the value indicated by the balloon will be used as a guide, but the ceiling will be classified estimated in accordance with par. 1436(4).

(3) Determine the height by means of the table appropriate to the balloon used. (See Table 4 for ascensional rate tables.) Interpolate if necessary.

(4) Add algebraically to the tabular value the difference between the height of the point of release and the official field elevation; if an official field elevation has not been established, add the height of the point of release above ground.*

1442.1. LIMITATIONS. The procedure indicated in par. 1442 applies to all types of balloons, except that heights of rawin and raob balloons will be computed rather than determined from ascensional rate tables. Ascensional rates of ceiling and pilot balloons are not affected by drizzle of any intensity, or any other form of precipitation of light intensity, except hail and freezing rain. During other precipitation conditions, use these balloons only as guides in estimating the ceiling.

*If a separate table has been computed for this purpose, the difference between the height of the point of observation and the field elevation should be incorporated in the table by adding it to each tabular value. If this has been done, step 4 will be omitted.

TABLE 4. HEIGHT IN FEET, DETERMINED BY CEILING OR PILOT BALLOON

Time	10 gm. Spherical		30 gm.	
Minutes and Seconds	Nozzle lift 1/ 40 gm.hyd. or 43 gm.helium	Nozzle lift 2/ 45 gm.helium	Nozzle lift 3/ 125 gm.hyd. or 139 gm.helium	Nozzle lift 4/ 132 gm.hyd. or 147 gm.helium
0:10	80	80	120	120
0:20	170	170	230	240
0:30	250	250	350	360
0:40	330	330	470	480
0:50	400	420	590	600
1:00	480	500	710	720
1:10	540	580	820	830
1:20	610	650	920	940
1:30	670	730	1030	1050
1:40	730	810	1140	1160
1:50	790	880	1250	1270
2:00	850	960	1360	1380
2:30	1030	1190	1680	1710
3:00	1210	1420	2010	2040
3:30	1390	1650	2320	2355
4:00	1570	1880	2630	2670
4:30	1750	2090	2940	2985
5:00	1930	2300	3250	3300
5:30	2110	2510	3540	3600
6:00	2290	2720	3840	3900
6:30	2470	2930	4130	4200
7:00	2650	3140	4430	4500
7:30	2830	3350	4720	4800
8:00	3010	3560	5020	5100

1/ For use at Air Force and Navy Stations - add 180 feet for each additional one-half minute after 8.

2/ For use at Civil Stations - add 210 feet for each additional one-half minute after 8.

3/ For use at Civil and Navy Stations - add 295 feet for each additional one-half minute after 8.

4/ For use at Air Force Stations - add 300 feet for each additional one-half minute after 8.

1444. PILOT OBSERVATIONS. Heights of clouds and obscuring phenomena will ordinarily be expressed by the pilot in terms of feet above mean sea level, and will be converted to feet above field elevation if necessary. It must be determined, in any case, whether the report refers to field elevation or sea level, and to a location within 1-1/2 miles of any runway of the airport. Pilots' reports in which the ceiling is indicated as estimated, rather than obtained by actual flight near the base, will not be used as "aircraft" ceilings.

1444.1. When a pilot's report of ceiling differs from the ceiling reported in the current observation, redetermine the latter value immediately. If the redetermined ceiling value cannot be classified measured, the ceiling reported by the pilot will be considered the current ceiling value, and a special observation filed if required by par. 9132.1. If the redetermined ceiling value is classified as measured, the measured value will be considered as the current ceiling, but the pilot's report will nevertheless be distributed in accordance with par. 10210.

1445. BUILDINGS, ETC. Determination of heights may be based on the point at which layers are intercepted by objects (buildings, etc. other than natural landmarks) whose heights are known. Allow, so far as possible, for any appreciable slope in the layer from the point of observation to the point of interception of the object.

1446. NATURAL LANDMARKS. Heights based on the unobstructed portion of hills or mountains surrounding the station, when their height above the elevation of the station is known, will be classified as estimated. Orographic lifting may cause layers to differ in height from those immediately above the station. Estimates of heights based on mountains more than 50 miles away will not be regarded as applicable to those overhead.

1447. CONVECTIVE CLOUD HEIGHT DIAGRAM. This diagram eliminates the computations necessary in determining height of convective-type clouds by use of a dew-point formula. It is not suitable for use at stations situated in mountainous or hilly terrain and will, therefore, not be used at these stations. Heights determined in this manner will be classified as estimated. (See Fig. 1.)

1447.1. The diagram will be used only when the clouds present are formed by active surface convection near the point of observation. The diagram is usually most accurate when used to compute the height of cloud bases 5000 feet or below; but at land stations in coastal regions, sea breezes frequently render it inapplicable to clouds formed over land before the onset of the sea breeze.

1447.2. Obtain the estimated height of a cloud base above the point of observation as follows:

(1) Locate the point of intersection of the vertical line

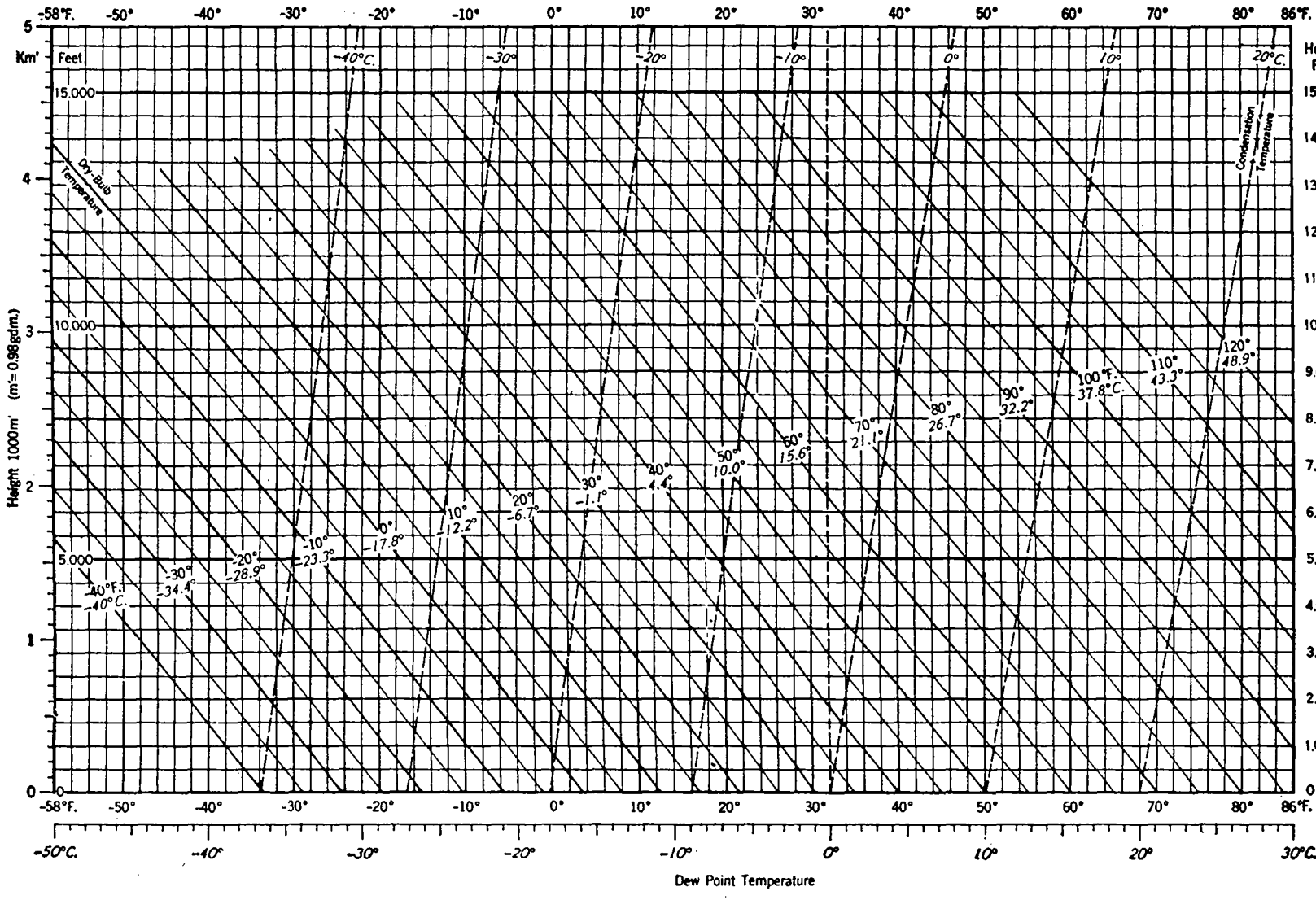


FIGURE 1.—Diagram for determining height of convective-type clouds.

(Convert sub-freezing dew-point temperatures from a water to ice basis by means of Table 10 before using this diagram)

(abscissa) corresponding to the observed dew-point temperature, and the curve (sloping upward to left) corresponding to the observed dry-bulb temperature.

(2) Find the height of the convective cloud base above the ground at the scale value (printed along the right side of the chart) corresponding to the point found in (1).

1450. FREQUENCY OF CEILING MEASUREMENTS. Whenever available, a ceiling light or ceilometer will be used as frequently as observations are taken, provided clouds are present at the observation and it appears likely that a height value can be secured. Stations not equipped with ceilometers will use balloons during daylight hours as specified in par. 1451-52. (See also par. 1442.1.)

1451. At stations where hourly observations for scheduled transmission are taken, balloons will be used as follows to determine the ceiling value:

(1) At the discretion of the observer, when the ceiling is estimated as 2000 feet or more.

(2) At hourly intervals or more frequently, when the ceiling is between 1000 and 2000 feet, unless the highest instrument minimum for the airport is above 1000 feet, in which case (3) applies.

(3) At half-hour intervals or more frequently, when the ceiling is below 1000 feet, or at or below the highest instrument minimum for the airport.

1452. At stations not taking hourly aviation observations, ceiling balloons will be used whenever the ceiling is estimated to be less than 3000 feet.

1500. ENTRIES ON WBAN-10

1510. CEILING AND SKY. (Col. 3-4) Enter in ascending order of height the appropriate sky-cover symbol for each layer, selected in accordance with the summation principles stated in par. 1511. Prefix the corresponding height in hundreds of feet (see par. 1440) to each sky-cover symbol, and an appropriate ceiling classification symbol to to the ceiling layer only. Heights ascribed to "X" will represent vertical visibility. A numerical value will not be ascribed to "-X" since unlimited vertical visibility is indicated. If the ceiling is variable (see par. 1420), enter the letter "V" following the ceiling value, e.g., M5V⊕.

1511. SUMMATION. The sky-cover symbol for each layer represents the summation total of all sky cover (see par. 1110) at and below that level, including the amount of sky hidden by surface-based obscuring phenomena. In determining summation totals, disregard portions of surface-based obscuring phenomena that do not conceal the sky, and portions of upper-cloud layers that are visible only through transparencies in lower layers. If any portion of the sky cover is transparent, determine, in addition to the foregoing summation, the summation of opaque sky cover at each level (see examples 7 and 8 below). If, at any level, the ratio of opaque to total sky cover (summation values) is 1/2 or less, prefix "-" (thin) to the corresponding sky-cover symbol. Omit this prefix if the ratio exceeds 1/2. Prefix "+" to layers that are unusually dark or threatening.

EXAMPLES

Opaque sky cover:

	Layers	Summation	Sky-Cover Symbol
(1)	0.4 sky hidden by fog	0.4	-X
	0.3 sky cover at 1000'	0.7	M10⊕
	0.2 sky cover at 5000'	0.9	50◐
(2)	Less than 0.1 sky cover at 500'	0.0	—
	Less than 0.1 sky cover at 2000' (Total sky cover 0.1)	0.1	20◐
(3)	0.6 sky cover at 1000'	0.6	M10◐
	0.3 sky cover at 5000'	0.9	50◐
	Less than 0.1 sky cover at 10,000'	0.9+	100⊕ ..(with remark: BINOVC)
(4)	0.1 sky cover at 1000' (Smoke aloft)	0.1	10◐ ..(with remark: KLYR 10◐)
	0.3 sky cover at 5000'	0.4	50◐
	0.1 sky cover at 10,000'	0.5	100◐
(5)	0.2 sky cover at 500'	0.2	5◐
	Sky hidden by snow, vertical visibility 1500'	1.0	P15X
(6)	0.8 sky hidden by snow	0.8	-X
	0.2 sky cover at 500'	1.0	M5⊕

Transparent or partially opaque sky cover:

	Layers	Summation Total	Summation Opaque Portions	Sky-Cover Symbol
(7)	0.8 sky cover at 500' (0.0 opaque)	0.8	0.0	*5-⌀
(8)	0.1 sky hidden by surface smoke	0.1	0.1	-X
	0.7 sky cover at 1000' (0.1 opaque)	0.8	0.2	*10-⌀
	0.2 sky cover at 5000' (all opaque)	1.0	0.4	*50-⊕

*Note that the ceiling classification letter is omitted because the layer is classified as "thin."

1520. REMARKS. (Col. 14) Enter data pertaining to clouds and obscuring phenomena in remarks as follows:

	Observed	Instructions for Entry
(1)	Breaks in overcast; one overcast layer only.	Enter "BINOVC," followed by direction of breaks where practicable.
(2)	Breaks in higher overcast; two or more overcast layers reported (lower one classified thin).	Enter "BRKHIC"
(3)	Higher clouds visible through breaks in overcast not classified thin.	Enter "HIR CLDS VSB"
(4)	Direction of breaks in broken layer with ceiling at or below highest instrument minimums. (Omit if breaks are in all quadrants)	Enter "BRKS," followed by direction, e.g.,"BRKS N"or "BRKS OVR MID MKR"
(5)	Obscuring phenomena (smoke, etc.) aloft	Enter "KLYR," "HLYR," etc., followed by height and corresponding sky-cover symbol, e.g., "KLYR 10⌀"
(6)	Special cloud types (see Circ. S for definitions)	
	a. Towering cumulus	Enter "TWRG CU," followed by direction from station.

Observed	Instructions for Entry
b. Cumulonimbus	Enter "CB," followed by direction from station and direction of movement, if known.
c. Cumulomammatus	Enter "CM," followed by direction from station.
d. Altocumulus castellatus	Enter "ACC," followed by direction from station.
e. Virga	Enter "VIRGA," followed by direction from station.
(7) Variable sky condition	Enter ranges of variability, separated by letter "V"; e.g., "⊕V⊕" to indicate that a layer reported as broken in Col. 3-4 is occasionally scattered.
(8) Variable ceiling	Enter range of variability separated by letter "V," and prefix entire remark with abbreviation "CIG"; e.g.,"CIG 15V20" (see par. 1420).
(9) Differing ceiling or sky condition at distance from station.	Enter appropriate remarks, such as "CIG LWR OVR CITY," "LWR CLDS W APCHG STN," etc.

1530. TOTAL SKY COVER. (Col. 21) At each record hourly observation, enter tenths of total sky cover as defined in par. 1110. Enter 1- if less than 0.1 sky cover is present; 9+ if more than 0.9 but with breaks; 0 if no sky cover is present; and 10 if the sky is completely covered.

1540. CLOUDS AND OBSCURING PHENOMENA. (Cols. 22-35) Entries will be made in columns 22-35 for each hourly observation at Air Force, Navy, and first-order Weather Bureau stations. Data will be entered in ascending order of height. When cloude or obscuring phenomena are present at more than four levels, do not enter data for levels above the fourth in these columns, but enter additional information concerning these levels in column 90. The presence of these levels will also be indicated by the entry for total sky cover (column 21).

1541. AMOUNT AND SUMMATION TOTAL. (Cols. 22, 25, 28, 29, 32, 33) Enter to the nearest tenth the sky cover (see par. 1110) observed at each level. Enter less than 0.1 as 1-; more than 0.9 but less than 1.0 as 9+. Since a series of frequent observations

(continued on next page)

or pilot reports often indicates the extent or existence of layers above a broken or overcast layer, amounts entered in Cols. 22, 25, 29, and 33 are not necessarily the amounts actually visible at the time of observation, and the sum of the number of tenths may exceed ten-tenths. However, the entries in columns 28 and 32 will be a summation of the sky cover at and below the elevations reported in columns 27 and 31 respectively, and will not exceed 1.0. For example: If 0.4 clouds are visible at 1000 feet and a pilot reports 1.0 clouds at 3000 feet, the summation total entered in column 28 would nevertheless be only ten-tenths.

1541.1. When higher layers cannot be identified because lower layers hide more than 0.9 of the sky, enter "U" in the amount columns and omit entries in the type, height, and summation columns pertaining to higher layers. When layers are not present at any level, or higher layers are not visible and 0.1 or more of the sky is visible, enter zeros in the appropriate amount columns and omit entry in type and height columns. When two or more types of clouds or obscuring phenomena occur at the same level, enter their combined amounts in the appropriate columns captioned "Amount". (See also par. 1542)

1542. TYPE, DIRECTION. (Cols. 23, 26,30, 34) Enter the appropriate abbreviation selected from Table 4a for clouds or obscuring phenomena. When two or more types of clouds or obscuring phenomena are observed at the same level, the predominating type with respect to amount will be recorded.* Enter the direction from which the layers are moving. When the direction is unknown, omit the entry. When motion is not discernible, enter "C" for calm; otherwise, enter an arrow denoting the motion to eight points of the compass immediately above the abbreviation. (See Table 4b.)

TABLE 4a. Cloud types and obscuring phenomena

Cloud type and obscuring phenomena	Abbreviations	Cloud type and obscuring phenomena	Abbreviations
CLOUDS		OBSCURING PHENOMENA—continued	
Altocumulus	Ac	*Precipitation*—Continued	
Altocumulus castellatus	Acc	Hail (any form and intensity including AP)	A
Altostratus	As	Ice crystals	IC
Cirrocumulus	Cc	Rain (any form and intensity including RW and ZR)	R
Cirrostratus	Cs	Sleet	E
Cirrus	Ci	Snow (any form and intensity including SW, SP, and SG)	S
Cumulonimbus	Cb		
Cumulonimbus mammatus (Mammato-cumulus)	Cm	*Hydrometeors other than precipitation*	
Cumulus	Cu	Blowing snow	BS
Fractocumulus	Fc	Fog (any form, including GF and IF)	F
Fractostratus	Fs		
Nimbostratus	Ns	*Lithometeors*	
Stratocumulus	Sc	Dust	D
Stratus	St	Haze	H
OBSCURING PHENOMENA		Sand	N
Precipitation		Smoke	K
Drizzle (any form and intensity including ZL)	L		

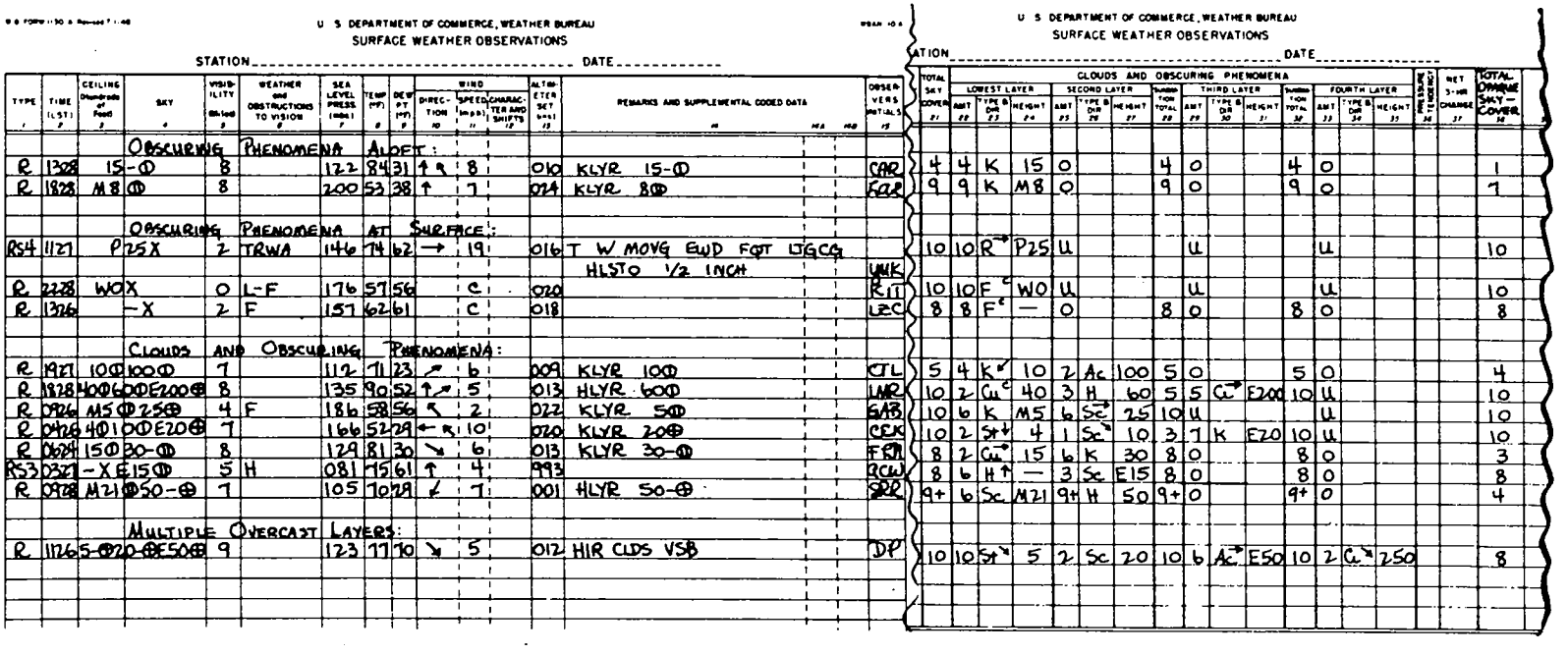
*If the amounts are equal, enter the type that, in the opinion of the observer, is most significant.

TABLE 4b. Cloud direction

↓	from north	↑	from south
↙	from northeast	↗	from southwest
←	from east	→	from west
↖	from southeast	↘	from northwest

1543. HEIGHT. (Cols. 24, 27, 31, 35) Enter height of clouds and obscuring phenomena aloft in columns captioned "Height." Enter the vertical visibility for obscuring phenomena with bases at the surface, using a dash to denote unlimited vertical visibility. Make all entries in hundreds of feet, using the intervals specified in par. 1440. Prefix an appropriate classification letter selected from Table 2a to the ceiling layer only.

1544. TOTAL OPAQUE SKY COVER. (Col. 38) Enter the tenths of sky that are hidden by clouds or obscuring phenomena. Enter 1- if less than 0.1 of the sky is hidden; 9+ if more than 0.9; 0 if no sky is hidden; and 10 if the sky is completely hidden. (Note that this entry is similar to the entry of total sky cover in column 21, except that sky cover through which the sky is visible is disregarded when determining the entry in column 38.)



U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS

STATION _____ DATE _____

TYPE	TIME (LST)	CEILING (Hundreds of Feet)	SKY	VISIBILITY (Miles)	WEATHER and OBSTRUCTIONS TO VISION	SEA LEVEL PRESS (mbs)	TEMP (°F)	DEW PT (°F)	WIND DIRECTION	WIND SPEED (mph)	WIND CHARACTER AND SHIFTS	ALTIMETER SET (mbs)	REMARKS AND SUPPLEMENTAL CODED DATA	OBSERVERS INITIALS
			OBSCURING PHENOMENA ALOFT:											
R	1308	15	-⊙	8		122	84	31	↑	8		010	KLYR 15-⊙	CAR
R	1828	M8	⊙	8		200	53	38	↑	7		014	KLYR 8⊙	GAR
			OBSCURING PHENOMENA AT SURFACE:											
RS4	1121	P25	X	2	TRWA	146	74	62	→	19		016	T W MOVG EWD FQT LGCG HLSTO 1/2 INCH	UNK
R	2228	WOX		0	L-F	176	57	56		C		020		RJI
R	1316		-X	2	F	157	62	61		C		018		LEC
			CLOUDS AND OBSCURING PHENOMENA:											
R	1921	10⊙	100⊙	7		112	71	23	↗	6		009	KLYR 100⊙	CTL
R	1828	400	600⊙E200⊙	8		135	90	52	↑↗	5		013	HLYR 600⊙	LMR
R	0926	M5	⊙250⊙	4	F	186	58	56	↖	2		022	KLYR 50⊙	GAB
R	0428	40	100⊙E200⊙	7		166	52	29	← ↖	10		020	KLYR 200⊙	CCK
R	0624	150⊙	30-⊙	8		129	81	30	↘	6		013	KLYR 30-⊙	FRM
RS3	0321	-X	E150⊙	5	H	081	75	61	↑	4		993		QCW
R	0928	M21	⊙50-⊙	7		105	70	29	↙	7		001	HLYR 50-⊙	SRR
			MULTIPLE OVERCAST LAYERS:											
R	1126	5-⊙	20-⊙E50⊙	9		123	77	70	↘	5		012	HIR CLDS VSB	DP

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS

ATION _____ DATE _____

TOTAL SKY COVER	CLOUDS AND OBSCURING PHENOMENA: LOWEST LAYER AMT	LOWEST LAYER TYPE & DIR	LOWEST LAYER HEIGHT	SECOND LAYER AMT	SECOND LAYER TYPE & DIR	SECOND LAYER HEIGHT	NUMBER TION TOTAL	THIRD LAYER AMT	THIRD LAYER TYPE & DIR	THIRD LAYER HEIGHT	NUMBER TION TOTAL	FOURTH LAYER AMT	FOURTH LAYER TYPE & DIR	FOURTH LAYER HEIGHT	PRESSURE TENDENCY	NET 3-HR CHANGE	TOTAL OBSVD SKY — COVER
4	4	K	15	0			4	0			4	0					-
9	9	K	M8	0			9	0			9	0					1
10	10	R→	P25	U				U				U					10
10	10	F	WO	U				U				U					10
8	8	F	—	0			8	0			8	0					8
5	4	K↙	10	2	Ac	100	5	0			5	0					4
10	2	Cu	40	3	H	60	5	5	Cu→	E200	10	U					10
10	6	K	M5	6	Sc→	25	10	U				U					10
10	2	St↓	4	1	Sc↘	10	3	7	K	E20	10	U					10
8	2	Cu→	15	6	K	30	8	0			8	0					3
8	6	H↑	—	3	Sc	E15	8	0			8	0					8
9+	6	Sc	M21	9+	H	50	9+	0			9+	0					4
10	10	St↘	5	2	Sc	20	10	6	Ac→	E50	10	2	Cu↘	250			8

Fig. 1a. Entries of clouds and obscuring phenomena - WBAN-10A and B.

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CHAPTER 2. VISIBILITY

2000. GENERAL

2010. Visibility is a term that denotes the greatest distance an object of specified characteristics can be seen and identified. This term may express the visibility in a single direction or the prevailing visibility based on all directions. Visibility observations will be taken from as many points as necessary to view all appropriate markers. Except as specified in par. 2011, observations should be with reference to a plane six feet above the ground or, if station facilities preclude an observation at this level, as close as practicable to it. Visibility will be observed and recorded in statute miles in accordance with Table 4c. When the visibility is halfway between two reportable values, select the lower value.

Table 4c. Reportable Visibility Values (Statute Miles)

Fractional increments	1-mile increments when visibility is 3 to 15 miles, inclusive. 5-mile increments when visibility is more than 15.
0	1
1/16	1-1/4
1/8	1-1/2
3/16	1-3/4
1/4	2
5/16	2-1/4
3/8	2-1/2
1/2	3
5/8	
3/4	

2011. Unless otherwise authorized, all stations at which control towers are situated will take visibility observations at the control-tower level, as well as at the usual point of observation, whenever the visibility at the latter point is less than three miles. At civil stations, control-tower visibilities will be used for all aviation observations, including record, coding, and summary, but will not be used for synoptic observations; at military stations, control-tower visibilities will be used only as specified in par. 2420.

2100. GUIDES IN DETERMINING VISIBILITY

2110. CHART OF VISIBILITY MARKERS. Each station will display charts of prominent objects and their distances from the observation point. These charts will include objects suitable for determining the visibility at night as well as by day. At least two charts will be available; one

including all markers throughout the entire range of visible objects, and the other an expanded scale chart including only those markers within 1-1/2 miles of the observation point.

2120. VISIBILITY MARKERS AT NIGHT. The most suitable objects for determining visibility at night are unfocused lights of moderate intensity at known distances, and the silhouettes of mountains or hills, etc., against the sky. The brilliance of stars near the horizon may also be a useful indication. Because of their intensity, airway beacons may not be used as visibility markers, but their degree of brilliance may be used as an aid to indicate whether visibility is greater or less than the distance of the beacon. "Course lights" (red or green) of beacons may be used as definite visibility markers. These and all other lights normally used as visibility markers should be used with caution after storms, for their intensity may be reduced by snow or freezing precipitation.

2130. VISIBILITY MARKERS DURING DAYLIGHT. For accurate determinations during daylight hours, confine the choice of markers to black, or nearly black, objects against the horizon sky rather than to light-colored markers and those appearing against terrestrial backgrounds.

2140. SIZE OF VISIBILITY MARKERS. In order that visibility values may be representative, they must apply to objects of specified minimum size or larger. An object that subtends an angle of less than 0.5 degree at the eye becomes invisible at a shorter distance than larger objects under the same conditions. Therefore, objects whose angular size is 0.5 degree or greater should be selected as visibility markers whenever possible. A hole 0.3 inch (or 5/16") in diameter punched in a card that is held at arm's length subtends an angle of approximately 0.5° at the eye. If the portion of any object above the horizon completely fills the hole when the card is held as explained above, the object is of suitable size for a marker.

2150. DAY AND NIGHT VISIBILITY. Transparency of the atmosphere in the open country (except in polar regions) removed from sources of atmospheric pollutants changes but very little from daylight to darkness and vice versa. However, in areas subject to pollution (as smoke from domestic heating or cooking, and industrial exhausts) there may be systematic variations during the transition period about sunrise or sunset. In such areas a decrease in visibility often occurs near dawn particularly when a steep inversion exists near the surface. Before taking a visibility observation at night, the observer should spend two to six minutes in the dark (depending upon the contrast between office and outside illumination) to adapt his eyes to nighttime conditions.

2160. ESTIMATIONS OF VISIBILITY. When the visibility is greater than the distance to the farthest object, note the sharpness with which

the object stands out. Sharp outlines in relief, with little or no blurring of color, indicate that the visibility is much greater than the distance of the reference object. On the other hand, blurred or indistinct objects indicate the presence of haze or other phenomena that has reduced the visibility to not less than the distance of the objects.

2200. VISIBILITY IN A DEFINITE DIRECTION

2210. Visibility in a definite direction is the greatest horizontal distance in that direction at which the outlines of visibility markers can be distinguished against the horizon sky under the conditions existing at the time of observation.

2300. PREVAILING VISIBILITY

2310. DEFINITION. Prevailing visibility is the maximum visibility common to sectors comprising 1/2 or more of the horizon circle. Under nonuniform conditions the sectors may be distributed in any order. Under uniform conditions the prevailing visibility is the same as the visibility in any direction. If the visibility is variable, i.e., the prevailing visibility rapidly increases and decreases by one or more reportable values during the period of the observation, use the average of all observed values as the prevailing visibility. Report the visibility as variable only if the prevailing visibility is less than three miles.

2320. DETERMINATION. To determine prevailing visibility under nonuniform conditions, regard the horizon circle as divided into several sectors of equal size in each of which the visibility is substantially uniform. Select the highest value that is equal to or less than the visibility of sectors that cover at least one-half of the horizon circle. For example, if the horizon circle were divided into six sectors and the respective visibility values were 1/16, 1/8, 1/4, 1/2, 3/4, and 1 mile, the prevailing visibility would be 1/2 mile. This is evident from the fact that 1/2 mile is the highest value equal to or less than the visibility values of 1/2 or more of the horizon circle. This is illustrated in Fig. 2.

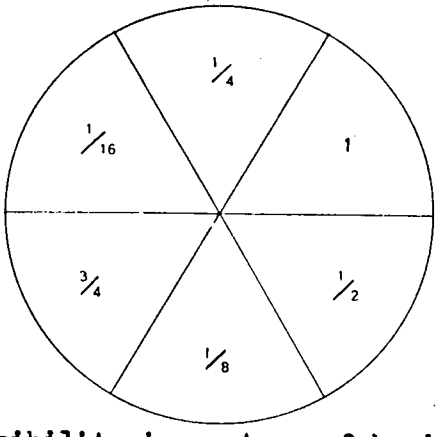

Fig. 2. Visibility in sectors of horizon circle.

2400. ENTRIES ON WBAN-10

2410. VISIBILITY. (Col. 5) Enter the prevailing visibility in the increments listed in Table 4c. If the visibility is variable, enter "V" following the visibility (see par. 2310). Enter "15+" when the visibility is more than 15 miles but suitable distant markers for more precise determination are lacking. At civil stations taking control-tower visibility observations, enter the visibility at the control-tower level in this column when the visibility at the usual point of observation is less than three miles.

2420. REMARKS. (Col. 14) Enter visibility data in this column as follows:

*(1) Visibility by quadrants: Enter visibility for quadrants in which it differs from the prevailing visibility, provided the visibility in one or more quadrants is less than three miles. Prefix each value with the corresponding quadrant designator; e.g., "VSBY N1".

(2) Visibility at differing levels (see pars. 2011 and 2410):

(a) At civil stations, when the visibility at the control-tower level (as entered in Col. 5) differs from the visibility at the usual point of observation, enter the latter value in Col. 14, followed by the height of the restricting phenomena if determinable; e.g., "SFC VSBY 2 GFDEP 50".

(b) At military stations, when the visibility at the control-tower level differs from the visibility at the usual point of observation, enter the former value in Col. 14, followed by the height of the restricting phenomena if determinable; e.g., "TWR VSBY 2 GFDEP 50".

*(3) Variable visibility when prevailing visibility is less than three miles (see par. 2310): Enter range of variability separated by "V"; e.g., "VSBY 1V2".

*These remarks will relate to the same observation point as the value entered in Col. 5; i.e., if tower visibility is recorded in Col. 5, remarks pertaining to visibility by quadrants or variable visibility will also represent control-tower values.

CHAPTER 3. ATMOSPHERIC PHENOMENA

3000. GENERAL

3010. Atmospheric phenomena observed as weather elements of an observation comprise tornadoes, waterspouts, thunderstorms, squalls, and precipitation in any form. Hydrometeors other than precipitation, and lithometeors, are termed obstructions to vision. Igneous and luminous meteors, such as lightning, rainbows, halos, coronas, and auroras, are also observed. Observations of these phenomena, except freezing rain and the determination of intensity of precipitation (see pars. 3432 and 3510) are taken without the use of instruments, and from as many points as necessary to view the entire horizon. Terms in parentheses indicate equivalents as used in synoptic reports, e.g., Light (Slight).

3100. TORNADOES AND WATERSPOUTS

3110. DESCRIPTION. These storms occur when meteorological conditions are favorable for intense thunderstorm activity. The distinguishing feature is the funnel-shaped appendage that hangs from the base of the cloud. The storm is described as a tornado when it occurs over land and as a waterspout when it occurs over water.

3120. OBSERVATION. Note the direction from the station, and the direction toward which it is going. The direction of motion is the same as that of the cloud with which the phenomenon is associated; however, it should be remembered that the direction of motion of a cloud is observed as the direction from which the cloud is moving. Intensity values are not ascribed to tornadoes or waterspouts.

3130. TORNADO REPORTS BY PUBLIC. The cooperation of local news-gathering agencies, police departments, and other organizations having special communication facilities will be solicited in obtaining public reports of tornadoes (see par. 3920). At locations where there are both military and civil weather stations, these arrangements will be made by the civil station.

3200. THUNDERSTORMS

3210. DEFINITION. A thunderstorm is regarded as occurring at the station when thunder has been heard within the previous 15 minutes.

3220. OBSERVATION. Note the following:

(1) Occurrence of thunder.

(2) Location of storm center with respect to the station.

(3) Direction toward which the storm is moving, when this can be determined with reasonable accuracy.

(4) Whether lightning is occurring from cloud to cloud, cloud to ground, or within clouds.

(5) Intensity of the storm.

3230. DETERMINATION OF INTENSITY. Classification of a thunderstorm as light (slight),[1] moderate or heavy is based upon the appearance of the storm from the point of observation. The thunderstorm may be classified as light throughout its history as viewed from this point, or it may be classified during its passage by the station as light, moderate, heavy; and, as it recedes, moderate, and light. Description of intensity will be based on the following general guides:

3231. LIGHT (SLIGHT) THUNDERSTORM. Lightning occurs within the cloud and rainfall accompanying it is light or moderate. Small hail may also be observed. The thunder is not loud, and lightning occurs at intervals of a minute or more. The surface wind speed at the beginning of or during the storm does not exceed 30 miles an hour (26 knots), and any sudden increase in speed is of short duration. The classification also applies to occasional peals of thunder during a general rain storm.

3232. MODERATE THUNDERSTORM. Loud peals of thunder occur at brief intervals and frequent flashes of lightning occur from cloud to ground, as well as from cloud to cloud; rain is moderate or heavy, and small hail is light or moderate. An onrush of wind may precede the storm, with a speed as high as 40 miles an hour (35 knots). Extensive masses of dark clouds showing visible indications of turbulent motion and rapid horizontal translation are usually observable.

3233. HEAVY THUNDERSTORM. Sharp and pronounced thunder and lightning occur almost continuously. Heavy rain usually occurs, sometimes accompanied by hail. The wind preceding and accompanying the storm may reach a speed in excess of 40 miles an hour (35 knots). A rapid drop in temperature occurs, sometimes as much as 20°F. in five minutes.

3300. SQUALLS

3310. A squall is a strong wind that increases suddenly in speed, maintains a peak speed of 19 mph. (16 knots) or more over a period of two or more minutes, and decreases in speed; similar fluctuations will occur at succeeding intervals. The occurrence of squalls is indicative of turbulence near the surface. The essential difference between squalls and gusts is the duration of the peak wind speed (see par. 8310). Although squalls are classified as an atmospheric phenomenon, instructions for reporting them will be found in paragraph 8450, because their observational criteria are exclusively wind.

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[1]The classification "light (slight)" is used only in synoptic observations.

3400. HYDROMETEORS - PRECIPITATION

3410. GENERAL. The term hydrometeors includes all atmospheric phenomena composed of liquid or solid forms of water. Clouds are not described here since they are considered separately in Chapter 1. The term precipitation includes all forms of moisture that fall to the earth's surface - rain, snow, hail, etc. Dew, frost, and rime, although classified as precipitation, are discussed in this chapter as miscellaneous hydrometeors.

3420. CHARACTER OF PRECIPITATION. Determine character of precipitation in accordance with the following criteria:

3421. CONTINUOUS. Intensity increases or decreases gradually.

3422. INTERMITTENT. Intensity increases or decreases gradually, and precipitation stops and recommences at least once within one hour preceding the time of observation.

3423. SHOWERY. Precipitation associated with cumuliform clouds, especially swelling cumulus and cumulonimbus. Intensity varies rapidly. Showers begin and end abruptly.

3424. COMBINATIONS. Showers and continuous or intermittent rain may occur in combination. Under such conditions the precipitation does not always cease, and when it is showery, the precipitation increases and decreases suddenly in intensity as the showers abruptly begin and end. Only the predominating character will be reported in an observation.

3430. INTENSITY OF PRECIPITATION. Intensities of precipitation are determined by one of two methods:

(1) Rate of accumulation (vertical depth of water per unit time, or depth on ground in solid form per unit time).

(2) Degree to which the precipitation affects visibility.

3431. Intensities of all forms of precipitation except snow and drizzle are determined by (1) above. Intensities of all forms of snow (i.e., snow, snow grains and snow pellets) and drizzle, when they occur alone, are determined by (2) above. When any form of snow or drizzle occurs in combination with one or more hydrometeors or lithometeors, the intensity of the precipitation will be determined on the basis of the rate of accumulation (1) above.

3432. At stations equipped with recording gages, determine the rate of accumulation, and select the corresponding intensity from Table 5. This table is applicable to all forms of precipitation except drizzle, provided solid forms are converted to water equivalent (see also pars. 3434 and 3435).

TABLE 5. Criteria for determining intensity of precipitation on rate-of-fall basis

Very Light	Scattered drops or flakes that do not completely wet or cover an exposed surface, regardless of duration.
Light (Slight)	Trace to 0.10 inch per hour; maximum 0.01 inch in 6 minutes.
Moderate	0.11 inch to 0.30 inch per hour; more than 0.01 inch to 0.03 inch in 6 minutes.
Heavy	More than 0.30 inch per hour; more than 0.03 inch in 6 minutes.

3433. At stations not having recording gages, determine the intensity of rain from the guides indicated in Table 6, and estimate the intensity of other forms from the water equivalent of the amount accumulating on the ground.

TABLE 6. Guides for approximating intensity of rain

Very Light	Scattered drops that do not completely wet an exposed surface, regardless of duration.
Light (Slight)	Individual drops are easily identifiable; spray observable over pavements, roofs, etc., is slight; puddles form very slowly; over two minutes may be required to wet pavements and similarly dry surfaces; sound on roofs ranges from slow pattering to gentle swishing; steady small streams may flow in gutters and downspouts.
Moderate	Individual drops are not clearly identifiable; spray is observable just above pavements and other hard surfaces, puddles form rapidly; downspouts on buildings run 1/4 to 1/2 full; sound on roofs ranges from swishing to gentle roar.
Heavy	Rain seemingly falls in sheets; individual drops are not identifiable; heavy spray to height of several inches is observable over hard surfaces; downspouts run more than 1/2 full; visibility is greatly reduced; sound on roofs resembles roll of drums or distinct roar.

3434. When drizzle occurs in combination with other hydrometeors and lithometeors, estimate the rate of accumulation and select the corresponding intensity from Table 7.

TABLE 7. Intensity of drizzle on rate-of-fall basis

Very Light	Scattered drops that do not completely wet an exposed surface, regardless of duration.
Light (Slight)	Trace to 0.01 inch per hour.
Moderate	More than 0.01 inch to 0.02 inch per hour.
Heavy	More than 0.02 inch per hour.

Note. - When precipitation equals or exceeds 0.04 inch per hour, there is a strong presumption that the precipitation is rain.

3435. When drizzle or snow (including snow pellets and snow grains) occurs alone, determine the intensity in accordance with Table 8.

TABLE 8. Intensity of drizzle and snow with visibility as criteria

Very Light	Scattered flakes or droplets that do not completely cover or wet an exposed surface, regardless of duration.
Light (Slight)	Visibility 1100 yards or more (5/8 statute mile).
Moderate	Visibility less than 1100 yards but not less than 550 yards.
Heavy	Visibility less than 550 yards (5/16 statute mile).

3440. TYPES OF PRECIPITATION. For purposes of these instructions, precipitation is divided into liquid, freezing, and frozen types. These types are discussed in pars. 3441 to 3443.7. A combination of types or of forms of one type will be individually observed and reported regardless of existing meteorological conditions that might appear to be inconsistent with them.

3441. LIQUID PRECIPITATION. Liquid precipitation is classified as rain or drizzle in accordance with the criteria below.

3441.1. RAIN. Drops of water (in the liquid state) falling from clouds; most drops are larger - or if not larger, sparser - than the drops in drizzle. Rain, as used in this manual, excludes drizzle and freezing rain.

3441.2. DRIZZLE. Very small and uniformly dispersed droplets that appear to float in the air and to follow very slight air currents. Drizzle usually falls from low stratus clouds and is frequently accompanied by low visibility and fog.

3442. FREEZING PRECIPITATION. Freezing precipitation is classified as freezing rain or freezing drizzle, in accordance with criteria below.

3442.1. FREEZING RAIN. Rain that falls in liquid form but freezes to the exposed surface of the ground, or to unheated objects on the ground. If the fall is so rapid that run-off occurs, the formation of ice will usually appear as glaze.

3442.2. FREEZING DRIZZLE. Drizzle that freezes similarly to rain (see par. 3442.1) is classified as freezing drizzle.

3443. FROZEN PRECIPITATION. Solid precipitation is classified in accordance with the criteria in pars. 3443.1 to 3443.7.

3443.1. SLEET (ICE PELLETS). Transparent, more or less globular, hard grains of ice about the size of raindrops, that rebound when striking hard surfaces. Its fall may be continuous, intermittent, or showery.

3443.2. HAIL. Ice balls or stones, ranging in diameter from that of medium-size raindrops to an inch or more. They may fall detached or frozen together into irregular, lumpy masses. They are composed either of clear ice or of alternating clear and opaque snowflake layers. Hail often accompanies thunderstorm activity. Surface temperatures are usually above freezing when hail occurs. Determination of size will be based on the diameter, in inches, of normally shaped hailstones.

3443.3. SMALL HAIL. Semitransparent, round or conical, grains of frozen water. Each grain generally consists of a smaller grain of soft hail as a nucleus, surrounded by a very thin ice layer, which gives it a glazed appearance. The grains are wet when they fall at temperatures above freezing. They are not crisp or easily compressible, and do not generally rebound or burst even when they strike hard ground.

3443.4. SNOW. White or translucent ice crystals chiefly in complex branched hexagonal form (six-pointed "stars"), often mixed with simple crystals. It occurs under meteorological conditions similar, with the exception of the accompanying temperatures, to those with which corresponding forms of rain are associated.

3443.5. SNOW PELLETS (SOFT HAIL). White, opaque, round or occasionally conical, kernels of snow-like consistency, 1/16 to 1/4 inch in diameter. They are crisp and easily compressible, and may rebound or burst when striking hard surfaces. They occur almost exclusively in showers.

3443.6. SNOW GRAINS (GRANULAR SNOW). The solid equivalent of drizzle. They take the form of minute, branched, star-like snowflakes,

or of very fine simple crystals. At times they have the appearance of rime. They occur under meteorological conditions similar to those of drizzle, except that the temperature is lower.

3443.7. ICE CRYSTALS. Small, unbranched crystals in the form of rods or plates that have a descending motion and that may be observed when the sky is clear. Ice crystals are associated with halo phenomena and with temperatures near or below 0°F. (See pars. 3432 and 3433 for intensity specifications.)

3500. HYDROMETEORS - MISCELLANEOUS

3501. FOG. Minute droplets suspended in the atmosphere. These droplets have no visible downward motion. Fog differs from clouds in that the base of fog is at the surface and the base of clouds is above the surface. It is easily distinguished from haze by its dampness and grey color. Although fog seldom forms when the difference between the air temperature and the temperature of the dew point is greater than 4.0°F, it should be reported when observed regardless of the temperature-dew point difference.

3502. GROUND FOG. If fog is not contiguous with the base of clouds that may be above it, and if it conceals less than 0.6 of the sky, i.e., the sky condition above an angle of 36° (see Table 2, Chapter 1) is observable, it will be reported as ground fog, rather than fog.

3503. SHALLOW FOG. Low-lying fog that does not obstruct horizontal visibility at a level six feet or more above the surface.

3504. ICE FOG. Suspended particles in the form of ice crystals. It occurs at low temperatures, and usually in clear, calm weather in high latitudes. The sun is usually visible, and may cause halo phenomena.

3505. DEW. Liquid water that condenses upon objects at or near the surface of the earth at temperatures above freezing. Condensation results when a shallow layer of air immediately above these objects is cooled by conduction until the dew point of the air is reached. Dew occurs on calm, clear nights.

3506. FROST (HOARFROST). Thin ice crystals in the form of scales, needles, feathers, or fans, deposited under conditions similar to dew, except that temperatures of the surfaces on which frost forms are 32°F. or lower. Air temperatures several degrees above freezing may occur a few feet above the surface upon which frost appears. Determine the intensity in accordance with pars. 3506.1 and 3506.2.

3506.1. LIGHT. Surface objects covered with a thin deposit of frost which may be more or less patchy.

3506.2. HEAVY. Surface objects covered with a copious deposit of frost.

3507. FREEZE. The condition of the lower atmosphere when the temperature of surface objects is 32°F. or lower. Air temperatures several degrees above the freezing point may occur a few feet above the region where a freeze occurs. A freeze may or may not be accompanied by an actual deposit of frost. When vegetation is injured by relatively low temperature, (with or without frost) the condition is termed a freeze. Classification follows.

3507.1. LIGHT. Little destructive effect on vegetation except on tender plants and vines.

3507.2. KILLING. Widely destructive effects on staple vegetation.

3507.3. HARD. Staple vegetation destroyed, the ground surface frozen solid under foot and heavy ice formed on small water surfaces such as puddles and water containers.

3508. RIME. Rime is classified as soft or hard.

3508.1. Soft rime consists of white layers of ice crystals deposited chiefly on vertical surfaces - especially on points and edges of objects - generally in supercooled fog or light fog. On the windward side soft rime may grow to very thick layers, or long feathery cones, or needles pointing into the wind and having a structure similar to that of frost.

3508.2. Hard rime is opaque, granular masses of ice deposited chiefly on vertical surfaces in wet fog at temperatures below 32°F. It is more compact and amorphous than soft rime, and may build out into the wind as glazed cones or feathers.

3509. DRIFTING SNOW. Snow raised from the surface by the wind to a height less than six feet above the surface. Drifting snow is not regarded as an obstruction to vision (see par. 3920), since it does not restrict visibility at six feet or more above the surface. When snow is raised six feet or more above the surface, it is classified as blowing snow.

3510. BLOWING SNOW. Snow lifted from the surface by wind to a height six feet or more above the surface and blown about in such quantities that the horizontal visibility is restricted at and above that height.

3511. GLAZE. Glaze is composed of homogeneous, transparent ice layers that are built up on exposed surfaces either by supercooled rain or drizzle, or by rain or drizzle that freezes upon contact with surfaces whose temperature is 32°F. or lower. The use of ice-accretion

indicators, at stations equipped with them, is required in determining whether or not rain or drizzle is freezing at the time of observation.

3600. LITHOMETEORS

3610. GENERAL. Lithometeors comprise a class of atmospheric phenomena, among which dry haze and smoke are the most common examples. In contrast to a hydrometeor, which consists largely of water, a lithometeor is composed of solid dust or sand particles, or the ashy products of combustion.

3620. HAZE. Dust or salt particles so small that they cannot be felt, or individually seen by the unaided eye; however, they reduce visibility and lend a characteristic opalescent appearance to the air. Haze resembles a uniform veil over the landscape that subdues its colors. This veil has a bluish tinge when viewed against a dark background, such as a mountain; but it has a dirty yellow or orange tinge against a bright background, such as the sun, clouds at the horizon, or snow-capped mountain peaks. When the sun is well up, its light may have a peculiar silvery tinge owing to haze. These color effects distinguish haze from light fog, whose thickness it may sometimes attain. Note:- Irregular differences in air temperature may cause a shimmering veil over the landscape; this is called "optical haze."

3630. SMOKE. An ashy product of combustion consisting of fine particles suspended in the atmosphere. When smoke is present the disk of the sun at sunrise and sunset appears very red and during the daytime has a reddish tinge. Smoke at a distance, such as from forest fires, usually has a light grayish or bluish color and is evenly distributed in the upper air.

3640. DUST. Finely divided earthy matter, uniformly distributed in the air. It imparts a tannish or grayish hue to distant objects. The sun's disk is pale and colorless or has a yellow tinge at all periods of the day.

3650. DUST DEVIL. Small, vigorous whirlwind, usually of short duration, made visible by dust picked up from the surface.

3660. BLOWING DUST. Dust picked up locally from the surface by the wind and blown about in clouds or sheets. Blowing dust may completely obscure the sky.

3670. DUSTSTORM[1]. Blowing dust that reduces the visibility to less than 1100 yards, but not less than 550 yards.

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[1]These phenomena are reported separately only in synoptic observations. In aviation observations, "duststorm" and "heavy duststorm" are reported as "blowing dust", and "sandstorm" and "heavy sandstorm" as "blowing sand".

3671. HEAVY (SEVERE) DUSTSTORM[1]. Blowing dust that reduces the visibility to less than 550 yards.

3680. BLOWING SAND. Sand picked up from the surface by the wind and blown about in clouds or sheets.

3690. SANDSTORM[1]. Sand blown through the air by a very strong wind or gale. Visibility is reduced to less than 1100 yards but not less than 550 yards. The sand particles are not carried to appreciable distances from their source.

3691. HEAVY (SEVERE) SANDSTORM[1]. Blowing sand that reduces visibility to less than 550 yards.

3700. IGNEOUS METEORS

3710. LIGHTNING. A visible electrical discharge occurring in the atmosphere. Lightning is the only common igneous meteor of importance in meteorology. It occurs as a discharge within a cloud; from cloud to cloud; or from cloud to ground. Distant lightning is any lightning that occurs so far from the observer that the resulting thunder cannot be heard. It may be observed as streaks or sheets.

3800. LUMINOUS METEORS

3810. GENERAL. Optical phenomena, with the exception of aurora, are caused by reflection, refraction, or diffraction of the light from the sun or moon as it passes through clouds or other hydrometeors.

3820. HALO, SOLAR OR LUNAR. A luminous ring, commonly of 22° radius around the sun or moon. It usually appears whitish, but it may show the spectral colors with the red on the inside. The sky is darker inside the ring than outside. Halos are formed by refraction of the light as it passes through ice crystals. Note:- This description applies only to the 22° halo. Other phenomena are the 46° ring, parhelia, tangent arc, etc.

3830. CORONA, SOLAR OR LUNAR. A luminous ring surrounding the sun or moon and formed by diffraction of light by water droplets. It may vary greatly in size, but is usually smaller than a halo. All the spectral colors may be visible, with the red on the outside, but frequently the inner colors are not visible. Sometimes the spectral colors or portions of them are repeated several times and are somewhat irregularly distributed; this is called iridescence.

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[1]These phenomena are reported separately only in synoptic observations. In aviation observations, "duststorm" and "heavy duststorm" are reported as "blowing dust", and "sandstorm" and "heavy sandstorm" as "blowing sand".

3840. RAINBOW. A semicircular arc seen opposite the sun, usually exhibiting all the primary colors, with red on the outside. It is caused by diffraction, refraction and reflection of light within raindrops, which often produces a secondary bow outside the primary one. In this case the colors are reversed.

3850. FOG BOW. A whitish, semicircular arc, seen opposite the sun in fog. Its outer margin has a reddish and its inner a bluish tinge. The middle of the band is white. An additional bow, with the colors reversed, sometimes appears inside the first.

3860. AURORA. A luminescence, frequently called Northern Lights. It is usually seen in the northern skies in lower latitudes, and overhead, or even to the southward of the zenith, in higher latitudes. It may appear in such forms as arcs, rays, curtains, coronas, etc. It is usually of a whitish color but may have various other colors. The lower edges of the arcs and curtains of the aurora are usually fairly well defined, while the upper edges are ill-defined.

3900. ENTRIES ON WBAN-10

3910. WEATHER AND OBSTRUCTIONS TO VISION. (Col. 6) Enter precipitation and obstructions to vision in accordance with the symbols in Tables 8a and 8b. Use + after precipitation symbols to indicate heavy intensity, - to indicate light, and - - to indicate very light; the absence of a sign indicates moderate intensity. Precipitation will be entered in this column only if actually occurring at the time of the observation. (See par. 3920 for entry of remarks concerning intermittent precipitation.) Two or more entries for a single observation will be made in the following order:

(1) Tornado (or waterspout)

(2) Thunderstorm

(3) Liquid precipitation, in order of decreasing intensity

(4) Freezing precipitation, in order of decreasing intensity

(5) Frozen precipitation, in order of decreasing intensity

(6) Obstructions to vision, in order of decreasing predominance if discernible.

3911. Omit entry of obstructions to vision in Col. 6 if the visibility recorded in Col. 5 is seven miles or more. If the visibility is less than seven miles, weather or obstructions to vision must be reported either in Col. 6 or Col. 14 (see par. 3920). If the visibility is reduced by phenomena not occurring at the station, enter an explanatory note in remarks, e.g., "GF BNK N".

TABLE 8a. Symbols for weather

TORNADO or WATERSPOUT (always written out in full) followed by direction from station.

T+	Heavy Thunderstorm	EW	Sleet Showers
T	Thunderstorm	S	Snow
R	Rain	SW	Snow Showers
RW	Rain Showers	SP	Snow Pellets
L	Drizzle	SG	Snow Grains
ZR	Freezing Rain	IC	Ice Crystals
ZL	Freezing Drizzle	A	Hail
E	Sleet	AP	Small Hail

TABLE 8b. Symbols for obstructions to vision

F	Fog	IF	Ice Fog
GF	Ground Fog	H	Haze
BS	Blowing Snow	K	Smoke
BN	Blowing Sand	D	Dust
BD	Blowing Dust		

3920. REMARKS (Col. 14). Enter data pertaining to weather and obstructions to vision as follows:

Observed	Instructions for Entry
(1) Tornado and waterspout	
(a) Observed from station	Enter direction toward which it is moving, e.g., MOVG NEWD
(b) Reported by public	Enter (1) location with respect to weather-reporting station or a city or town, (2) direction toward which it is moving, (3) time tornado was observed, e.g., UNCONFIRMED TORNADO 15 MIS W DCA MOVG N 1600E
(2) Thunderstorm	Enter direction, if observable: (1) with respect to station (2) direction toward which storm is moving, e.g., T OVHD MOVG EWD or T SW MOVMNT VRBL (omit remark concerning movement if movement unknown)

Observed	Instructions for Entry
(3) Lightning, with or without audible thunder	Enter if observable: (1) Frequency (2) Type (cloud to cloud, etc.) (3) Direction from station Use authorized abbreviations, e.g., OCNL LTGCG, FQT LTGIC NW, etc.
*(4) Precipitation	
(a) Hail	Enter diameter in inches of largest hailstones, e.g., HLSTO 1 1/4
(b) Intermittent and showery	Enter abbreviation for intermittent, followed by type of precipitation (e.g., INTMT R-), if intermittent precipitation has occurred within the previous 15 minutes. This entry will be made to report intermittent precipitation regardless of whether precipitation is entered in Col. 6 (see par. 3910). Enter "OCNL RW", etc. if showers have occurred within the previous 15 minutes and are not reported in Col. 6.
(c) Wet snow	Enter WET SNW
(d) Snow depth increase	Enter abbreviation SNOINCR, followed by average depth of snow accumulated during the past hour, to the nearest whole inch (e.g., SNOINCR 5). This remark will be used only if average snow depth has increased during past hour by two or more inches.
(e) Variation of intensity	Enter appropriate abbreviations, e.g., R- OCNLY R+
(f) Precipitation at a distance but not at station	Enter form and intensity of precipitation if known and direction with respect to station. Use "U" following precipitation symbols to indicate unknown intensity, e.g., RU OVR RDG N or PCPN W INTSTY UNK

*In reporting data pertaining to snow, snow showers, or sleet in remarks, use the symbols S, SW, and E only when there is no possibility of their being confused with points of the compass. Otherwise, use established English abbreviations (SNW, SNW SHWRS, etc.).

Observed	Instructions for Entry
(g) Times of beginning or ending of precipitation	Enter remarks in the next succeeding record observation to report times of beginning or ending of precipitation that has occurred within the past hour and has not been reported by means of special observations in accordance with par. 9132.6. Use the symbol "E" followed by the time in minutes past the hour to signify time of ending, and the symbol "B" similarly to signify time of beginning. Disregard intensities and changes in character (e.g. S to SW) but not changes in type (e.g., R to S); also disregard intervals of 15 minutes or less between cessation and recommencement (see examples 3 and 4 below).

Examples

1. RW- reported in 1228 obs; RW- ended at 1305. Enter remark in 1328 obs: "RWE05".

2. No precipitation reported in 1228 obs; S- began at 1235 and continued through 1330. Enter remark in 1328 obs: "SB35".

3. No precipitation reported in 1228 obs; S began at 1240 ended 1255; began 1305 and ended at 1315. Enter remark in 1328 obs: "SB40E15"

4. RW- began 0515E and ended 0620E; no precipitation falling at actual time of 0628E observation, but recommencement within 15 minutes of 0620E appeared probable at time of observation. Enter remarks:

Observed	Instructions for Entry
(g) Times of beginning or ending of precipitation. (continued from page 38.)	(a) In 0628E obs: "OCNL RW" (Note that time of ending of RW not reported since recommencement within 15 minutes of 0620E appeared probable).
	(b) In 0728E obs: None (Note that, since precipitation did not resume within 15 minutes of 0620E as previously expected and more than an hour elapsed between actual time of ending and 0728E obs., time of ending not reported).

(5) Obstructions to vision

(a) Fog dissipating (or increasing)	Enter F DSIPTG (or F INCRG)
(b) Smoke drifting over field	Enter K DRFTG OVR FLD
(c) Shallow ground fog (height less than 6')	Enter SHLW GFDEP 4
(d) Drifting snow (height less than 6')	Enter DRFTG SNW (omit if "BS" is reported
(e) Dust devils	Enter DUST DEVILS, followed by direction from station.
(f) Obstructions that restrict visibility at a level below the usual point of observation (see par. 2010).	Enter appropriate phrase contractions or plain words, e.g., "PTCH GF W".

NOTE: Report in remarks obstructions to vision for which symbols have not been established, e.g., blowing spray, by means of authorized contractions or plain language.

3930. CLIMATOLOGICAL DATA. (Cols. 82-90) Enter data pertaining to weather or obstructions to vision in authorized teletype symbols and contractions, and plain English only. Since there will always be a time lapse between the occurrence of phenomena and their reporting, it will not be necessary to reconcile this difference in time with the time entries

pertaining to the observations reporting their occurrence or cessation. When the times of beginning and ending of several phenomena coincide, a single combined entry may be made.

3931. PRECIPITATION AND THUNDERSTORMS. (Cols. 82-85) Enter times of beginnings and endings, to the nearest minute, of thunderstorms, precipitation, changes in forms and character of precipitation (e.g., rain to rain shower) and changes in intensity of thunderstorms and precipitation. Intermittent, but not distant, precipitation will be recorded in these columns. Times should be those of actual cessation, and not, for example, 15 minutes after thunder was last heard. Intervals of 15 minutes or less between the time of ending and recommencement need not be recorded unless occurring within one hour previous to the beginning of a six-hourly observation, when all beginnings and endings will be recorded. This also applies to changes in intensity that do not last more than 15 minutes. When any of these phenomena is occurring at midnight, enter "cont." in column 84 for the day preceding midnight, and in column 83 for the day following midnight.

3932. OBSTRUCTIONS TO VISION. (Cols. 86-89) Enter the times of beginning and ending of each obstruction to vision. When any of these phenomena is occurring at midnight, enter "cont." in column 88 for the day preceding midnight, and in column 87 for the day following midnight. These entries pertain only to phenomena at the usual point of observation, not at the control-tower level or a point distant from the station.

3933. DURATION. (Cols. 85 and 89) Unless otherwise designated, make no entries in these columns.

3934. REMARKS, NOTES, AND MISCELLANEOUS PHENOMENA. (Col. 90) Enter all pertinent information concerning severe storms, floods, miscellaneous hydrometeors, luminous meteors, etc., and, when required, snow surface temperature data.

3934.1. HAILSTORMS. Enter all available information, including the diameters of the largest and average sized hailstones, damage caused, etc.

3934.2. TORNADO OR WATERSPOUT. Enter as complete information as possible on time, path, size of storm, its appearance, direction of movement, damage, etc., and source of information.

3934.3. LIGHTNING. Enter notes on approximate duration, distance, direction, frequency, etc., of lightning observed when a thunderstorm is not in progress at the station; i.e., when thunder is not heard.

3934.4. AURORA. Enter appropriate notes on extent, color, duration, etc.

3934.5. HARBOR ICE. At Weather Bureau and Navy stations enter

appropriate data on quantity, thickness, character, breaks, size of floes, persistence, conditions of aircraft landing area, conditions affecting the transfer of passengers from craft of all types, and any other conditions worthy of note.

3934.6. MISCELLANEOUS. Enter data concerning phenomena sent in synoptic messages as special phenomena groups, such as frost, etc.

3934.7. SUNRISE AND SUNSET. At stations equipped with registers recording duration of sunshine, enter character of sunrise and sunset in the spaces provided, as clear, cloudy, foggy, hazy, dusty, or smoky. Omit entry in these spaces at other stations.

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CHAPTER 4. MEASUREMENT OF PRECIPITATION

4000. METHOD OF DETERMINING VERTICAL DEPTH OF WATER AND WATER EQUIVALENT

4010. GENERAL. Measurements of all forms of precipitation are expressed in terms of vertical depth of water (or water equivalent, in the case of solid forms) accumulated within a specified time on a horizontal surface. It is assumed that no loss from evaporation occurs. Solid forms of precipitation are also measured on the basis of actual depth of accumulations.

4020. UNIT OF MEASUREMENT. The inch is the unit of measurement of precipitation. The vertical depth of water or water equivalent is expressed to the nearest 0.01 inch; less than 0.005 inch is called a trace. The actual depth of solid forms is expressed to the nearest 0.1 inch, and less than 0.05 inch is called a trace.

4030. TYPES OF GAGES. Precipitation measurements are made from samples caught in gages, or from samples taken from representative areas when the catch of solid forms in the gage is not representative. When more than one type of gage is available the gage appearing highest on the following list will be used.

(1) Weighing gage equipped with 24-, 12-, or 6-hour gears; with other gears, treat as (5) below.

(2) Stick measurement of tipping-bucket gage.

(3) Eight-inch gage.

(4) Four-inch gage.

(5) All other types.

4040. MEASUREMENT OF RAIN. If a tipping-bucket gage is used, drain the catch into the measuring tube. If an 8-inch gage is used, it is not necessary to remove the tube to make a measurement. Insert a dry measuring stick into the measuring tube. Permit the stick to rest on the bottom of the tube for two or three seconds. Withdraw the stick and read the depth of precipitation at the upper limit of the wet portion of the stick. Precipitation collected in the 4-inch gage is measured by lining up the top of the catch with the measuring scale on the transparent wall of the receiver.

4041. If the measuring tube of the 8-inch gage is full (this equals two inches of precipitation), carefully remove it from the overflow container and empty it. Pour the overflow into the measuring tube, measure it, and add the value to the two inches emptied from the tube. If in

removing the full measuring tube some water is spilled into the overflow container, measure the amount remaining in the tube before measuring the amount of the overflow. The total precipitation is the sum of the individual measurements. When measurement is completed, empty the measuring tube and reassemble the gage. All gages except the weighing gage will be emptied at each synoptic and midnight observation.

4050. MEASUREMENT OF SNOW, SLEET, HAIL, FREEZING RAIN. Pour a measured quantity of warm water into the overflow container of the 8-inch gage to melt the collected snow or ice. Pour the entire contents into the measuring tube. Measure the water as outlined in par. 4040. To obtain the water equivalent of the precipitation, subtract the amount of water used to melt the solid forms from the total measurement.

4051. When moderate or strong winds occur during a snowfall, the amount of snow collected in the overflow container will not be representative of the actual snowfall, and the catch should be discarded. To obtain a representative amount invert the overflow container of the 8-inch rain gage and use it to cut a cylindrical sample from the snow to be measured at a location where the fall seems least affected by drifting. Melt the sample and measure it in accordance with instructions in par. 4050. If the snow is deeper than the inside vertical height of the container, any cylinder with an 8-inch diameter may be used.

4052. When the procedure described in paragraph 4051 is used, the snow sample must not include snow resulting from a previous storm. When the ground has once been covered with snow, greater accuracy in taking future snow samples will be secured if pieces of thin wood or its equivalent at least 2 feet square are placed on top of the first fall at various locations, all of which are not likely to be subject to drifting from a single storm. An observation for the next succeeding storm could then be based on a sample taken from the top of the snow to the wooden square, after which the square would be moved to the top of the snow to serve as a reference point for future observation. When taking a sample, estimate the depth of snow as a check on the vertical thickness of the sample, to insure that a hard crust is not mistaken for the ground or for the reference board.

4053. When an observation is taken of the water equivalent of snow on the ground, the sample of snow will be secured in the same manner as that described in paragraph 4051 except that the sample will extend from the top of the snow to the ground.

4100. ESTIMATION OF WATER EQUIVALENT OF SNOW

4110. When the water equivalent of snow cannot be accurately measured by melting, use one-tenth of the average snow depth as the water equivalent. For example, 10 inches of snow correspond to 1 inch of melted snow.

4200. DEPTH MEASUREMENT OF SOLID FORMS

4210. GENERAL. For purposes of depth measurements, the term snow also includes sleet, glaze, hail, any combination of these, and sheet ice formed directly or indirectly from precipitation. Therefore, if snow falls, melts, and refreezes, the depth of ice formed will be included in depth measurements of snow.

4220. MEASUREMENT OF TOTAL DEPTH. Measurement of total depth will be made in accordance with the following instructions:

4221. UNDRIFTED SNOW. Thrust the measuring stick vertically into the snow so that the end rests on the ground surface. Read the depth to the nearest 0.1 inch. Repeat at several spots and take the average of the readings as the snow depth. If the ground is covered with ice, cut through the ice with some suitable implement, and measure the thickness. Add the thickness of the ice to the depth of snow above the ice.

4222. DRIFTED SNOW. When the snow is drifted, a reasonably accurate depth measurement may be made by taking the average of several measurements over representative areas. These should include the greatest and least depths. For example, if spots with no snow are visible, one of the values should be zero.

4230. SNOWFALL WITHIN SPECIFIED PERIODS. These measurements are most conveniently made on a surface that has been cleared of previous snowfall. If such a spot is not available, measure the total depth of snow and subtract the depth previously measured. If the previous snowfall has crusted, the new fall may be measured by permitting the end of the measuring stick to rest on the crust. If different falls of snow are mixed by drifting, measure the total depth of snow and subtract the previously measured depth. The remainder is the approximate depth of the new fall, which will be adjusted if necessary to correct for melting, evaporation, and run-off. If several snow showers occur between observations and each melts before the following one occurs, the total snowfall for the period will be the sum of the maximum depths (measured or estimated) for each occurrence.

4300. ENTRIES ON WBAN-10

4310. PRECIPITATION. (Col. 44) Enter in the 6-hourly spaces the total precipitation (water equivalent), in inches and hundredths, occurring during the six hours ending with the observation. On the line captioned "Mid" enter the amount measured at midnight; i.e., the amount that has occurred between midnight and the preceding 6-hourly observation. 1/ On the line captioned "Mid to" enter the amount that has occurred between midnight and the following 6-hourly observation. (Note that the entry for the first 6-hourly observation after midnight is the sum of the entries opposite "Mid" (for the preceding day) and "Mid to". Enter "T" for trace (see par. 4020) and "0" if no precipitation has fallen.

4311. If no precipitation has fallen during the six hours preceding the time of measurement of precipitation for the 6-hourly observation, but begins shortly thereafter and before the coded synoptic observation (or additive data group) is filed, enter "T" in Col. 44. This procedure will be followed even though a measurable amount may have fallen.

1/For purposes of entries on WBAN-10B, the midnight observation will be considered as the last observation of the day; e.g., a midnight observation taken at 0000 LST on the 15th will be entered on WBAN-10B for the 14th.

4320. SNOWFALL. (Col. 45) Enter in the 6-hourly spaces the maximum (unmelted) depth (inches and tenths) of frozen precipitation (see par. 3443) that has fallen during the six hours ending with the observation, obtained in accordance with Sec. 4200. On the line captioned "Mid", enter the amount occurring between midnight and the preceding 6-hourly observation.1/ On the line captioned "Mid to", enter the amount that has occurred between midnight and the following 6-hourly observation. (Note that the entry for the first 6-hourly observation after midnight is the sum of the entries opposite "Mid" (for the preceding day) and "Mid to". Entries for hail will be followed by an asterisk, and "*Hail" will be recorded in Col. 90. Enter "T" for trace (see par. 4020) and "0" if no frozen precipitation has fallen. When frozen precipitation melted as it fell, i.e., there is no visible accumulation on the ground, enter "T" with a note " Melted as it fell" in Col. 90. If there is a visible accumulation of snow but some melting has occurred within the past six hours, enter an estimated amount in Col. 45 and a note "Estimated due to partial melting" in Col. 90.

4330. SNOW DEPTH. (Col. 46) Enter in the 6-hourly spaces the depth of frozen precipitation (see par. 3443) and ice on the ground at each 6-hourly observation, to the nearest inch. On the line captioned "Mid", enter the amount on the ground at midnight.1/ Entries for hail will be followed by an asterisk and "*Hail" will be recorded in Col. 90. Enter "T" for amounts of less than 0.5 inch, and "0" when none is on the ground in exposed areas, even though snow is still present in surrounding forested or otherwise protected areas. If snow melts as it falls, and there is no visible accumulation on the ground (see par. 4320), enter "0". When snow that occurs between observations melts partially before the following observation, enter in Col. 90 the maximum depth (measured or estimated) between observations.

4340. TWENTY-FOUR HOUR PRECIPITATION. (Col. 68) Enter the total precipitation (water equivalent in inches and hundredths for the 24 hours ending at midnight. Enter "T" for trace (see par. 4020), and "0" if none has fallen. The sum of any number of "T" observations will be regarded as a trace unless recording gages indicate the total is .005 inch or more. (Note that the entry in this column is the sum of the entries in Col. 44, exclusive of the first 6-hourly observation of the day.)

4350. TWENTY-FOUR HOUR SNOWFALL. (Col. 69) Enter to inches and tenths the total amount (unmelted) of frozen precipitation that has fallen during the twenty-four hours ending at midnight. (Note that the entry in this column is the sum of the entries in Col. 45, exclusive of

1/For purposes of entries on WBAN-10B, the midnight observation will be considered as the last observation of the day; e.g., a midnight observation taken at 0000 LST on the 15th will be entered on WBAN-10B for the 14th.

the entry for the first 6-hourly observation of the day.) Entries for hail will be followed by an asterisk and "*Hail" entered in Col. 90. Enter "T" for trace, and "0" if none has fallen. When precipitation melts as it falls, enter "T" with a note "Melted as it fell" in Col. 90.

4360. SNOW DEPTH. (Col. 70) Transcribe the value recorded in Col. 46 for the 0030 GCT observation.

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CHAPTER 5. TEMPERATURE

5000. GENERAL

5010. SCALE. With certain specified exceptions, Fahrenheit thermometers are used to measure temperature. It will therefore be assumed, lacking a statement to the contrary, that temperatures as used in these instructions refer to the Fahrenheit scale.

5020. TYPES OF THERMOMETERS. The Fahrenheit thermometers in general use include the following nonrecording and recording types:

5020.1. Nonrecording mercurial or spirit-filled thermometers.

(1) Dry-bulb (exposed).

(2) Wet-bulb (with wick-covered bulb).

(3) Psychrometer (dry- and wet-bulb mounted on a common back).

(4) Maximum.

(5) Minimum.

5020.2. Nonrecording electrical resistance thermometers.

(1) Telethermoscope.

5020.3. Recording thermometers.

(1) Thermograph (including hygro-thermograph).

(2) Telepsychrometer.

5100. TEMPERATURE READINGS FROM NONRECORDING THERMOMETERS

5110. READING THE THERMOMETER. Determine the temperatures indicated by any mercurial or spirit thermometer as follows:

(1) Stand as far from the thermometer as is consistent with accurate reading, to prevent body heat from affecting the instrument.

(2) Insure that the line of sight from the eye to the top of the liquid column makes an angle of 90° with the thermometer tube. This will avoid an error of parallax.

(3) Read the thermometer to the nearest 0.1°. A degree interval begins at the middle of the degree markings etched on the tube.

5120. DRY-BULB TEMPERATURE. The dry-bulb temperature is the temperature of the free air taken at a specified location under conditions designed to eliminate as completely as possible the effects of extraneous sources of heat and the effects of radiation on the measuring apparatus.

5120.1. With driving rain or snow, the dry-bulb thermometer may become wet. When this occurs, dry the bulb and shield it from the precipitation for a few seconds, or longer if necessary, to permit dissipation of extraneous heat before reading it again. Use this reading for psychrometric purposes rather than the reading made when lowest wet-bulb reading was taken. When frost forms on the thermometer, remove it by a warm cloth and allow sufficient time for the dissipation of extraneous heat before reading the thermometer.

5130. WET-BULB TEMPERATURE. The wet-bulb temperature is the lowest temperature to be secured by evaporating water from the wick-covered bulb of a thermometer at a specified rate of ventilation. It differs from the dry-bulb temperature in an amount dependent on the temperature and relative humidity of the air. At dry-bulb temperatures below -35°F. the wet-bulb thermometer will not be read.

5131. MOISTENING THE WET-BULB. The procedure used in moistening the wet-bulb varies according as the dry-bulb temperature is above freezing, near, or below freezing, and according as the relative humidity is high or low.

5131.1. Moisten the wet-bulb just prior to ventilating the psychrometer. If, however, the temperature is high and the relative humidity is low, or it is expected that the final temperature of the wet-bulb will be 32° or less, moisten the wet-bulb thoroughly several minutes before taking a reading so that a drop of water will have formed on the end of the bulb. This will reduce the temperature of the wet-bulb without prolonged ventilation and the consequent danger of the wick's drying out before the temperature of the wet-bulb will have reached its lowest point.

5131.2. In areas where the temperature is high and the humidity low, it may be necessary to use precooled water for moistening the wet-bulb to avert premature drying of the wick. Water can be precooled for this purpose by storing it in a porous jug. Sufficient water will seep through the jug to cool it by evaporation. To avoid altering moisture conditions in the shelter, do not keep this jug in the shelter. If this method should not be effective, the wick may be extended from the wet-bulb to an open container of water. Between observations, the end of the wick should remain immersed in the water. Continuous evaporation will maintain the thermometer close to the wet-bulb temperature. When the psychrometer is ventilated, the wick must be removed from the water until the wet-bulb thermometer has been read. Regardless of the method used,

the psychrometer must always be ventilated in accordance with par. 5150 before determining the wet-bulb temperature.

5131.3. At dry-bulb temperatures of 37°F. or below, use water that has been kept at room temperature in order to melt completely any accumulation of ice on the wet-bulb. Moisten the bulb thoroughly, at least 15 minutes before ventilating the psychrometer, and longer if necessary to permit the latent heat, released if the water freezes, to be dissipated before ventilation is begun. Do not allow excess water to remain on the wet-bulb, since a thin, thoroughly cooled coating is necessary for accurate data.

5140. CORRECTIONS. At civil stations, instrumental calibration corrections, which are listed on a correction card, will be applied to all thermometer readings under conditions (1) and (2). An additional correction factor will be applied to all wet-bulb thermometer readings under condition (3).

(1) Whenever the temperature indicated by the thermometer is above 42°F., and the instrumental correction is ±0.3°F. or more in the case of mercurial thermometers, or ±0.5°F. or more in the case of spirit-filled thermometers.

(2) Whenever the temperature indicated by the thermometer is 42°F. or less.

(3) Whenever the wet-bulb thermometer has an indicated reading higher than that of the dry-bulb thermometer. If the reading of the wet-bulb thermometer, after the correction has been applied, remains higher than the dry-bulb reading, disregard it and use the dry-bulb value for both temperatures. (See par. 6110.1)

5141. Corrections are furnished for intervals not greater than 20°. Add the appropriate correction algebraically to the reading of the thermometer.

EXAMPLES:

	°F.
Reading of the thermometer	62.1
Correction to be applied	-0.5
Corrected reading	61.6
Reading of the thermometer	-8.2
Correction to be applied	-1.2
Corrected reading	-9.4
Reading of the thermometer	+0.4
Correction to be applied	-1.2
Corrected reading	-0.8

5142. For an observed reading between the temperatures for which corrections are given, an interpolated value of the correction will be used whenever necessary. Tables for the purpose may be prepared locally.

5150. PSYCHROMETER. Psychrometers are designed to secure ventilation by means of a fan, a whirling apparatus, or a sling apparatus. The psychrometer should be so ventilated that the minimum speed of air passing over the thermometer bulbs is at least 15 feet per second. This is approximately equal to one r.p.s. (revolution per second) of the geared (2 to 1 ratio) whirling psychrometer crank, 2 r.p.s. of the sling psychrometer, and 3-1/2 r.p.s. of the psychrometer fan or rotor (direct drive) whirling psychrometer. Psychrometric tables and calculators are based upon this rate of ventilation, which must be maintained to obtain accurate humidity measurements.

5150.1. The sling psychrometer should be used as follows:

(1) Select a shady spot with no obstructions within radius of the whirling sling.

(2) Face into the wind.

(3) Whirl the psychrometer as far in front of the body as possible.

5151. PSYCHROMETRIC READINGS. Obtain readings from the dry- and wet-bulb thermometers in accordance with par. 5110 and the following instructions.

5151.1. Saturate the wick of the wet-bulb thermometer with clean water even though the humidity is high or the wick already appears wet.

5151.2. After ventilating the psychrometer for about 10 seconds, quickly read both thermometers, the wet-bulb first. Repeat until two successive readings of the wet-bulb are the same, indicating that the wet-bulb has reached its lowest temperature. If the temperature of the wet-bulb rises between two successive readings, remoisten the wick and repeat the process of ventilation. Before commencing for a second time, permit the wet-bulb to assume as low a temperature as possible.

5151.3. When the wet-bulb temperature is below 32°F. and the wick is not obviously frozen or ice covered, it should be brought to the latter state by touching it with clean ice, snow, or some other object whose temperature is approximately the same as, or less than, that of the dry-bulb.

5151.4. It is especially important that thermometers should be read accurately at low temperatures, for as temperatures (especially below freezing) become lower, a given difference between the dry- and

wet-bulb readings has a progressively greater effect upon the accuracy of humidity values computed from them.

5151.5. Read the dry- and wet-bulb temperatures at the time of the lowest wet-bulb reading. (See par. 5120.1.)

5151.6. Apply corrections, if necessary, in accordance with par. 5140.

5160. MAXIMUM READINGS. The maximum thermometer is a mercurial thermometer made with a constriction in the bore near the bulb to prevent the mercury from withdrawing into the bulb when the temperature falls.

5161. To read the maximum thermometer, release the catch on the support and lower the bulb end slowly until the thermometer is vertical or approximately so, and the mercury column is resting on the constriction at the base. Read similarly to the dry-bulb thermometer.

5162. Before setting the maximum thermometer, be sure that the mercury column is resting on the constriction at the base. Otherwise, the glass forming the constriction may be broken when the thermometer is spun. To set it, spin the thermometer until its reading is the same as that of the dry-bulb temperature. If the readings of the dry-bulb and maximum thermometer disagree, check the thermometers for the source of error in accordance with maintenance instructions. Lock the thermometer in place on the support. Reset the maximum thermometer at each synoptic and midnight observation.

5163. If the maximum thermometer reading is known to be in error, obtain the maximum temperature to the nearest whole degree from a thermogram, if one is available; otherwise, use the highest corrected temperature observed within the observation period.

5170. MINIMUM READINGS. Alcohol is used in the minimum thermometer. A freely moving dark-colored glass index is placed in the bore. As the temperature falls, the retreating upper end of the alcohol column retracts the index, which remains at the position of the lowest temperature until reset.

5171. The minimum temperature is read at the end of the colored glass index farther from the bulb. Read the thermometer without disturbing it and while it is in its correct position for exposure. It will be read before reading the maximum thermometer. Set the minimum thermometer after the maximum thermometer has been set, by turning it to a vertical position and holding it bulb end up until the index reaches the end of the column and the reading is the same as the dry-bulb temperature. If the readings of the minimum and dry-bulb thermometer disagree, check the thermometers for the possible source of error in

accordance with par. 5172 or separate maintenance instructions. Return the thermometer to its correct position. Reset the minimum thermometer at each synoptic and midnight observation.

5172. Minimum thermometers are subject to errors caused by separation of the spirit column. Sometimes the spirit vapor condenses in the upper end of the bore to form one or two short segments above the rest of the column. At other times, bubbles that form in the column may trap the index. Erroneous readings will result in both cases, and therefore the thermometer should be examined at each observation for separation of the column. Errors also result from recession of the index owing, chiefly, to the shelter's being jarred or subjected to vibration by the wind.

5173. If the minimum thermometer reading is known to be erroneous, obtain the minimum temperature to the nearest whole degree from the thermogram, if one is available, or use the lowest corrected temperature observed within the observation period.

5180. TELETHERMOSCOPE READINGS. The telethermoscope is used to obtain air temperatures at a location remote from the observer. It is an electrical resistance thermometer, the resistance of which changes with the temperature. The instruments are calibrated to read directly in degrees Fahrenheit.

5200. RECORDING THERMOMETERS

5210. THERMOGRAPH. The thermograph consists of a temperature-sensitive element whose movements are communicated by suitable linkage to a pen bearing upon a chart that is mounted on a clock-driven drum. A continuous record of temperature is traced upon the chart, which is called a thermogram. The temperature-sensitive element is either a bimetallic thermometer or a Bourdon-tube assembly. When the thermograph is combined with a humidity measuring instrument it is called a hygrothermograph. The thermograph should be mounted on a horizontal platform with the base at least six inches above the bottom of the shelter. The case should be so oriented as to place the temperature-sensing unit as close to the center of the shelter as practicable.

5210.1. As the temperature changes in the Bourdon-tube thermograph, the change in the volume of the liquid in the Bourdon tube modifies the curvature of the tube. When one end of the tube is in a fixed position, and the free end connected to a pen through a linkage system, a continuous temperature record is traced on the thermogram. The effective pen-arm length (the distance from the pen point to the axis of rotation of the pen arm) should be maintained at 5.51 inches (14 cm.). The period of rotation of the record cylinder is determined by the gear and pinion used; 29- and 176-hour (generally referred to as 1- and 7-day) gear-and-pinion sets are available, with

the 7-day set used for normal operation. The number of hours required for one revolution of the cylinder is stamped on each gear.

5211. The temperature is read on a thermogram by first finding the point at which the appropriate printed time curve intersects the temperature trace. This point is evaluated in terms of temperature by referring it to the closest of the horizontal printed lines of the thermogram. These lines correspond to the engraved degree marks on a thermometer tube, and are labeled accordingly. Interpolation may be necessary for values of temperature and time intermediate between those corresponding to the printed lines of the thermogram.

5212. At each 6-hourly observation, make a time-check mark on the trace by raising the pen the width of two temperature intervals printed on the chart. Wind the clock completely once a week, preferably at the time the chart is changed.

5213. CHARTS. Charts will usually be changed on 7-day thermographs on the 1st, 8th, 15th, 22d, and 29th of the month, at 0800 LST or as soon thereafter as practicable. An exception to this procedure may be made at Weather Bureau stations obtaining hourly temperatures from the thermogram for entry on WBAN-10B or WB Form 1001B. If necessary, the thermograms may be changed on Saturdays at these stations in order to conform with instructions for mailing them. Before placing the chart on the thermograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

(1) In the upper left-hand corner, or in spaces provided, enter the station name and type (WBO, WBAS, NAS, AFB, etc.), meridian of local standard time and, on the first of the month, the time that the pen is touched. (See par. 5212.)

(2) Across the top of 7-day charts at each noon line, enter the corresponding date.

(3) Above the point where the trace will begin, enter the dry-bulb temperature and the time of beginning to the nearest minute.

5213.1. To change the chart, move the pen aside with the shift rod and lift the cylinder until it is clear of the spindle. Wind the clock and replace the chart. Be sure that the bottom of the chart rests against the shoulder of the drum and that the chart fits the drum snugly, with both ends under the spring clip. The horizontal lines should coincide where the right end of the chart overlies the left. Replace the cylinder on its spindle, and adjust the position of the chart for time and temperature in accordance with pars. 5214 and 5215 before replacing the pen on the chart.

5213.2. After removing the chart:

(1) Enter (a) the time of any adjustment, (b) an arrow

indicating the point of adjustment, and (c) the dry-bulb temperature if adjustment other than for time has been made.

(2) Above the end of the trace, enter the time of removal and the dry-bulb temperature at the time the pen was lifted from the chart.

(3) At military and first-order Weather Bureau stations only: (a) above the time check lines, enter the difference between the thermograph reading and the corresponding dry-bulb reading; (b) above the point of maximum and minimum temperatures for the day, enter the difference between the thermograph readings and the corresponding readings of the maximum and minimum thermometers.

Enter the differences in red ink to whole degrees as corrections, and prefix the proper sign to each correction; e.g., maximum temperature from column 66 of WBAN-10B, 48°;maximum temperature from thermograph trace for the corresponding time, 50°; correction entered on the thermogram, -2.

5213.3. At civil stations, forward completed thermograms for the month, including the record up to 0800 LST on the first of the following month, to the station to which WBAN-10A and B are sent, not later than the second working day of the following month. At military stations, forward completed thermograms similarly to squadron headquarters or as specified by military directives.

5214. TIME ADJUSTMENT. Adjust the chart for time by turning the cylinder until the pen point is slightly to the right of the appropriate time-arc line on the chart. Take up the play in the gear mechanism by holding the top edge of the cylinder lightly and turning it counter to the direction of normal rotation until the pen point indicates the correct time. Adjust the instrument promptly if, at any time the record trace is in error by more than 30 minutes on a 7-day thermograph, or 10 minutes on a 1-day thermograph.

5215. TEMPERATURE ADJUSTMENT. When the chart is changed, adjust the thermograph to the dry-bulb temperature by means of the adjusting screw located on an extension of the pivoted end of the Bourdon tube. During the process, tap the instrument lightly to eliminate transient frictional effects in the linkage mechanism. Adjust the instrument promptly if, at any time, the record trace is in error by more than five degrees. When it appears that the pen will pass off the printed divisions of the chart, set the pen up or down equivalent to 10 or 20 degrees by means of the adjusting screw, renumber the lines accordingly, and indicate on the chart the time of the adjustment.

5215.1. If, after the thermograph is adjusted to any intermediate temperature, it records too low at the time of daily maximum temperatures, and too high at the time of daily minimum temperatures, the pen arm is swinging over too small an arc. To lengthen the pen arm, turn the length-adjusting nut in the direction that moves the fulcrum to the left. Conversely, if the recorded temperature is too high at the time of maximum temperatures and too low at the time of minimum temperatures, shorten the pen arm by turning the adjusting nut in the opposite direction.

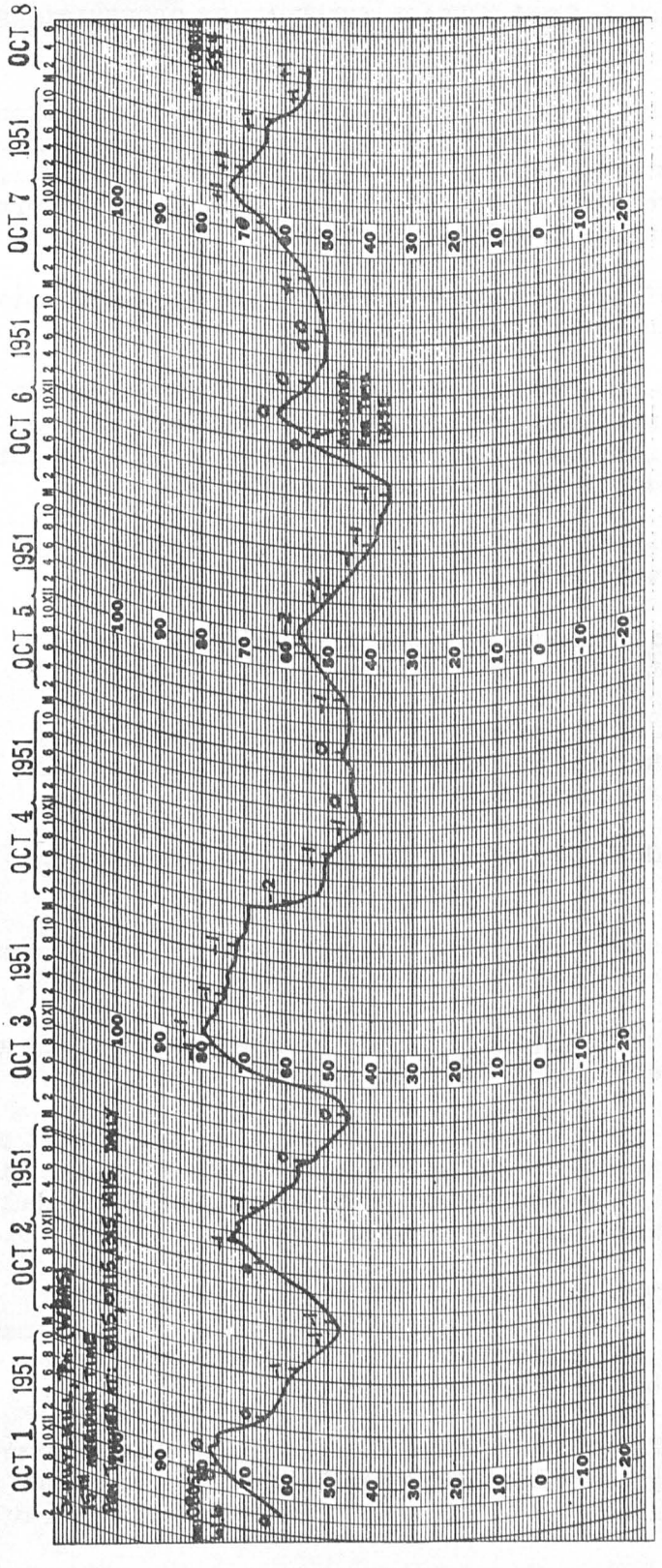

Fig. 2a. Thermogram

5300. SNOW SURFACE TEMPERATURE OBSERVATIONS (WEATHER BUREAU STATIONS ONLY)

5310. GENERAL. Snow surface temperature observations will be taken at Weather Bureau raob stations north of the 40th parallel under the conditions stated below. They will be taken not later than 10 minutes after the release of the nighttime radiosonde and preferably as soon after release as possible.

(1) 5/10 of the ground is covered with snow not less than two inches in average depth.

(2) A snow-covered area is available that is remote from buildings and that will permit exposure of the thermometer, in accordance with par. 5320, within 200 feet of the instrument shelter.

(3) Snow between shelter and point of exposure is relatively level.

(4) Precipitation is not occurring and fog is not present.

(5) Height of the dry-bulb thermometer above the snow-surface thermometer can be determined with reasonable accuracy.

5320. EXPOSURE OF THE THERMOMETER. The thermometer will be exposed as follows:

(1) At least 50 feet from the edge of the snow covered area, whenever complete snow coverage is not present.

(2) As close to the instrument shelter as possible and preferably under it.

(3) If the snow is too light to support the weight of the thermometer, place it on a piece of metal light enough to be supported by the snow, with the bulb extending beyond the metal support.

(4) Cover the bulb with 1/8 to 1/2 inch of snow.

(5) Expose the thermometer for at least ten minutes prior to reading it.

5330. READING THE THERMOMETER. Read the thermometer to the nearest whole degree before removing it from the snow and while it is in a horizontal position. At the same time note the depth of snow under the thermometer.

5340. HEIGHT OF DRY-BULB ABOVE SNOW SURFACE. Favorable exposure sites within 200 feet of the instrument shelter should be sketched on a map to assist in selecting a suitable site for exposing the snow surface thermometer under various conditions. When there is no snow on the ground, compute the differences in elevation between these exposure sites and the dry-bulb thermometer. The height of the dry-bulb above the snow surface at each observation thereafter will be determined by subtracting algebraically the depth of snow under the exposed thermometer from the difference in elevation between the exposure site and the dry-bulb thermometer.

5400. WATER TEMPERATURE OBSERVATIONS (WEATHER BUREAU AND NAVY STATIONS ONLY)

5410. At Weather Bureau and Navy stations having sea or lake water thermometer installations available, read the temperature of the water surface to the nearest 0.1°F.

5500. ENTRIES ON WBAN-10

5510. TEMPERATURE. (Col. 8) Enter the dry-bulb temperature to the nearest whole degree Fahrenheit. Prefix a minus sign to temperatures below zero.

5520. REMARKS. (Cols. 14A and 14B) At Weather Bureau stations enter dry- and wet-bulb temperature readings taken for specialized purposes in these columns.

5530. DRY-BULB. (Col. 18) Enter the dry-bulb temperature to the nearest degree and tenth, Fahrenheit, prefixing minus signs as required.

5531. At Weather Bureau stations equipped with telepsychrometers, when the dry-bulb is above 20°F., but the wet-bulb is 33° or less, enter the dry-bulb temperature obtained from the telepsychrometer in column 18.

5540. WET-BULB. (Col. 19) Enter the temperature of the wet-bulb to the nearest degree and tenth, prefixing minus signs as required. At dry-bulb temperatures below -35°F., enter the dry-bulb temperature from column 18 in parentheses in column 19. (See par. 11020.)

5541. At Weather Bureau stations equipped with telepsychrometers, when the wet-bulb is 33°F. or less and the dry-bulb is above 20°F., enter in column 19 the wet-bulb temperature as computed on the psychrometric diagram*, using (1) the dry-bulb temperature obtained from the telepsychrometer and (2) the dew point obtained from mercurial thermometers.

*Relating dew point, dry- and wet-bulb temperatures.

5550. MAXIMUM AND MINIMUM TEMPERATURES. (Cols. 47 and 48) Enter these data only at stations equipped with maximum and minimum thermometers, telepsychrometers, or thermographs. Enter the maximum and minimum temperatures to degrees and tenths Fahrenheit for the six hours ending with the observation. Take the data from telepsychrometer or maximum and minimum thermometers, if available; if not, from the thermomograph. Note that these temperatures must be as high and low respectively as any temperature recorded in the preceding six hours, including the current temperature. If the hourly temperatures are inconsistent with the maximum and minimum readings, assume that the hourly readings are correct and adjust the maximum and minimum readings accordingly. On the line captioned "Mid" enter the maximum and minimum temperatures occurring between midnight and the preceding 6-hourly observation.* On the line captioned "Mid to", enter the maximum and minimum temperatures occurring between midnight and the succeeding 6-hourly observation. Note that these are not necessarily the maximum and minimum temperatures for the 6-hourly observation. At stations not taking midnight observations, the data will be taken from the thermograph, if available; otherwise, the entry will be omitted.

5560. WATER TEMPERATURE. (Col. 55) On ships and at Weather Bureau and Navy land stations where water temperatures are read, enter data to degrees and tenths Fahrenheit.

5570. SOIL TEMPERATURE. (Col. 56) At designated Weather Bureau stations, enter soil temperature to degrees and tenths Fahrenheit.

5580. MAXIMUM AND MINIMUM TEMPERATURES. (Cols. 66-67) Enter these data in whole degrees Fahrenheit. Note that the maximum and minimum temperatures must be at least as high and low, respectively, as any temperature recorded through the day.

5590. SNOW SURFACE TEMPERATURE. (Col. 90) At Weather Bureau stations observing these data (see par. 5310), enter snow surface temperature and related data. Example: "SNW SFC TMP -20°C., 0410 GCT, 4.6 FT. DIF."

*See footnote to par. 4310.

CHAPTER 6. HUMIDITY MEASUREMENT

6000. DEFINITIONS

6010. GENERAL. These instructions are concerned with the expression of humidity in terms of relative humidity and dew point. These data are calculated with psychrometric tables or calculators based on atmospheric pressures of 23, 25, 27,28, 29, and 30 inches of mercury. If a psychrometric calculator is available, it will be used in preference to the tables unless the dry- and wet-bulb temperatures exceed the range of the calculator.

6010.1. Relative humidity and dew point data can be expressed with respect to ice or water. For record purposes, it is required that these data be expressed at all temperatures with respect to water. The psychrometric calculator satisfies this requirement. Psychrometric tables numbered WB 235 express values of relative humidity with respect to ice when the dry-bulb is less than 32°, and of dew points with respect to ice when the dew point is less than 32°. These values must be converted to their water equivalent, and Tables 9 and 10 are provided for this purpose.

6020. DEW POINT. The dew point is the temperature to which a sample of air must be cooled, while the mixing ratio[1] and barometric pressure remain constant, in order to attain saturation[2] with respect to water. The dew point is expressed to the nearest whole degree Fahrenheit.

6030. RELATIVE HUMIDITY. Relative humidity is the percentage of (a) the mixing ratio of a sample of air to (b) the mixing ratio of air saturated with respect to water at the same temperature and pressure as those of the sample.

6100. PSYCHROMETRIC COMPUTATIONS

6110. DEPRESSION OF THE WET-BULB. The depression of the wet-bulb is the algebraic difference between the dry- and wet-bulb temperatures. It is used with the psychrometric tables and calculators to make dew point and relative humidity computations.

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[1]MIXING RATIO. The mixing ratio of moist air is the ratio of the mass of water vapor to the mass of dry air with which the water vapor is associated.

[2]SATURATION. Saturation as used here denotes a state in which the mixing ratio of a sample of air is equal to that of air immediately over a flat surface of pure water, where equality exists between the rates of evaporation from and condensation of water vapor on the surface, provided that the temperature and barometric pressure of the sample are the same as those of the surface and the superjacent air.

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EXAMPLES:

(1) Dry-bulb temperature.....40.6
Wet-bulb temperature.....32.1

Depression.....8.5

(2) Dry-bulb temperature.....1.2
Wet-bulb temperature.....-0.7

Depression.....1.9

(3) Dry-bulb temperature.....-3.4
Wet-bulb temperature.....-4.7

Depression.....1.3

6110.1. When the wet-bulb is covered with water and a depression cannot be obtained, the relative humidity will be regarded as 100%, and the temperature of the dew point as the same as that of the wet-bulb. If the wet-bulb is covered with ice and a depression cannot be obtained, the relative humidity will be regarded as 100% with respect to ice and the relative humidity and the dew point will be converted to their water equivalents. (See pars. 6131.1-6131.2.)

6120. PSYCHROMETRIC CALCULATOR. At civil stations, use the calculator based on the barometric pressure nearest the normal station pressure (see par. 6010). Air Force stations will use the nearest existing station pressure. Instructions for use of the calculator are printed on it. Note that different scales of the calculator will be used according as the wet-bulb is covered with ice or water at the time of the observation (see par. 5151.3).

6130. PSYCHROMETRIC TABLES. At civil and Navy stations, use the tables based on the barometric pressure nearest the normal station pressure (see par. 6010). At Air Force stations use the table nearest the existing pressure. The arguments are (a) the dry-bulb temperature as given in the vertical column at the left of the table, and (b) the depression of the wet-bulb printed across the top of the table. Dew point and relative humidity data are given as tabular values on correspondingly captioned pages.

6131. The dew point and relative humidity are found from the tables as follows:

(1) When the temperature of the dry-bulb and the depression of the wet-bulb coincide with those given in the tables, the dew point or relative humidity is the tabular value at the intersection of the vertical column corresponding to the wet-bulb depression and the horizontal row corresponding to the air temperature.

(2) When either the air temperature or the depression of the

wet-bulb is between the values given in the tables, find, by single interpolation, the proportional part to be used in determining the dew point or relative humidity from the tabular values.

(3) When both the air temperature and the depression of the wet-bulb are between the values given in the tables, double interpolation is required to determine the proportional parts to be used in the calculation of the dew point from the tabular values.

6131.1. When the dew point is less than 32°, dew points derived from the tables are expressed with respect to ice. (See par. 6010.1.) Before these data are used for any purpose, they must be converted to their water equivalent. Using Table 9, find on the upper scale the dew point temperature, to the nearest tenth of a degree, with respect to ice derived from the psychrometric tables. Read this point in terms of the lower scale to find the corresponding value with respect to water.

6131.2. When the temperature of the dry-bulb is less than 32°, relative humidity data derived from the tables are with respect to ice and must be converted to their water equivalent. Using Table 10, find the tabular value at the intersection of (1) the vertical column corresponding to the value derived from the psychrometric tables, and (2) the horizontal row corresponding to the dry-bulb temperature in whole degrees. Interpolation will be made for values of relative humidity between those printed at the top of the table. Tabular values will be rounded to the nearest whole percent for all record purposes.

EXAMPLE: A small portion of the psychrometric tables is reproduced below.

Temperature of dew point in degrees Fahrenheit

(Pressure=29.0 inches)

Air temperature	Depression of wet-bulb thermometer ($t-t'$)				
	0.2	0.4	0.6	0.8	1.0
−10	−12	−14	−17	−19	−23
−9	−11	−13	−15	−18	−21
−8	−10	−12	−14	−16	−19
	0.5	1.0	1.5	2.0	2.5
40	39	38	37	35	34
41	40	39	38	37	35
42	41	40	39	38	36

Relative humidity, percent—Fahrenheit temperatures

(Pressure=29.0 inches)

Air temperature	Depression of wet-bulb thermometer ($t-t'$)				
	0.2	0.4	0.6	0.8	1.0
−10	90	79	69	58	48
−9	90	80	70	60	51
−8	91	81	72	62	53
	0.5	1.0	1.5	2.0	2.5
40	96	92	88	84	80
41	96	92	88	84	80
42	96	92	88	85	81

COMPUTATIONS

Dry-bulb reading	−9.6°	−8.4°	41.3°	−10.0°
Wet-bulb reading	−10.2°	−9.3°	39.9°	−10.7°
Depression of wet-bulb	0.6°	0.9°	1.4°	0.7°
Dew point temperature (ice)	−16.2°	−18.3°		−18.0°
Dew point temperature (water) (See Table 9)	−21°	−24°	38°	−23°
Relative humidity (ice)	69	57		64
Relative humidity (water) (See Table 10)	55	46	89	51

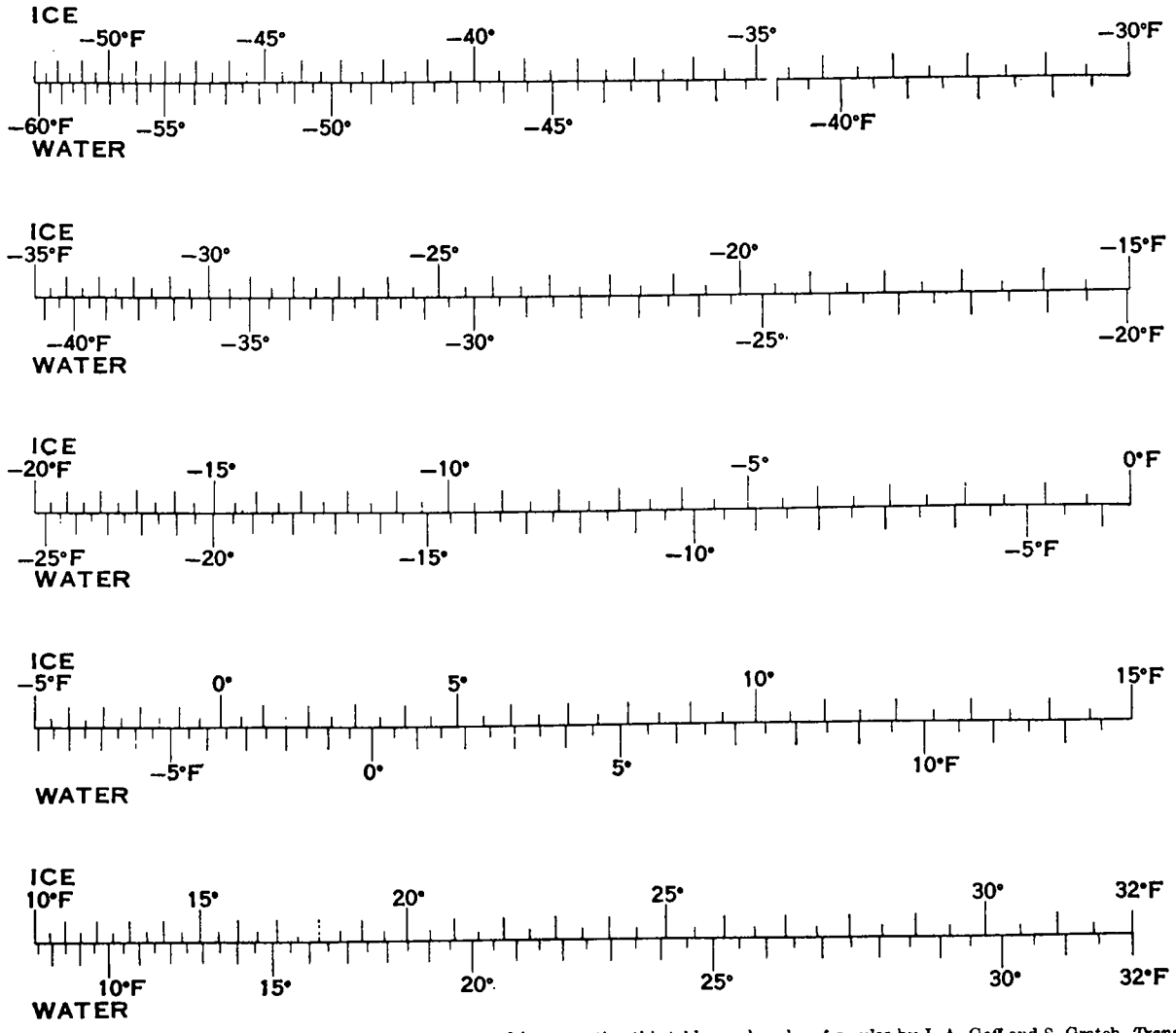
(Note that the relative humidity and dew point for temperatures below freezing in this example are with respect to ice and must be converted to their water equivalents.)

TABLE 9.—*Dew point conversion table, showing relationship between dew point with respect to ice and dew point with respect to water (° F.).*

DEW POINT CONVERSION TABLE

Showing Relationship Between

Dew Point with Respect to Ice and Dew Point with Respect to Water (°F)



[NOTE.—Saturation vapor pressures over ice and water, used in computing this table, are based on formulas by J. A. Goff and S. Gratch, *Trans. Amer. Soc. Heat. and Vent. Eng.*, vol. 52, p. 95, 1946. Formula for saturation vapor pressure over water assumed to apply from −60° F. to 140° F.]

TABLE 10A—*Relative humidity conversion table*

[Tabular values are relative humidities with respect to water (RH_w) corresponding to relative humidities with respect to ice (RH_i) given at heads of the columns]

Dry bulb temp. (°F.)	Relative humidity with respect to ice (RH_i)										Dry bulb temp. (° F.)	Relative humidity ratio RH_w/RH_i
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		
	%	%	%	%	%	%	%	%	%	%		
−11	7.9	15.8	23.8	31.7	39.6	47.5	55.5	63.4	71.3	79.2	−11	0.7922
−10	8.0	15.9	23.9	31.9	39.8	47.8	55.7	63.7	71.7	79.6	−10	.7963
−9	8.0	16.0	24.0	32.0	40.0	48.0	56.0	64.1	72.1	80.1	−9	.8007
−8	8.1	16.1	24.2	32.2	40.3	48.3	56.4	64.4	72.5	80.5	−8	.8051
−7	8.1	16.2	24.3	32.4	40.5	48.6	56.7	64.8	72.9	80.9	−7	.8095
−6	8.1	16.3	24.4	32.6	40.7	48.8	57.0	65.1	73.2	81.4	−6	.8139
−5	8.2	16.4	24.6	32.7	40.9	49.1	57.3	65.5	73.7	81.8	−5	.8184
−4	8.2	16.5	24.7	32.9	41.1	49.4	57.6	65.8	74.1	82.3	−4	.8230
−3	8.3	16.5	24.8	33.1	41.4	49.6	57.9	66.2	74.4	82.7	−3	.8271
−2	8.3	16.6	24.9	33.3	41.6	49.9	58.2	66.5	74.8	83.2	−2	.8315
−1	8.4	16.7	25.1	33.4	41.8	50.2	58.5	66.9	75.2	83.6	−1	.8360
0	8.4	16.8	25.2	33.6	42.1	50.5	58.9	67.3	75.7	84.1	0	.8410
+1	8.5	16.9	25.4	33.8	42.3	50.7	59.2	67.6	76.1	84.5	+1	.8454
2	8.5	17.0	25.5	34.0	42.5	51.0	59.5	68.0	76.5	85.0	2	.8501
3	8.5	17.1	25.6	34.2	42.7	51.3	59.8	68.4	76.9	85.5	3	.8546
4	8.6	17.2	25.8	34.4	43.0	51.6	60.2	68.7	77.3	85.9	4	.8593
5	8.6	17.3	25.9	34.6	43.2	51.8	60.5	69.1	77.8	86.4	5	.8641
6	8.7	17.4	26.1	34.7	43.4	52.1	60.8	69.5	78.2	86.8	6	.8685
7	8.7	17.5	26.2	34.9	43.7	52.4	61.1	69.9	78.6	87.3	7	.8733
8	8.8	17.6	26.3	35.1	43.9	52.7	61.5	70.2	79.0	87.8	8	.8780
9	8.8	17.7	26.5	35.3	44.1	53.0	61.8	70.6	79.5	88.3	9	.8829
10	8.9	17.8	26.6	35.5	44.4	53.3	62.1	71.0	79.9	88.8	10	.8876
11	8.9	17.9	26.8	35.7	44.6	53.6	62.5	71.4	80.3	89.3	11	.8927
12	9.0	17.9	26.9	35.9	44.9	53.8	62.8	71.8	80.8	89.7	12	.8974
13	9.0	18.0	27.1	36.1	45.1	54.1	63.2	72.2	81.2	90.2	13	.9024
14	9.1	18.1	27.2	36.3	45.4	54.4	63.5	72.6	81.6	90.7	14	.9072
15	9.1	18.2	27.4	36.5	45.6	54.7	63.8	73.0	82.1	91.2	15	.9121
16	9.2	18.3	27.5	36.7	45.9	55.0	64.2	73.4	82.5	91.7	16	.9171
17	9.2	18.4	27.7	36.9	46.1	55.3	64.5	73.8	83.0	92.2	17	.9220
18	9.3	18.5	27.8	37.1	46.4	55.6	64.9	74.2	83.4	92.7	18	.9270
19	9.3	18.6	28.0	37.3	46.6	55.9	65.3	74.6	83.9	93.2	19	.9322
20	9.4	18.7	28.1	37.5	46.9	56.2	65.6	75.0	84.3	93.7	20	.9371
21	9.4	18.8	28.3	37.7	47.1	56.5	65.9	75.4	84.8	94.2	21	.9421
22	9.5	18.9	28.4	37.9	47.4	56.8	66.3	75.8	85.3	94.7	22	.9473
23	9.5	19.1	28.6	38.1	47.6	57.2	66.7	76.2	85.7	95.3	23	.9526
24	9.6	19.2	28.7	38.3	47.9	57.5	67.0	76.6	86.2	95.8	24	.9576
25	9.6	19.3	28.9	38.5	48.1	57.8	67.4	77.0	86.7	96.3	25	.9629
26	9.7	19.4	29.0	38.7	48.4	58.1	67.8	77.4	87.1	96.8	26	.9680
27	9.7	19.5	29.2	38.9	48.7	58.4	68.1	77.9	87.6	97.3	27	.9733
28	9.8	19.6	29.4	39.1	48.9	58.7	68.5	78.3	88.1	97.9	28	.9786
29	9.8	19.7	29.5	39.4	49.2	59.0	68.9	78.7	88.5	98.4	29	.9838
30	9.9	19.8	29.7	39.6	49.5	59.4	69.2	79.1	89.0	98.9	30	.9892
31	9.9	19.9	29.8	39.8	49.7	59.7	69.6	79.6	89.5	99.4	31	.9944
32	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	32	.9999

NOTE: Saturation vapor pressures over ice and water, used in computing this table, are based on formulas by J. A. Goff and S. Gratch, *Trans. Amer. Soc. Heat. and Vent. Eng.*, vol. 52, p. 95 (1946). Formula for saturation vapor pressure over water assumed to apply from −60° F. to 140° F.

TABLE 10B—*Relative humidity conversion table*

Tabular values are relative humidities with respect to water (RH_w) corresponding to relative humidities with respect to ice (RH_i) given at heads of the columns]

Dry-bulb temp. (°F)	Relative humidity with respect to ice (RH_i)										Dry bulb temp. (° F)	Relative humidity ratio RH_w/RH_i
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		
	%	%	%	%	%	%	%	%	%	%		
−60	6.1	12.3	18.4	24.5	30.7	36.8	42.9	49.0	55.2	61.3	−60	0.6130
−59	6.2	12.3	18.5	24.6	30.8	37.0	43.1	49.3	55.4	61.6	−59	.6160
−58	6.2	12.4	18.6	24.8	31.0	37.1	43.3	49.5	55.7	61.9	−58	.6191
−57	6.2	12.4	18.7	24.9	31.1	37.3	43.5	49.8	56.0	62.2	−57	.6220
−56	6.3	12.5	18.8	25.0	31.3	37.5	43.8	50.0	56.3	62.5	−56	.6252
−55	6.3	12.6	18.9	25.1	31.4	37.7	44.0	50.3	56.6	62.8	−55	.6284
−54	6.3	12.6	18.9	25.3	31.6	37.9	44.2	50.5	56.8	63.1	−54	.6315
−53	6.3	12.7	19.0	25.4	31.7	38.1	44.4	50.8	57.1	63.5	−53	.6347
−52	6.4	12.8	19.1	25.5	31.9	38.3	44.7	51.0	57.4	63.8	−52	.6379
−51	6.4	12.8	19.2	25.6	32.1	38.5	44.9	51.3	57.7	64.1	−51	.6412
−50	6.4	12.9	19.3	25.8	32.2	38.7	45.1	51.5	58.0	64.4	−50	.6444
−49	6.5	13.0	19.4	25.9	32.4	38.9	45.4	51.8	58.3	64.8	−49	.6479
−48	6.5	13.0	19.5	26.0	32.5	39.0	45.6	52.1	58.6	65.1	−48	.6507
−47	6.5	13.1	19.6	26.2	32.7	39.2	45.8	52.3	58.9	65.4	−47	.6541
−46	6.6	13.2	19.7	26.3	32.9	39.5	46.0	52.6	59.2	65.8	−46	.6576
−45	6.6	13.2	19.8	26.4	33.1	39.7	46.3	52.9	59.5	66.1	−45	.6611
−44	6.6	13.3	19.9	26.6	33.2	39.9	46.5	53.2	59.8	66.5	−44	.6646
−43	6.7	13.4	20.0	26.7	33.4	40.1	46.7	53.4	60.1	66.8	−43	.6677
−42	6.7	13.4	20.1	26.9	33.6	40.3	47.0	53.7	60.4	67.2	−42	.6716
−41	6.8	13.5	20.3	27.0	33.8	40.5	47.3	54.0	60.8	67.5	−41	.6751
−40	6.8	13.6	20.4	27.1	33.9	40.7	47.5	54.3	61.1	67.8	−40	.6785
−39	6.8	13.6	20.5	27.3	34.1	40.9	47.7	54.6	61.4	68.2	−39	.6820
−38	6.9	13.7	20.6	27.4	34.3	41.1	48.0	54.8	61.7	68.6	−38	.6855
−37	6.9	13.8	20.7	27.6	34.5	41.4	48.3	55.2	62.1	69.0	−37	.6895
−36	6.9	13.9	20.8	27.7	34.6	41.6	48.5	55.4	62.3	69.3	−36	.6928
−35	7.0	13.9	20.9	27.9	34.8	41.8	48.8	55.7	62.7	69.6	−35	.6965
−34	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	63.0	70.0	−34	.7002
−33	7.0	14.1	21.1	28.2	35.2	42.2	49.3	56.3	63.4	70.4	−33	.7039
−32	7.1	14.2	21.2	28.3	35.4	42.5	49.5	56.6	63.7	70.8	−32	.7077
−31	7.1	14.2	21.3	28.5	35.6	42.7	49.8	56.9	64.0	71.1	−31	.7114
−30	7.2	14.3	21.5	28.6	35.8	42.9	50.1	57.2	64.4	71.5	−30	.7152
−29	7.2	14.4	21.6	28.8	36.0	43.2	50.3	57.5	64.7	71.9	−29	.7192
−28	7.2	14.5	21.7	28.9	36.1	43.4	50.6	57.8	65.1	72.3	−28	.7229
−27	7.3	14.5	21.8	29.1	36.3	43.6	50.9	58.1	65.4	72.7	−27	.7267
−26	7.3	14.6	21.9	29.2	36.5	43.8	51.2	58.5	65.8	73.1	−26	.7308
−25	7.3	14.7	22.0	29.4	36.7	44.1	51.4	58.8	66.1	73.4	−25	.7344
−24	7.4	14.8	22.2	29.5	36.9	44.3	51.7	59.1	66.5	73.9	−24	.7386
−23	7.4	14.8	22.3	29.7	37.1	44.5	52.0	59.4	66.8	74.2	−23	.7425
−22	7.5	14.9	22.4	29.9	37.3	44.8	52.3	59.7	67.2	74.6	−22	.7465
−21	7.5	15.0	22.5	30.0	37.5	45.0	52.5	60.0	67.5	75.0	−21	.7504
−20	7.5	15.1	22.6	30.2	37.7	45.3	52.8	60.4	67.9	75.5	−20	.7546
−19	7.6	15.2	22.8	30.3	37.9	45.5	53.1	60.7	68.3	75.9	−19	.7586
−18	7.6	15.3	22.9	30.5	38.1	45.8	53.4	61.0	68.6	76.3	−18	.7627
−17	7.7	15.3	23.0	30.7	38.3	46.0	53.7	61.3	69.0	76.7	−17	.7668
−16	7.7	15.4	23.1	30.8	38.5	46.3	54.0	61.7	69.4	77.1	−16	.7709
−15	7.8	15.5	23.3	31.0	38.8	46.5	54.3	62.0	69.8	77.5	−15	.7751
−14	7.8	15.6	23.4	31.2	39.0	46.8	54.6	62.4	70.1	77.9	−14	.7794
−13	7.8	15.7	23.5	31.3	39.2	47.0	54.8	62.7	70.5	78.4	−13	.7835
−12	7.9	15.8	23.6	31.5	39.4	47.3	55.1	63.0	70.9	78.8	−12	.7878
−11	7.9	15.8	23.8	31.7	39.6	47.5	55.5	63.4	71.3	79.2	−11	.7922

NOTE: Saturation vapor pressures over ice and water, used in computing this table, are based on formulas by J. A. Goff and S. Gratch, *Trans. Amer. Soc. Heat. and Vent. Eng.*, vol. 52, p. 95 (1946). Formula for saturation vapor pressure over water assumed to apply from −60° F. to 140°F.

6200. HYGROGRAPH

6210. GENERAL. The hygrograph provides a continuous record of relative humidity. To read the relative humidity from the hygrograph, follow the same procedure as that for the thermograph, described in par. 5211. The scale is based on relative humidity values from 0 to 100 percent. When the hygrograph is adjusted to correspond with a psychrometric reading made at dry-bulb temperatures below freezing, the psychrometric value of relative humidity with respect to water will be used. Hygrograms will be evaluated according to local needs and the records disposed of locally. Hygrograph data will not be entered on observational records unless specifically authorized.

6300. HYGROTHERMOGRAPH (WEATHER BUREAU STATIONS ONLY)

6310. The hygrothermograph is a combination of the hygrograph and thermograph. The actuating elements - - a Bourdon tube for temperature and a bundle of hairs for humidity - - are placed side by side, each with its separate linkage and pen arm. Temperature and humidity are recorded simultaneously on separate portions of the chart. Instructions in Sec. 5200 will be followed with respect to the temperature portion of the record, and instructions in Sec. 6200 with respect to the humidity portion.

6400. ENTRIES ON WBAN-10

6410. DEW POINT. (Col. 9) Enter the dew point temperature to the nearest whole degree. Prefix a minus sign to dew-point temperatures below zero. Whenever the air temperature is below -35°F., the wet-bulb temperature will be regarded as the same as the dry-bulb temperature. Determine the corresponding dew point, with respect to water (see par. 6010.1), and enter this value in column 9 in parentheses. (See par. 11020.)

6420. RELATIVE HUMIDITY. (Col. 20) Enter relative humidity for each record observation unless the air temperature is below -35°F. (See par. 11010.)

6421. At Weather Bureau stations equipped with telepsychrometers, whenever the wet-bulb is 33°F. or less and the dry-bulb is above 20°F., enter in column 20 the relative humidity as computed on the psychrometric calculator, using 1) the dry-bulb temperature obtained from the telepsychrometer, and 2) the dew-point temperature obtained from the mercurial thermometers.

6430. TWENTY-FOUR HOUR MAXIMUM RELATIVE HUMIDITY. (Col. 78) At stations computing hourly relative humidity, enter the maximum relative humidity as obtained from column 20.

6440. TWENTY-FOUR HOUR MINIMUM RELATIVE HUMIDITY. (Col. 79) At stations computing hourly relative humidity, enter the minimum relative humidity as obtained from column 20.

CHAPTER 7. PRESSURE

7000. GENERAL

7010. Atmospheric pressure is the pressure exerted by the weight of a column of air, of unit area, extending vertically from the reference surface to the top of the atmosphere. Atmospheric pressure is measured by means of a barometer, four types of which are in general use:

(1) Mercurial barometers (adjustable-and fixed-cistern).

(2) Aneroid barometers.

(3) Aneroid barographs and microbarographs.

(4) Altimeter setting indicators.

Pressure is not determined from types (2), (3), and (4) above unless an approved mercurial barometer is available for periodically checking them.

7011. At stations having two or more of the above types, observe the following priority in selecting the instrument to be used for hourly or 6-hourly pressure observations:

Hourly observations	6-hourly observations
(1) Precision aneroid barometer *	(1) Precision aneroid barometer *
(2) Altimeter-setting indicator *	(2) Altimeter-setting indicator *
(3) Microbarograph	(3) Mercurial barometer
(4) Mercurial barometer	

7100. READING MERCURIAL BAROMETERS

7110. ADJUSTABLE-CISTERN BAROMETERS. The construction of adjustable-cistern barometers requires that the mercury surface in the cistern be adjusted to the tip of an ivory point projecting downward into the cistern. The tip corresponds to the zero line of a scale calibrated in inches and hundredths.

7111. Prior to reading the barometer scale perform the following operations in the order given below:

(1) Read to the nearest 0.5° F. the thermometer attached to the barrel.

(2) Turn the thumb-screw at the bottom of the barometer until the surface of the mercury in the cistern touches the tip of the ivory point. The tip of the ivory point should be coincident with its image in the mercury. If a dimple forms on the surface, the cistern has been raised too far. Contact of the mercury with the ivory point is seen more easily against a white background.

(3) Tap the barrel near the top of the column of mercury.

(4) Set the vernier (movable scale) so that the base just cuts off light at the highest point of the meniscus. The meniscus is the curved upper surface of the mercury column. The

***Civil Stations only.**

front and rear sighting edges of the base of the vernier coincide when they are on a level with the eye. A white background is helpful when making this adjustment of the vernier.

(5) Lower the mercury about ¼ inch from the ivory point; do not change the vernier setting.

7112. Verniers on adjustable-cistern barometers are constructed in two ratios: 10 to 9, and 25 to 24. (See Figure 3.) The scale with which the 10 to 9 vernier is used is graduated at intervals of 0.100 inch. The length of the graduated portion of the vernier, 0.900 inch, is divided into 10 spaces, each 0.090 inch in length. Therefore, each vernier interval is 0.010 inch shorter than scale intervals. With these verniers the scale may be read without interpolation to the nearest 0.010 inch. The length of the 25 to 24 vernier, 1.200 inches, is divided into 25 intervals, each 0.048 inch in length. As the scale is graduated at intervals of 0.050 inch, each space on the vernier is 0.002 inch shorter than the spaces on the scale. With these verniers the scale may be read without interpolation to the nearest 0.002 inch.

7113. Obtain the barometer reading to the nearest 0.001 inch as follows:

(1) When both the zero and the top graduation lines of the vernier coincide with scale lines, read the scale at its coincidence with the zero line of the vernier; no further reading is necessary. If the zero line of the vernier lies between two lines on the fixed scale, read on the scale the value of the lower line, and proceed as outlined in (2) and (3) below.

(2) Select on the vernier the line that lies exactly opposite, or the shortest distance above, a line on the scale. For the 10 to 9 vernier multiply the number of this line by 0.010 and add the product to the reading obtained in step (1). For the 25 to 24 vernier multiply the number of the line by 0.002 and add the product to the reading obtained in step (1).

(3) Estimate the final thousandths, if any, from the proportional parts, and add to the sum obtained in step (2).

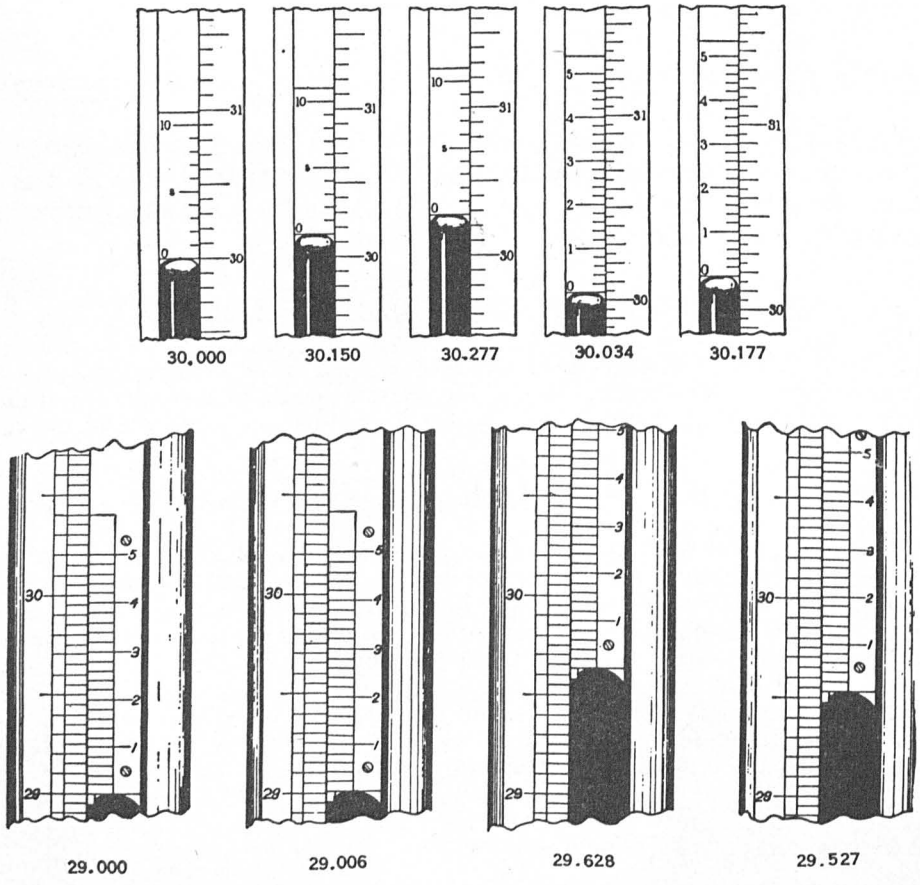


Fig. 3. Barometer verniers.

7120. FIXED-CISTERN BAROMETERS. The Bowen fixed-cistern barometer is calibrated to give pressure readings in millibars; the attached thermometer is in the centigrade scale.

7121. Before reading the Bowen barometer:
(1) Read the attached thermometer to the nearest 0.5°C.
(2) Tap the barrel near the meniscus.
(3) Set the vernier as for the adjustable-cistern type.

7122. The vernier on this barometer is so made that 10 spaces on the vernier are equal in length to 19 millibar spaces on the scale. That is, the length of 1 division on the vernier is equivalent to 1.90 millibars.

7123. Read the barometer to the nearest 0.01 millibar as follows:
(1) If the zero line of the vernier is exactly opposite a line on the scale, read the scale directly to whole millibars at that line. If the zero line of the vernier falls between two lines on the scale, read the value of the lower line, and continue as indicated in (2) and (3) below.
(2) Select the line on the vernier that lies exactly opposite, or the shortest distance above, a line on the scale. Multiply the number of this vernier line by 0.10, and add the product to the reading obtained in step (1).
(3) Estimate the hundredths of millibars, and add the value to the result obtained in step (2).

7200. DETERMINATION OF STATION PRESSURE

7210. GENERAL. Station pressure is determined at fixed intervals by means of corrected mercurial barometer readings, and at intermediate times by means of aneroid barometers or barographs periodically corrected to mercurial readings. Station pressure from mercurial barometer readings is the pressure value obtained after all required corrections have been applied to the observed mercurial reading. Station pressure from aneroid barometers and barographs is the value obtained after the correction established from the mercurial barometer reading has been applied.

7220. STATION ELEVATION. Station pressure is related to an assigned station elevation (H_b) above mean sea level. This assigned elevation remains constant even should the station be moved to a different elevation. If it should be moved, a "removal correction" is applied to readings taken at the new location. The corrected reading is then very close to what it would have been if it had been taken at the original location.

7230. CORRECTIONS TO BAROMETER READINGS—GENERAL. Atmospheric pressure from the observed barometer readings must be corrected for temperature, local gravity, and instrumental error. In addition, to make the pressure value comparable with previous pressure values at the same station, the application of a removal correction may be required (see paragraph 7220). Corrections to be applied to the different types of mercurial barometers are described as follows.

7231. CORRECTIONS TO ADJUSTABLE-CISTERN BAROMETERS. Corrections applied to readings of adjustable-cistern barometers comprise a temperature correction, a scale error and capillarity (instrumental) correction, local gravity correction, and sometimes a correction to assigned station elevation. The temperature correction is determined from the publication "Correction of Mercurial Barometer for Temperature, English Measures." Corrections for scale error and capillarity, local gravity, and removal are collectively referred to as the "sum of corrections." They are listed on the barometer correction card furnished with each barometer. The correction to station elevation may be constant. If the correction varies with temperature, owing to the amount of difference between assigned station elevation and the elevation of the barometer, the "sum of corrections" will be found on the back of the card. It will facilitate computation if the "sum of corrections" and the temperature corrections are incorporated into a single table. The algebraic sum of the temperature correction and the "sum of corrections," as defined above, in such a table is referred to as the total correction. To obtain the total correction from this table use as arguments the attached thermometer reading to the nearest 0.5° Fahrenheit or centigrade and the observed barometer reading in inches and thousandths or millibars and tenths.

7232. CORRECTIONS TO BOWEN FIXED-CISTERN BAROMETER. Corrections

applied to the Bowen barometer comprise temperature, volume, gravity, residual, and removal (if required). These corrections are incorporated into a table furnished to the stations requiring it. To obtain the total corrections from this table, use as arguments the attached thermometer reading to the nearest 0.5° C. and the observed reading in millibars and hundredths.

7240. ANEROID BAROGRAPH. A continuous record of station pressure is recorded on a chart by the aneroid barograph. The barograph consists of an aneroid pressure unit with pen linkage, and a clock-driven drum upon which the chart is fastened. The scale of the 2½ to 1 open-scale microbarograph is magnified, or opened, so that a pressure difference of 1 inch of mercury is represented on the chart by a linear distance of 2½ inches. The distance between adjacent pressure ordinates printed on the chart is equivalent to 0.020 inch of mercury. On the 1 to 1 scale, a pressure difference of 1 inch of mercury is represented on the chart by a linear distance of 1 inch. The distance between adjacent pressure ordinates is equivalent to 0.050 inch of mercury.

7241. To determine station pressure from the barograph:

(1) Tap the instrument lightly, on the top of the case.

(2) Read to the nearest 0.005 inch the pressure value indicated by the position of the pen on the chart, estimating for values lying between the printed ordinates.

(3) Apply the correction established for the barograph in accordance with instructions in par. 7242.

7242. A barograph will not be used for original determination of pressure unless a correction is established every six hours by comparison with the station pressure determined from the mercurial or precision aneroid barometer or altimeter setting indicator. Determine to the nearest 0.005 inch or 0.1 mb. the correction necessary to make the barograph reading agree with the station pressure computed from the barometer reading. If this correction exceeds 0.05 inch, the barograph should be reset at the time the barometer reading is made. If the barometer is calibrated in millibars, the barograph correction will be determined by converting station pressure from millibars and tenths to inches and hundredths. Apply this correction to all barograph readings until another correction is established at the next succeeding 6-hourly comparison. Post the correction by entry on WBAN-10B and, if necessary, on a separate indicator so that it will be available to all personnel taking pressure readings from the barograph.

7243. Make a time-check line on the barograph sheet after the barograph correction is determined. This line should be about equal in length to the width of two divisions on the chart and should be made carefully to avoid injury to the delicate mechanism of the barograph. If the instrument is so exposed that the dash-pot liquid becomes cold, which prevents the pen from returning to position, do not make a time-check line.

7244. Whenever a reading is taken, ascertain that the clock is running and that the ink is flowing properly. When it appears that the pen will pass off the printed divisions of the chart, set the pen up or down, equivalent to one full inch of pressure, by means of the adjusting screw, renumber the lines accordingly, and indicate on the chart the time of the adjustment.

7245. CHARTS. The elevation range of the barograph is indicated on the nameplate. At civil stations, select the chart to conform with the elevation of the barometer in accordance with Table 10c. (Military stations are provided with only one type of chart.)

TABLE 10c. Barograph Charts (2-1/2 to 1 scale)

Elevation of Station Barometer (ft.)	Midway Isobar Pressure (inches)	Elevation of Station Barometer (ft.)	Midway Isobar Pressure (inches)	Elevation of Station Barometer (ft.)	Midway Isobar Pressure (inches)
0-30	30.25* or 29.75#	2361-2860	27.25*	6111-6710	23.75#
		2861-3370	26.75#	6711-7310	23.25*
31-490	29.75#	3371-3890	26.25*	7311-7920	22.75#
491-950	29.25*	3891-4420	25.75#	7921-8540	22.25*
951-1415	28.75#	4421-4970	25.25*	8541-9165	21.75#
1416-1880	28.25*	4971-5530	24.75#	9166-9790	21.25*
1881-2360	27.75#	5531-6110	24.25*	9791-10420	20.75#

*Use WB Form 1068C
#Use WB Form 1068D

7245.1. CHANGING CHARTS. Charts will be changed on 4-day barographs on the 1st, 5th, 9th, 13th, 17th, 21st, 25th, and 29th of the month, and on weekly barographs on the 1st, 8th, 15th, 22nd, and 29th. The charts should be changed at the standard synoptic hour (0030 GCT, 0630 GCT, etc.) nearest to noon, LST. If for any reason the chart is not changed at the usual time, it will not be changed before the following 3-hourly pressure-tendency observation at stations where these data are observed, since an unbroken record is desirable for this observation; at stations not observing pressure tendency, the charts will be changed as soon as practicable.

7245.11. Before placing a chart on the barograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

(1) In the upper left-hand corner, or in spaces provided, enter the name of the station and the type (WBO, WBAS, AFB, NAS, etc.), 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 chart on each noon line, enter the date of the day's record.

(3) Along the first and last 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. 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.

(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.

7245.12. To replace the chart, remove the pen from the chart by means of the lever mechanism, and lift the cylinder vertically until it is free of the spindle. Remove the cylinder and loosen the clip holding the chart to the cylinder, and remove the chart. Avoid storing or handling charts in a manner that might smear the trace before it is dry. Fit the replacement chart smoothly and tightly on the cylinder, with the bottom edge of the chart uniformly in contact with the flange at the bottom of the cylinder, and replace the clip. Inaccurately-cut charts should be trimmed along a line parallel to and 1/4 inch below the lower, horizontal boundary ordinate. Wind the clock and lower the cylinder gently over the center spindle until the gears have fully meshed, holding the cylinder by the top and bottom to avoid disturbing the position of the chart. Fill the pen with ink and return it almost to the surface of the chart. Adjust the pen, if necessary, for pressure and time (see pars. 7245.2 and 7245.3). Return the pen to the surface of the chart and check the inking action of the pen.

7245.13. After removing a completed barogram:

(1) Enter the time of each adjustment, and an arrow to indicate the point of adjustment.

(2) Above the end 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) At military and first-order Weather Bureau stations only, enter, above the time-check lines, the corrections from column 65 of WBAN-10B (or column 60 of WB 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., +.055/0, above the break in the trace. (See Fig. 4.)

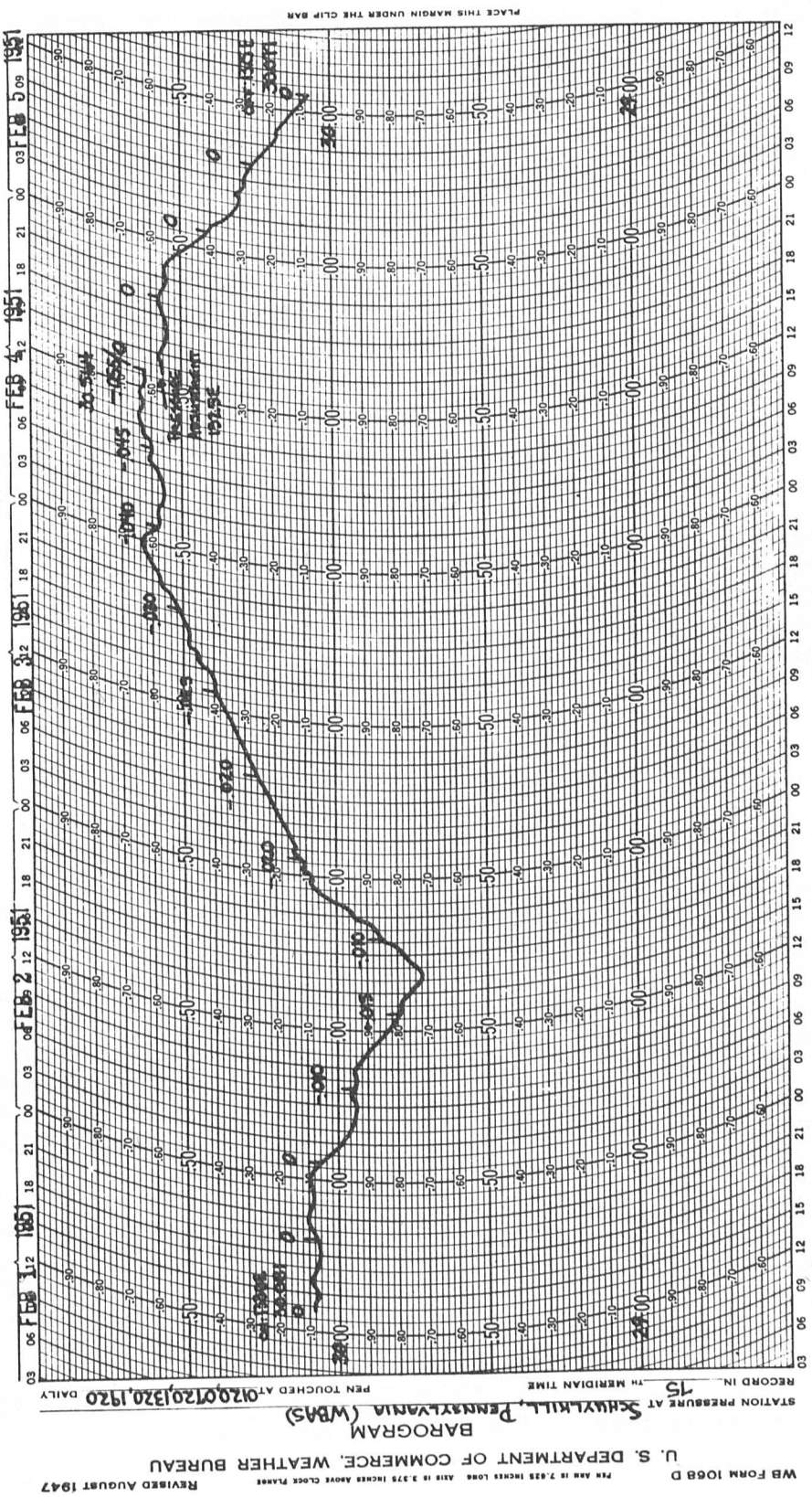


Fig. 4. Barogram

7245.14. At civil stations, forward completed barograms for the month (including the record up to the time of changing the chart on the 1st of the following month) to the station to which WBAN-10A and B are forwarded, not later than the second working day of the following month. At military stations, forward completed barograms similarly to the squadron headquarters or as specified by military directives.

7245.2. ADJUSTMENT FOR PRESSURE. To adjust the position of the pen, turn the knurled, pressure-adjusting knob at the top of the cylindrical pressure-element housing until the pen is at the correct station pressure. Tap the case or chassis lightly to overcome any sticking in the linkage mechanism before checking the adjustment of the pen. (See pars. 7242 and 7245.12 for conditions under which adjustment for pressure is required.)

7245.3. ADJUSTMENT FOR TIME. To adjust the cylinder for time, turn it counterclockwise until all slack motion in the drive mechanism is removed. If the pen position does not bear the proper relationship to the time-ordinate lines after the slack has been removed, continue to turn the cylinder counterclockwise with sufficient force to override the friction drive until the timing error is eliminated. Adjust the instrument promptly if, at any time, the record trace is in error by more than 15 minutes.

7250. ANEROID BAROMETER. Pressure is indicated on an aneroid barometer by the position of a hand on a graduated dial. Aneroids have dials graduated at intervals equivalent to inches and hundredths of mercury or millibars and tenths. Rapid changes of temperature, or exposure to direct heat or sunlight, may cause erratic performance in an aneroid barometer, and jars or shocks may dislocate elements of the linkage system. If an aneroid barometer is observed to have a correction that tends to be erratic (for example, +0.01 inch at one mercurial barometer comparison, +0.04 inch at the next, and a -0.02 inch at a third) the matter will be reported immediately. An unusually high wind will cause an aneroid barometer to indicate a pressure differing from one obtained from a mercurial barometer. This difference is especially apparent when the exposures of the two instruments are dissimilar. Differences noted at the time of high winds need not be reported unless they persist after the disappearance of the atmospheric conditions first associated with them.

7251. To determine station pressure from the aneroid barometer:

(1) Tap the face of the instrument lightly with the finger or the eraser-end of a pencil to bring the hand to its true position.

(2) Read to the nearest 0.005 inch or 0.1 millibar estimating for values between the scale graduations.

(3) Apply any necessary correction established in accordance with par. 7252.

7252. Corrections to be applied to precision-type aneroid barometers will be determined in accordance with instructions issued to the stations requiring them. Other types of aneroid barometers will not be used for original determination of pressure unless a correction is established at 6-hourly intervals by comparison with the station pressure determined from the mercurial or precision-aneroid barometer; or altimeter-setting indicator. This correction is the difference between the station pressure computed from the mercurial barometer reading and the pressure indicated at the same time by the aneroid barometer. Apply the correction to all aneroid readings until another is established at the next succeeding 6-hourly observation. Post the correction so that it will be available to all personnel taking pressure readings from the aneroid barometer.

7260. STATION PRESSURE FROM ALTIMETER-SETTING INDICATORS. At Weather Bureau and CAA stations, station pressure will be determined from altimeter-setting indicators in accordance with the following instructions, provided that the indicators are periodically compared with mercurial barometers as required by instructions issued to stations having both instruments.

(1) Determine the corrected altimeter setting to the nearest 0.005 inch from the altimeter-setting indicator.

(2) Find in the altimeter setting tables the tabular value corresponding to the altimeter setting determined in (1).

(3) Read at the side and top of the table the corresponding station pressure interpolating to the nearest 0.005 inch.

NOTE:- If the exact value of the altimeter setting determined in (1) does not appear in the altimeter setting tables, interpolate to obtain the station pressure and dispose of the thousandths digit in accordance with instructions in the Introduction.

7300. SEA-LEVEL PRESSURE

7310. GENERAL. Sea-level pressure represents the atmospheric pressure at sea level under prevailing meteorological conditions of temperature and station pressure. When the station is not at sea level, the station pressure is said to be reduced to sea level. The reduction is accomplished by the use of tables supplied each station. The tables are based on the elevation of the individual station at which they are to be used, and upon certain assumptions implicit in the hypsometric equation employed in their computation. The reduction table may be expressed in inches of mercury, or expressed directly in millibars, according as the original pressure readings are in inches

or millibars. The arguments used in the tables are station pressure and temperature. Mean temperature intervals in the reduction tables vary with the station elevation as follows:

Station elevation	Mean temperature intervals
0— 50 feet	None (constant correction)
51— 500 feet	10°
501—1000 feet	5°
1001 feet or more	2°

7320. REDUCTION OF STATION PRESSURE TO SEA-LEVEL PRESSURE. In reducing station pressure to sea-level pressure, use as arguments:

(1) The station pressure rounded to the nearest 0.01 inch or 0.1 millibar in accordance with instructions contained in the Introduction.

(2) The 12-hour mean temperature, to tenths, obtained from the current air temperature, and the air temperature 12 hours previously. If a temperature observation was not made 12 hours previously, determine from the thermograph, to whole degrees, the temperature 12 hours previously.

7321. Determine the sea-level pressure from reduction tables as follows:

(1) When observed values of mean temperature and station pressure correspond exactly with tabular arguments, find the sea-level pressure as a tabular value at the intersection of the respective columns.

(2) In all other instances, interpolate for pressure or temperature or both, by use of proportional parts tables, or by means of arithmetical interpolation.

7322. Four tables of proportional parts, which are described below, are available to facilitate the interpolation referred to in (2) above:

Table 1—Temperature increments of 0.1° from 0.0° to 2.0°. Pressure increments of 0.01 inch from 0.01 to 0.04 inch. This table is for use with sea-level reduction tables having temperature arguments of 2° increments.

Table 2—Temperature increments of 0.1° from 0.0° to 1.0° and increments of whole degrees from 1.0° to 5.0°. Pressure increments of 0.01 inch from 0.01 inch to 0.04 inch. This table is for use with sea-level reduction tables having temperature arguments of 5° increments.

Table 3—Temperature increments of 0.1° from 0.0° to 1.0° and increments of whole degrees from 1.0° to 10.0°. Pressure increments of 0.01 inch from 0.01 to 0.04 inch. This table is for use with sea-level reduction tables having temperature arguments of 10° increments.

Table 4—Pressure increments of 0.01 inch from 0.00 to 0.10 inch for horizontal tabular differences (as found in sea-level reduction tables) in increments of 0.01 inch from 0.10 to 0.15 inch.

7323. The station pressure will be reduced to sea-level by use of a sea-level reduction table and tables of proportional parts in accordance with the following instructions. Each step in the instructions is illustrated by an example based upon a given station pressure and a given 12-hour mean temperature. Portions of the sea-level reduction and proportional parts tables necessary to evaluate the example are reproduced following par. 7324.

Given: Station pressure=24.17
12-hour mean temperature=58.7°

(1) Find the station pressure argument in the table next lower to the actual station pressure. In the example, 24.10 would be selected as next lower to 24.17.

(2) Find the temperature argument in the sea-level table next higher to the 12-hour mean temperature. In the example, 60 would be selected as next higher to 58.7.

(3) Find the tabular value at the intersection of the columns selected in accordance with (1) and (2) above. In the example, this tabular value would be 30.71.

(4) Find the vertical pressure difference between the tabular value selected in accordance with (3) above and the next higher tabular value. In the example this would be 0.01 (difference between 30.71 and the next higher value, 30.72).

(5) Find the horizontal pressure difference between the value found in accordance with (3) above and the next higher tabular value. In the example, the difference would be 0.12 (difference between 30.71 and the next higher horizontal value, 30.83).

(6) Find the temperature difference to tenths between the actual 12-hour mean temperature and the value selected in accordance with (2) above. In the example this would be 1.3 (the difference between 58.7 and 60.0).

(7) Find the pressure difference between the actual station pressure and the value selected in accordance with (1) above. In the example, this would be 0.07 (the difference between 24.17 and 24.10).

(8) To summarize, the following values have been found:
(a) Vertical pressure difference (this equals 0.01 in the example).
(b) Horizontal pressure difference (this equals 0.12 in the example).
(c) Temperature difference (this equals 1.3 in the example).
(d) Pressure difference (this equals 0.07 in the example).

(9) Select the vertical pressure versus temperature table of proportional parts appropriate to the station sea-level table in accordance with paragraph 7322. In the example, the difference between successive temperature arguments is 2°; therefore, proportional parts Table 1 is used.

(10) Using the table selected in accordance with (9), find the vertical pressure argument corresponding to the value found in (4) and the temperature argument corresponding to the value found in (6). Find the tabular value at the intersection of the respective columns. In the example this would be 0.007.

(11) Using proportional parts Table 4, find the horizontal pressure argument corresponding to the value found in (5), and the pressure difference found in (7). Find the tabular value at the intersection of the respective columns. In the example, this would be 0.084.

(12) Add the values found in (3), (10), and (11). The sum is the sea-level pressure. In the example this would be 30.800, which is obtained as follows:
(a) From (3), a tabular value of sea-level pressure=30.71.
(b) From (10), an interpolated value of pressure using Table 1=0.007.
(c) From (11), an interpolated value of pressure using Table 4=0.084.
(d) From (12) a sum that equals the sea-level pressure=30.801.
The thousandths digit is disposed of in accordance with instructions contained in the Introduction.

7324. Sea-level reductions in terms of millibars will be made similarly to the foregoing by use of proportional parts Tables 5–8. In all operations, values as they appear in the tables will be carried forward to the final computation before disposing of the final digit.

PORTIONS OF SEA-LEVEL REDUCTION AND PROPORTIONAL PARTS TABLES

Mean temperature (° F.)	Station pressure (inches)			
	24. 00	24. 10	24. 20	24. 30
56	30. 61	30. 74	30. 87	30. 99
58	30. 60	30. 72	30. 85	30. 98
60	30. 58	30. 71	30. 83	30. 96
62	30. 57	30. 69	30. 82	30. 95

FROM PROPORTIONAL PARTS TABLE 1

Temperature increments (° F.)	Vertical tabular differences (inch)	
	0. 01	0. 02
1. 2	0. 006	0. 012
1. 3	. 007	. 013
1. 4	. 007	. 014

FROM PROPORTIONAL PARTS TABLE 4

Pressure increments (inch)	Horizontal tabular differences (inch)	
	0. 12	0. 13
0.06	0. 072	0. 078
0.07	. 084	. 091
0.08	. 096	. 104

7400. COMPUTATION OF HEIGHT OF THE 850-MILLIBAR SURFACE ABOVE SEA LEVEL

7410. DESCRIPTION OF DIAGRAMS. The height of the 850-millibar surface (25.10 inches) is computed by means of one of the hypsometric diagrams listed below. The diagrams used for the computation must have ranges of pressure and temperature that include the current values of station pressure and mean virtual temperature.

Form number	Temperature Range, ° F	Pressure range, inches of mercury
1154C	10 to 90	28.80 to 25.10
1154D	10 to 90	27.70 to 22.75
1154E	10 to 90	25.10 to 20.60
1154F	−50 to 30	28.80 to 25.10
1154G	−50 to 30	28.00 to 22.50
1154H	−50 to 30	25.10 to 20.60

Forms 1154D and G are for intermediate values of pressure that overlap pressure ranges of other diagrams. Two linear scales, one in gpft. and one in kilometers, are printed at the left of the diagram. To the right of the diagram is a millibar-inch pressure conversion scale for use at stations supplied with barometers calibrated in millibars.

7420. DESCRIPTION OF SCALE. A gpft. scale which is available as a separate form, is used in computing the height of the 850-millibar surface. It is furnished in a height range from 2350 to 9500 feet for use with all diagrams listed in par. 7410. A kilometer scale is printed on the right in a range equivalent to the range of the gpft. scale. The station elevation in gpft. should be indicated on the scale with a fine, thin penciled arrow that extends across the width of the scale. The position of this arrow on the scale should be verified for accuracy by another of the station personnel, after which the arrow should be re-

traced with permanent ink. The head of the arrow should terminate about 1/16" from the edge of the scale. Trim the scale so that the line in the center becomes the right edge, and the graduations and legends remain on the left side. The scale is subject to contraction and expansion with changes in humidity and temperature. Precautions should therefore be taken to avoid subjecting the diagrams and the scales to extremes of either humidity or temperature.

7430. COMPUTATION OF MEAN VIRTUAL TEMPERATURE. Enter the following temperature data on the form provided for computation of the mean virtual temperature:

(1) Current temperature.

(2) Current temperature

(3) Temperature 6 hours previously.

(4) Sum of (1), (2), (3).

(5) One-third of (4) (whole degrees).

(6) Correction from table entitled "Correction for Lapse Rate and Humidity," using as arguments the values closest to the current station pressure and the temperature computed in (5).

(7) Algebraic sum of (5) and (6).

7440. SELECTION OF DIAGRAM. Select a diagram whose range of pressure, printed along the side, includes the station pressure, and whose range of temperature, printed along the top, includes the mean virtual temperature computed in accordance with par. 7430 above. The slanting lines of the hypsometric diagrams represent values of pressure in increments of five-hundredths of an inch corresponding to station pressure; the vertical lines represent temperature in whole degrees Fahrenheit corresponding to values of mean virtual temperatures.

7450. USE OF SCALE. (Form 1154J). Place the gpft. scale on the hypsometric diagram so that height in gpft. increases with decrease in pressure. Place the edge of the scale parallel with and immediately adjacent to the vertical line corresponding to the mean virtual temperature, to the nearest whole degree Fahrenheit. Slide the scale vertically until the tip of the arrow coincides with the value of station pressure to the nearest 0.01 inch. The height of the 850-millibar surface above sea level will be read on the gpft. scale at its intersection with the 25.10 line, which is a dashed horizontal line with arrow heads at its extreme tips.

EXAMPLE

Given:

Station elevation gpft..... 5,290
Station pressure.....24.645
Current temperature (t).....29.3°F
Temperature 6 hours previously (t_6).....33.6°F

(1) To determine temperature argument:

t.....29.3°
t.....29.3°
t_6.....33.6°

Sum.....92.2°
Mean.....30.7°

t" (to nearest whole °F).....31°.
c = Correction from lapse rate and humidity correction table (at intersection of 24.60 pressure line (closest to 24.64) and 30°F temperature column (closest to 31°)..... +2
t_{mv} = Mean virtual temperature argument, nearest whole °F..... 33°

(2) Pressure argument (station pressure to nearest 0.01 inch).....24.64 inches

(3) To determine the height of the 850-millibar surface above sea level:
Using 24.64 as the pressure argument place the edge of the scale along the 33° temperature line with the arrow marking the station elevation, 5290, at the 24.64 inch pressure value. At the intersection of the scale with the 25.10 inch pressure line (equivalent to 850-millibar) read the height of the 850-millibar surface above sea level (to nearest 10 gpft.). Height equals 4810 gpft.

7500. ALTIMETER SETTING

7510. GENERAL. The altimeter setting is a pressure, in inches, used for setting a pressure-scale type sensitive altimeter in an airplane so that upon landing of the airplane the instrument will indicate an altitude reading equal or very close to that of the field elevation above sea level. The altimeter setting is sometimes called the standard atmosphere sea-level pressure, since it is based on the standard atmosphere. Computation of the altimeter setting is independent of temperature. Altimeter settings are determined only at stations equipped with an approved mercurial barometer with whose readings those of any pressure instrument used in determining the altimeter setting are periodically compared. A new determination of the altimeter setting will be made whenever the information is requested and the latest determination was made 30 minutes or more before the request. At civil stations, altimeter settings determined at the time of the 6-hourly synoptic observation will be furnished to local operations desiring them immediately after determination. These readings are required for comparative purposes, and are in addition to those normally transmitted in observations to local operations.

7520. DETERMINATION OF ALTIMETER SETTING FROM STATION PRESSURE. Altimeter-setting tables, containing station pressure arguments for obtaining altimeter settings, are furnished to stations requiring them. The station pressures pertain only to the elevation of the station at which the table is designed to be used. Therefore, each table may be used only at a station whose elevation corresponds with that of the one used in computing the table. The station pressure arguments are given at the side of the table to tenths of an inch and at the top of the table to hundredths of an inch.

7521. To determine the altimeter setting, read the station pressure to the nearest 0.01 inch and find in the body of the table the value corresponding to the station pressure. No interpolation is necessary.

EXAMPLES

A portion of the altimeter setting table for Kansas City, Mo., follows:

ALTIMETER SETTINGS, KANSAS CITY, MO., FIELD ELEVATION 742 FEET

Station pressure (inches)	.01	.02	.03	.04
28.80	29.60	29.61	29.62	29.63
28.90	29.70	29.71	29.72	29.73

Station elevation, $H_b = 750.0$ feet. Actual elevation barometer $H_a = 760.328$ feet.

(1) Given:
Station Pressure 28.825, rounded to the nearest 0.01 inch 28.83
Value from table found in column headed .03 ..... 29.62

(2) Given:
Station Pressure 28.927, rounded to the nearest 0.01 inch 28.93
Value from table found in column headed .03 ..... 29.72

7530. ALTIMETER-SETTING INDICATORS. (Not applicable to military stations.) The altimeter-setting indicator is a special form of aneroid barometer so designed that after installation and proper adjustment, the altimeter setting may be read directly from the scale. Corrections for this instrument will be determined in accordance with instructions issued to stations requiring them.

7600. DETERMINATION OF CHARACTERISTIC AND AMOUNT OF BAROMETRIC TENDENCY

7610. The barometric tendency comprises three elements: (1) the net change in barometric pressure within a specified time before an observation, (2) indication as to whether the barometric pressure is higher or lower at the end of a period than at the beginning of the period, and (3) the characteristic of the change during the period.

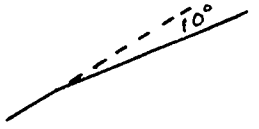
7620. Pressure tendencies will be determined only at stations equipped with a barograph. Determine the characteristic from the trace for the full 3-hour period preceding the actual time of observation, or, at stations computing 850-mb. data, for the full 3-hour period ending three hours before the time of observation. Observe whether the pressure is the same as, or higher or lower than, the pressure at the time of the beginning of the period, and whether the trace shows a falling, rising, steady, or unsteady tendency, or a combination of these. If the characteristic is so variable over the period that it cannot be identified, determine it for the period immediately preceding the observation, or for whatever interval will permit of a reasonably accurate determination of a characteristic. When the tendency of the observed trace is incompatible with the sign of the net change, select the tendency that is most nearly representative and still compatible with this sign. Classify barometric tendencies in accordance with Table 10d and pars. 7621 and 7622.

TABLE 10d. Pressure Tendencies

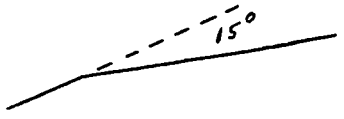
Code figure	Observed trace	Description	
0		Rising, then falling.	Barometer now higher than, or the same as, 3 hours ago.
1		Rising, then steady; or rising, then rising more slowly.	
2		Unsteady or rising unsteadily.	
3		Steady or rising steadily.	
4		Falling or steady, then rising; or rising, then rising more quickly.	
5		Falling, then rising.	Barometer now lower than 3 hours ago.
6		Falling, then steady; or falling, then falling more slowly.	
7		Unsteady or falling unsteadily.	
8		Falling steadily.	
9		Steady or rising, then falling; or falling, then falling more quickly.	

7621. Classify barometric tendencies as "3" or "8" only if the trace contains no points of discontinuity. A point of discontinuity is defined as a point at which the extension of the earlier part of the trace makes an angle with the subsequent trace of 15° or more (estimated). Classify tendencies as "2" or "7" only if there are at least two crests or two troughs of .02 inch or more. If neither of the foregoing criteria applies, classify the tendency as "0", "1", "4", "5", "6", or "9", according to the general criteria in Table 10d and the additional instructions in par. 7622.

Examples

A. 

This tendency should be classified as 3 because discontinuity is less than 15°.

B. 

This tendency should be classified as 1 because discontinuity is 15°.

C.

This tendency should be classified as 7 because there are two crests of .02 inch.

7622. When two or more characteristics apply, select the tendency that is representative of the latter portion of the trace (see examples A and B below), unless this tendency is not compatible with the net amount of change in the past three hours. In this latter case, select the tendency that is most descriptive of the entire 3-hour period and is also compatible with the net 3-hour change. (See examples C and D below.)

A. should be classified as 4.

B. should be classified as 5.

C. should be classified as 0.

(Although numeral 6 of the tendency code is more representative of the latter portion of the period, it is not compatible with the positive sign of the net 3-hour change.)

D. should be classified as 0.

(Although numeral 7 of the tendency code is more representative of the latter portion of the period, it is not compatible with the positive sign of the net 3-hour change.)

7630. To find the amount of change, determine to the nearest 0.005 inch the net change over the interval. (See par. 7760.)

7640. When the barogram indicates a rapid fall in pressure followed by an abrupt rise, with both rise and fall at the rate of 0.06 inch per hour or more, the lowest pressure in the "V" will be noted and converted to sea-level pressure for reporting in accordance with par. 7730. The mean temperature used in the reduction will be determined in accordance with the following:

(1) When a thermograph is available, select the temperatures corresponding to the time of the lowest pressure and to the time 12 hours previously.

(2) When a thermograph is not available, select the temperatures at the preceding observation and at a time 12 hours previously.

7700. ENTRIES ON WBAN-10

7710. SEA-LEVEL PRESSURE. (Col. 7) Omit the initial "9" or "10" of the sea-level pressure and enter it as three figures (without a decimal point) representing tens, units, and tenths of millibars; e.g., enter 1013.2 as "132".

7720. ALTIMETER SETTING. (Col. 13) Omit the initial "2" or "3" of the altimeter setting and enter it as three figures (without a decimal point) representing units, tenths, and hundredths of inches; e.g., enter 29.94 as "994". At stations not equipped with mercurial barometers but requiring altimeter settings for operational purposes, prefix an "E" to the entry.

7730. REMARKS. (Col. 14) Enter pressure data in column 14 as follows:

Observed	Entry
(1) Pressure rising or falling at rate of .06 inch per hour or more.	PRESRR or PRESFR

Observed	Entry
(2) Barogram "V" (see par. 7640)	Enter in the next record observation the lowest sea-level pressure in tens, units, and tenths of millibars, and time of occurrence LST; e.g., "LOWEST PRES 631 1745C".
(3) Pressure unsteady, as shown on the barogram by sharp troughs or crests that depart at least .03 inch from the mean trend.	PRES UNSTDY

7740. STATION PRESSURE. (Col. 17) Enter station pressure to the nearest .005 inch determined from the instrument appearing highest in the priority list in par. 7011. Omit entry if a mercurial barometer is not available at the station for periodic comparisons with other pressure-measuring instruments.

7750. PRESSURE TENDENCY. (Col. 36) Make this entry for 3- and 6-hourly synoptic observations at stations equipped with a barograph or microbarograph. Enter a single code figure, taken from Table 10d for pressure tendency during the 3-hour period ending at the time of observation. (See Sec. 7600.)

7760. NET THREE-HOUR PRESSURE-CHANGE. (Col. 37) Make entries in this column at stations where pressure tendencies are entered in accordance with par. 7750. Determine the net change in station pressure for the preceding three hours to the nearest .005 inch by subtracting corresponding entries in Col. 17.

7770. HEIGHT OF 850-MILLIBAR SURFACE. (Col. 49) At stations whose elevations are between 2500 and 9500 feet, enter the height of the 850-millibar surface above sea level in feet to the nearest ten gpft.

7780. STATION PRESSURE COMPUTATIONS. (Lines 59-65) Enter station pressure computations for the 6-hourly synoptic observations as specified below:

7781. TIME. (Line 59) Enter the time of reading the barometer. (Note that this time will usually differ from that ascribed to the observation in columns 2 and 16.)

7782. ATTACHED THERMOMETER. (Line 60) Enter the temperature of the thermometer attached to the mercurial barometer to the nearest 0.5° Fahrenheit or centigrade. Omit entries when the pressure readings are taken from precision aneroid barometers or altimeter-setting indicators.

7783. OBSERVED BAROMETER. (Line 61) Enter the uncorrected observed reading of the mercurial barometer to the nearest .001 inch or .05 mb.; or of the precision aneroid barometer to the nearest .005 inch or .1 mb. Omit entry if an altimeter-setting indicator is being used to determine station pressure (see par. 7011).

7784. TOTAL CORRECTION. (Line 62) Enter the sum of all corrections required to reduce the observed reading to station pressure. Omit entry if an altimeter-setting indicator is being used to determine station pressure.

7785. STATION PRESSURE. (Line 63) Enter to the nearest .001 inch or .05 mb. for mercurial barometer reading; to the nearest .005 inch or .1 mb. for precision aneroid or altimeter-setting indicator readings.

7786. BAROGRAPH READING. (Line 64) Enter to the nearest .005 inch or .2 mb. according as the barogram is graduated in millibars or inches. When the barogram is changed at the time of the 6-hourly observation, take the barograph reading from the new barogram.

7787. BAROGRAPH CORRECTION. (Line 65) Enter to the nearest .005 inch or .1 mb. with proper sign, the difference between the entries in lines 63 and 64, that is, line 63 minus line 64. If for any reason the barogram is changed after the time of the 6-hourly observation, enter the new barograph correction in column 90 and an asterisk in column 65 preceding the correction established at the time of the 6-hourly observation.

CHAPTER 8. WIND

8000. GENERAL

8010. Wind is measured in terms of velocity, a vector that includes direction and speed. The absence of apparent motion in the air is termed "calm." Wind direction, speed, character, and shifts are determined instrumentally, or by estimation when instrumental determination is not possible.

8100. DETERMINATION OF DIRECTION

8110. GENERAL. Wind direction is defined as the direction from which the wind is blowing. Wind direction is determined with reference to true north, and is expressed to 16 points of the compass or nearest 10 degrees. (See Table 11.)

TABLE 11.—*Wind direction in degrees, to 16 compass points*

Direction	Compass point	Degrees	Direction	Compass point	Degrees
North	N	349°–11°	South	S	169°–191°
North-northeast	NNE	12 –33	South-southwest	SSW	192 –213
Northeast	NE	34 –56	Southwest	SW	214 –236
East-northeast	ENE	57 –78	West-southwest	WSW	237 –258
East	E	79 –101	West	W	259 –281
East-southeast	ESE	102 –123	West-northwest	WNW	282 –303
Southeast	SE	124 –146	Northwest	NW	304 –326
South-southeast	SSE	147 –168	North-northwest	NNW	327 –348

8120. NONINSTRUMENTAL. When the station is not equipped with wind-indicating equipment or the equipment is unserviceable, the direction will be determined by observing the wind cone or tee at an airport, or the drift of smoke, or the movement of twigs, leaves, and similar flexible objects elsewhere. True direction can be estimated quite accurately by facing into the wind in unsheltered areas.

8130. INSTRUMENTAL. Wind direction is taken from 4- and 9-light (4- and 8-point) wind-direction indicators, recorders, or from direct-reading dials, by observing the indicator for a 1-minute interval in accordance with the following instructions for the type of indicator in use.

8131. The lamps of a 4-point indicator are assigned the cardinal directions, North, East, South, and West. When one lamp of a 4-light (4-point) indicator burns steadily, or one lamp burns steadily with flashes occasionally from a lamp on either side of it, the lamp burning steadily indicates the wind direction. When one lamp burns steadily with occasional flashes of a lamp on one side only, the wind direction is between the cardinal and intermediate directions, e. g., north-northeast. When two adjacent lamps burn steadily or intermittently, the direction is the intermediate one between them, e. g., northeast.

8132. The lamps of an 8-point indicator are assigned the cardinal and intermediate directions, North, Northeast, East, Southeast, South, Southwest, West, and Northwest. When one lamp, for a cardinal or intermediate direction, of a 9-light (8-point) indicator burns steadily, with or without occasional flashes of either or both adjacent lamps, the direction is the cardinal or intermediate one indicated by the lamp burning steadily. When one lamp burns steadily with an adjacent lamp burning more than 50 percent of the time, or when both lamps burn intermittently, the direction is between the intermediate and cardinal directions represented by the lamps.

8133. Directions from a direct-reading dial will be indicated by the average position of the pointer during a 1-minute interval.

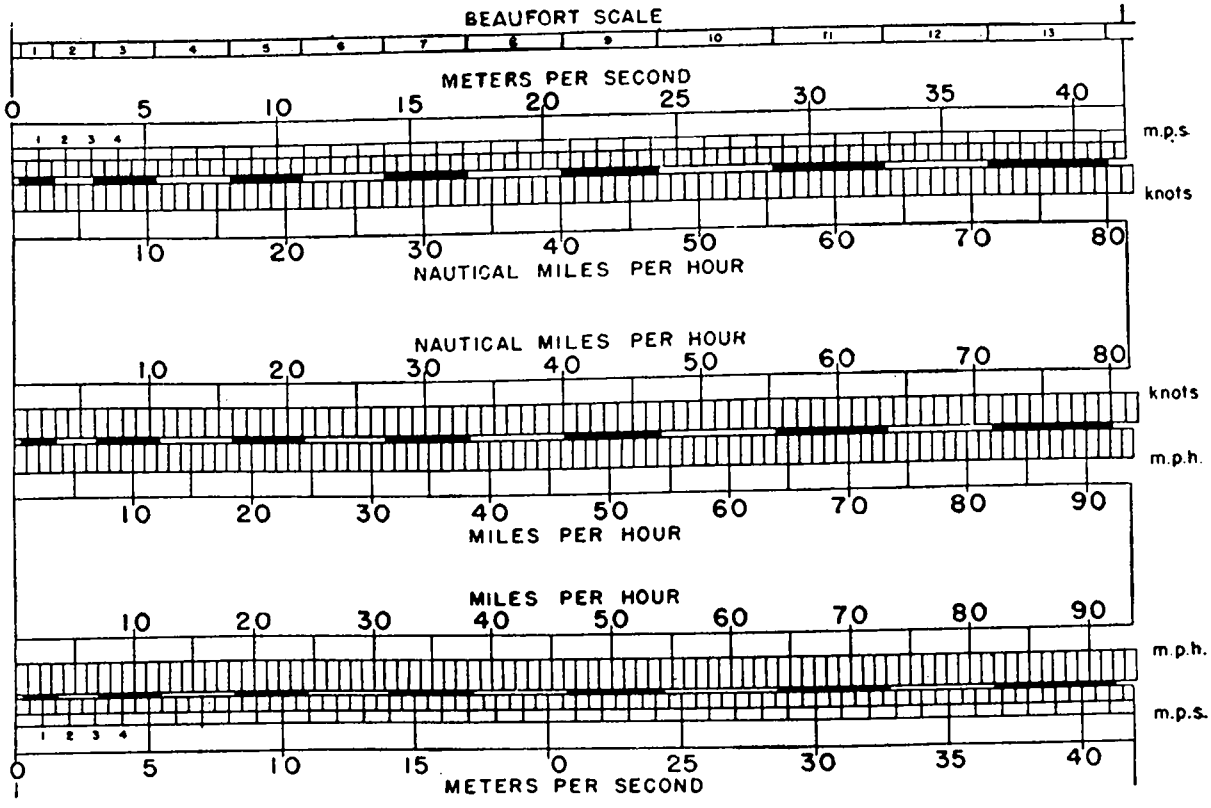
8134. Wind velocity recorders of the continuous registering type may be used for determining the direction, which will be the average direction during the last full minute of record preceding the observation.

8135. Direction from a single or multiple register will be obtained by averaging the indications over a 5-minute period.

8200. DETERMINATION OF SPEED

8210. GENERAL. Speed of the surface wind will be determined to the nearest statute mile per hour or knot, depending on the anemometer used and the requirements of par. 8420. Conversion will be made as required by means of Table 12. In general, observed wind speeds are a 1-minute average, but may also be a 5-minute average, or the fastest mile, when the speed is determined from recording equipment. So far as possible, average wind speed observations will not be taken during periods of extreme wind speeds - either high or low.

TABLE 12.—*Wind speed conversion.*



8220. NONINSTRUMENTAL. If equipment for observing wind speed is not available, the speed may be estimated by means of Table 13 (usually known as the Beaufort scale of wind speeds).

TABLE 13.—*Wind equivalents—Beaufort scale*

Beaufort number	M. P. H.	Knots	International description	Specifications
0	Less than 1	Less than 1	Calm	Calm; smoke rises vertically.
1	1–3	1–3	Light air	Direction of wind shown by smoke drift; but not by wind vanes.
2	4–7	4–6	Light breeze	Wind felt on face; leaves rustle; ordinary vane moved by wind.
3	8–12	7–10	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag.
4	13–18	11–16	Moderate breeze	Raises dust, loose paper; small branches are moved.
5	19–24	17–21	Fresh breeze	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25–31	22–27	Strong breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32–38	28–33	Moderate gale	Whole trees in motion; inconvenience felt walking against wind.
8	39–46	34–40	Fresh gale	Breaks twigs off trees; generally impedes progress.
9	47–54	41–47	Strong gale	Slight structural damage occurs; (chimney pots, slates, removed).
10	55–63	48–55	Whole gale	Seldom experienced inland; trees uprooted; considerable structural damage occurs.
11	64–72	56–63	Storm	Very rarely experienced; accompanied by widespread damage.
12	73–82	64–71	Hurricane	
13	83–92	72–80		
14	93–103	81–89		
15	104–114	90–99		
16	115–125	100–108		
17	126–136	109–118		

8230. INSTRUMENTAL. Instrumental measurement of a 1-minute average speed will be made by one of the following methods. At stations having two or more types of equipment, observe the following priority in selecting the equipment to be used:

(1) Direct-reading equipment (indicating or recording).

(2) Condenser-discharge equipment.

(3) Nine-light indicator.

(4) Multiple register.

(5) Other.

8231. Using the 1/60 mile indicator (statute or nautical), count the number of times the center lamp lights or the buzzer sounds during an exact 60-second interval. Apply the correction, from Table 14, appropriate to the type of anemometer in use.

TABLE 14. Corrections to indicated wind speeds
(1/60- or one-mile anemometers)

Speed Indicated					
By 3-cup anemometer ML-80, m.p.h.	By 3-cup "S" type anemometer, m.p.h.	By 4-cup anemometer, m.p.h.	By 4-cup anemometer with beaded cups, m.p.h.	By small airway "SA" type anemometer, m.p.h.	Corrections in whole miles per hour
11-60	0*-16	0*-8	0*-5	0*-35	+1
0*-10 & 61-70	17-26	9-12	6-13	35-57	0
71-80	27-35	13-16	14-20	(Corrections)	-1
81-90	36-44	17-20	21-27	for higher	-2
91-100	45-52	21-24	28-34	velocities	-3
101-110	53-61	25-28	35-41	not deter-	-4
111-120	62-70	29-32	42-48	mined; use	-5
121-130	71-79	33-36	49-55	zero.)	-6
131-140	80-87	37-39	56-62		-7
141-150	88-96	40-43	63-69		-8
	97-105	44-47	70-75		-9
	106-114	48-51	76-82		-10
	115-122	52-54	83-89		-11
	123-132	55-58	90-96		-12
	133-139	59-62	97-103		-13
	140-149	63-65	104-110		-14
	150-157	66-69	111-117		-15
	158-166	70-73	118-124		-16
	167-174	74-77	125-131		-17
	175-184	78-80	132-138		-18
	185-192	81-84	139-145		-19
	193-200	85-88	146-152		-20
		89-91	153-158		-21
		92-95	159-165		-22
		96-99	166-171		-23
		100-103	172-178		-24
		104-106	179-185		-25
		107-110	186-192		-26
		111-114	193-200		-27
		115-117			-28
		118-121			-29
		122-125			-30
		126-128			-31
		129-132			-32
		133-136			-33
		137-140			-34
		141-143			-35

*Movement of anemometer cups observed.

8232. Condenser-discharge indicators give an uncorrected average value at the highest point reached on the scale during a single pulse or oscillation. Observe the face of the indicator over a period of one minute and take the average of the corrected highest points reached by the meter needle during successive pulses or oscillations. Apply the correction indicated in Table 15.

TABLE 15. Corrections to indicated wind speeds
(Condenser-discharge type anemometers)

A. Type "S" anemometer		B. Type "SA" anemometer	
Uncorrected speed (m.p.h.)	Correction (whole m.p.h.)	Uncorrected speed (m.p.h.)	Correction (whole m.p.h.)
0-59	0	0-87	0
60-69	-1	88-94	+1
70-79	-2	95-100	+2
80-100	-3		

8233. Direct-reading indicators and recorders usually indicate almost instantaneous values. (Note that the condenser-discharge indicator is not considered direct-reading since an instantaneous wind speed cannot be taken directly from the indicator.) Observe the indicator or recorder trace for a 1-minute period and determine an average value. Apply to the average value the correction furnished for the particular instrument.

8234. If it is impossible to obtain a wind speed from any indicator described above, the wind speed may be taken from a single or multiple register record. Determine the average speed over the 5-minute interval immediately preceding the observation and apply the appropriate correction from Table 14.

8235. Assume zero correction for anemometers for which no correction tables have been furnished.

8236. Estimate the wind speed when it is less than the starting speed of the anemometer.

8300. CHARACTER OF WIND

8310. GUSTINESS. Gustiness is characterized by sudden, intermittent increases in speed, with at least 10 miles per hour or 9 knots variation (corrected) between peaks and lulls. The peak speed must reach at least 19 m.p.h. or 17 knots, and the average time interval between peaks and lulls should usually not exceed 20 seconds. (See par. 3310.)

8311. Gustiness will be estimated from 1/60 mile (buzzer or light) indicators by noting the variations in the time interval between buzzes or flashes, and will be determined from direct-reading indicators by observing the pointer. The peak gust is the highest speed momentarily indicated, without regard to the duration of the gust. Gustiness cannot be determined directly with the condenser-discharge type indicator, but an estimate can be made after successive fluctuations of the pointer have been noted.

8312. At stations equipped with gust recorders, the character of the wind may be taken from recorders. During the passage of hurricanes or other periods of high gusty winds, recorders designed for two-speed operation will be operated at the higher speed.

8320. (Cancelled)

8330. WIND SHIFTS. Wind shifts, as defined and used in this manual, are usually associated with the following phenomena, characteristic of a cold-front passage. These phenomena are:

(1) Gusty winds shifting in a clockwise manner in the Northern Hemisphere, i.e., south shifting to west, or southwest shifting to northwest (shifting counterclockwise in the Southern Hemisphere).

(2) Rapid drop in the dew point.

(3) Rapid drop in temperature.

(4) Rapid rise in pressure.

(5) In summer; lightning, thunder, heavy rain, and possibly hail.

(6) In winter; frequent rain or snow squalls with cloud heights changing rapidly - either to higher or lower heights than existed prior to the wind shift.

8331. (Cancelled)

8332. In the Northern Hemisphere, whenever the wind shifts suddenly to a westerly or northerly quadrant, be alert for the characteristic changes accompanying a shift. If some of the changes accompanying a shift are noted before the wind changes direction or speed, watch for a clockwise shift of wind direction, an increase in speed, or a change in direction of low clouds.

8333. In flat regions, wind shifts without precipitation, but accompanied by strong winds, sometimes occur. The visibility may be greatly restricted by blowing dust over extensive areas.

8400. ENTRIES ON WBAN-10

8410. WIND DIRECTION. (Col. 10) Enter the wind direction to sixteen points of the compass by means of one or two short arrows, as shown in Table 16. When the wind is calm, make no entry in this column.

TABLE 16. Wind direction symbols

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

8420. WIND SPEED. (Col. 11) At civil stations enter the wind speed in statute m.p.h. in column 11. At military stations, column 11 is divided into columns 11A and 11B; enter the wind speed in knots in column 11A and in statute m.p.h. (in red) in 11B. If the wind speed is estimated, enter the letter E immediately following the speed. Enter C for calm.

8430. GUSTINESS. (Col. 12) Report gusts by the symbol "+" immediately after the one-minute wind speed. Enter the peak speed of gusts observed during the past 15 minutes immediately after this symbol. (See Fig. 6.)

8440. SHIFTS. (Col. 12) Enter the direction of the wind before the shift to sixteen points of the compass with short arrows followed by the local standard time of the shift (24-hour clock) and a letter denoting the local standard time zone. Since the space provided in column 12 is not sufficient for wind shift data, distribute all wind data evenly among columns 10, 11, and 12; e.g., "↘25+40 ↖1614C" in these columns would indicate a wind shift from southeast to northwest at 1614 CST.

8450. SQUALLS. (Col. 12) Report squalls by the symbol "Q" immediately following the one-minute wind speed and preceding the peak speed of gusts observed during the past 15 minutes (see Fig. 6 and Sec. 3300).

8460. PEAK GUST. (Cols. 71-73) Enter this datum only at stations supplied with recording equipment other than single or multiple register. The peak gust is the highest speed recorded during the 24 hours ending at midnight. Enter (1) the direction to 16 points if suitable recording

equipment is available otherwise to eight points; (2) the speed to nearest statute m.p.h.; and (3) the time to nearest minute.

CHAPTER 9. TYPES OF 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 terms "aviation observation" and "synoptic observation" connote the assemblage of specified observational elements in a manner designed to satisfy meteorological and operational requirements. All scheduled observations will be started just sufficiently in advance of the time of transmission to permit accurate evaluation of all the elements. The observation of elements will be taken in the order given below, unless the sites of instrumental equipment require deviation:

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

9100. AVIATION OBSERVATIONS

9110. GENERAL. Aviation observations are primarily intended to provide (a) immediate weather information for aviation interests, and (b) data for climatological investigations. 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 par. 9142. The weather will be observed and the various elements evaluated between observations as often as is consistent with the condition of the weather. Changing weather situations that might require a special or local extra observation will be watched most closely to insure that an observation will be filed promptly after the change occurs. All elements reported in an aviation observation will have been observed within 15 minutes preceding the time of entry on WBAN-10.

9120. RECORD OBSERVATIONS. A record observation is taken at scheduled hourly intervals and will be prepared for teletype transmission at least two minutes and not more than five 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.

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*In aviation observations, these items should be reviewed if practicable before filing the message to ensure that current data are being transmitted.

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

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

9130. SPECIAL OBSERVATIONS. Special observations are taken to provide information on significant developments in meteorological conditions occurring at other than scheduled times. They are taken by all first-order Weather Bureau, CAA, Air Force, Navy and SAWRS observing stations. Other stations will take special observations only as specified in separate administrative instructions.

9131. 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) Wind shift or an increase in wind speed

When a change in any other element satisfies the criteria for a special observation, the observation will include:

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

In all cases remarks will be added when appropriate.

9132. 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. At Air Force stations additional criteria will be specified in separate instructions. Stations taking less than 24 hourly observations will take special observations as required following the first record observation for the day.

9132.1. CEILING.

(1) The ceiling decreases to less than 1500 feet, or increases to 1500 feet or more.

(2) The ceiling decreases to less than 1000 feet, or increases to 1000 feet or more.

(3) The ceiling decreases to less than 500 feet, or increases to 500 feet or more.

(4) A ceiling of less than 500 feet changes by 100 feet or more.*

(5) The ceiling decreases to less than the highest instrument minimum for the airport.*

(6) The ceiling increases to or above the highest instrument minimum for the airport.*

9132.2. SKY CONDITION. A layer is observed below:

(a) 1000 feet, and no layer was previously reported below this altitude.

(b) the highest instrument minimum for the airport, and no layer was previously reported below this altitude.*

9132.3. VISIBILITY.

(1) The visibility decreases to less than:

(a) 3 miles
(b) 1 mile
(c) 3/4 mile
(d) 1/2 mile *
(e) 1/4 mile

(2) 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

9132.4. TORNADO.

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

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*Effective only at stations having scheduled air-carrier operations, and at all Air Force stations.

9132.5. THUNDERSTORM.

(1) Begins (A special observation is not required to report the beginning of a new thunderstorm if one is currently reported as in progress at the station.)

(2) Increases in intensity

(3) Ends (Special observation 15 minutes after thunder is last heard at station.)

9132.6. PRECIPITATION.

(1) Hail begins, ends, or changes in intensity.

(2) Freezing precipitation other than very light begins, ends, or changes in intensity.

(3) Sleet begins, ends, or changes in intensity.

9132.7. 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.

9132.8. 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.

9140. LOCAL EXTRA OBSERVATIONS. Local extra observations are taken, at all stations, for local distribution only, under the circumstances specified in par. 9141-43. 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. Local extra observations will be taken at intervals not exceeding 15 minutes, beginning whenever there are impending aircraft operations** and

(1) the ceiling decreases to 500 feet or less, or
(2) the visibility decreases to one mile or less.

**These observations will be taken at Air Force stations irrespective of impending aircraft observations.

Observations will be discontinued when values above these minimums have been reported or when there are no impending aircraft operations. 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. 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, or to meet other local needs, will be taken and recorded, 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 of all elements ordinarily included in a record observation will be taken immediately following any aircraft accident or report of an aircraft in distress in the vicinity of the observing station. These observations are for record purposes only and need not be disseminated. The note "ACFT ACCIDENT" will be entered in column 14. 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 this observation may be taken promptly. If notification of an accident is not received immediately, the observation should nevertheless be taken immediately after notification, unless there has been an intervening observation. An explanatory note should be entered in column 90 of WBAN-10B whenever this observation has been delayed.

9150. CHECK OBSERVATIONS. Check observations will be taken at all stations where scheduled aviation broadcasts of local weather are made even though no significant changes in weather have occurred. The local schedule of broadcasting will determine the time of taking them. Check observations will not be taken if a record, special or local extra observation has been taken within the previous 20 minutes. The check observation will be taken within 20 minutes of the scheduled time of local broadcast, preferably as near to the time of broadcast as practicable unless a pilot balloon observation is being taken. In this latter

*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.

case, no check observation will be recorded, and the previous record or special observation will be used for broadcast purposes. 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
(2) Sky
(3) Visibility
(4) Weather
(5) Obstructions to vision
(6) Wind
(7) Altimeter setting

9160. GROUPING OF ELEMENTS. Aviation observations are disseminated in a code that consists of symbols and numerals arranged in relatively fixed positions. Word and phrase contractions or complete words are used in a specified manner to supplement the coded data. The letter symbol "M" is used to indicate missing data, or data entered in parentheses (see par. 11020), pertaining to an element normally included in a report. Elements regularly omitted are indicative of data not observed at a particular station. The elements of the observation are placed in groups as specified below, with slants and spaces used to separate numerical data that might otherwise be misinterpreted.

9161. HOURLY REPORTS. Data pertaining to record observations are coded in groups as follows: Station identification (space) ceiling, sky, visibility, weather, obstructions to vision (space) pressure (slant) temperature (slant) dew point, wind direction and speed (slant) altimeter setting (slant) and remarks. Additive data are separated by a slant and a space from the last element of the aviation observation. Except as stated in separate coding instructions (see also par. 11103.1), no specified sequence need be observed in appending these additional groups to the aviation observation.

EXAMPLE: DCA E18V⊕12 271/74/58 ← ↙ 8/032/CIG 16V20/ 2002

9162. OTHER REPORTS. Data pertaining to special, check, and local extra reports are grouped similarly to hourly observations insofar as the same data are transmitted (see pars. 9131, 9141, and 9150). Spaces will be used following type of report and time of report, which are sent for all special observations and for local extra and check observations if they are transmitted on local teletype circuits.

EXAMPLE: DCA S8 1009E E18V⊕12 ← ↙ 8/CIG 16V20

9163. CORRECTED REPORTS. A report correcting a previously transmitted report will be identified by the letters "COR" immediately preceding the station identification. The report will include station

identifier and time. If the observation to be corrected is a special, record-special, or local extra report, the correcting report will also include type of report. If an error in a record, or record-special observation is discovered within the hour after the observation has been transmitted on the teletype, a correction will be filed immediately, regardless of special observations that might have been transmitted in the meantime. If an error is discovered in a special or local extra observation before the next succeeding observation is given teletype or local distribution, a correction will be filed. If an error is discovered in a check observation, a correction will be given to the broadcaster. When more than an hour has elapsed before an error in a transmitted observation has been discovered at the originating station, a corrected report will not be transmitted.

9163.1. A correction message may consist of a complete, corrected observation, or of a single element properly identified (e.g., COR 1328E ALSTG 969), whichever procedure is the shorter.

9170. CODING. Instructions in Chapters 1-8 will be observed in coding individual elements of observations for teletype and radio distribution. Instructions for the coding of station identification, type of report, and time are given in pars. 9171-9173.

9171. STATION IDENTIFICATION. The station identification is a three letter symbol assigned to the station for use in teletype transmissions. These symbols are listed in the Civil Aeronautics Administration publication "Location Identifiers."

9172. TYPE. Record observations are not identified by any symbol in teletype transmission. Special and record-special reports are identified by the letter "S" followed by a serial number (see par. 11101). Local extra reports transmitted on local teletype circuits are identified by the contraction "LCL."

9173. TIME. The time of record and record-special observations is not included in the report, since the time of the sequence in which the reports are included appears at the heading of the sequence collection. However, a corrected report of a record observation will include the sequence time of the record observation immediately following the station identification. In special and local extra reports, when coded for teletype transmission, the time, in four figures, is followed by the correct time zone indicator selected from Table 17, except that Air Force stations and other designated stations will use Greenwich mean time and the indicator "Z."

9174. DELAYED OBSERVATIONS. When an observation is not available for transmission at the scheduled time but will be available later, file the abbreviation "DLAD" at the time of the scheduled observation.

9180. DISSEMINATION. Record and special aviation observations will

be transmitted by teletype or radio where suitable facilities are available. These transmissions will be made in accordance with communication manuals specified by the individual services. When transmission is delayed until time for the next record or special observation, transmit only the latest observation and enter "FIBI" in column 14 of the observation not transmitted.

9181. LOCAL DISTRIBUTION. All observations will be distributed by a common airport communications system, when available, to local operational offices desiring them. If a single airport communications system is not available, observations will always be furnished to the tower, GCA units, and air-ground positions if desired by these units, and to other local operations if time and station workload permits.

9200. SYNOPTIC OBSERVATIONS
(Not applicable at Air Force stations)

9210. Data to be included in synoptic observations are those specified in current synoptic codes. The required data will be observed and evaluated in accordance with instructions in this manual. Synoptic observations are coded directly from the corresponding hourly aviation observation, and are not separately recorded on WBAN-10A. In the event that rapidly changing conditions require that the synoptic observation differ from the corresponding aviation observation, enter a brief explanatory note in column 90.

9300. MIDNIGHT OBSERVATION

9310. At midnight, local standard time, an observation of maximum and minimum temperatures and of precipitation will be taken at all stations having personnel in duty status at that time, except that this observation may be omitted at stations in time zones where a synoptic observation is begun within ten minutes of local midnight. If no midnight observation is taken, omit all entries from WBAN-10B on the lines captioned "Mid" and "Mid to".

CHAPTER 10. PILOTS' REPORTS

10000. GENERAL

10010. Pilots' reports of meteorological phenomena encountered in flight are variously termed PIREPS (pilots' reports), AFREPS (Air Force reports), NYREPS (Navy reports), POREPS (post-flight reports), RMREPS (Army reports), ALREPS (airline reports). Pireps will be used as a basic term for convenience of discussion. These reports of weather are an extremely valuable source of information that often is not otherwise available. Observers will cooperate to the fullest extent possible with pilots and with ground personnel to secure all available pilots' reports promptly.

10100. CODING

10110. GENERAL. All reference to heights of phenomena encountered in flight will be expressed in hundreds of feet to the nearest hundred above mean sea level, indicated by the letters "MSL".[1] Authorized weather symbols, international cloud abbreviations, and word and phrase contractions will be used; or if they are lacking, complete words. All phenomena having an authorized symbol (see Tables 8a and 8b) will be reported in symbol form followed, if required, by the appropriate intensity indicator. "U" will be used for "intensity unknown." If the phenomenon has been reported in general terms by the pilot ("precipitation" without indication of rain or snow, etc.) the phenomenon and its intensity will be reported in an authorized phrase contraction or, lacking that, in one or more complete words.

10120. ARRANGEMENT OF ELEMENTS. Pireps will be coded in accordance with pars. 10121-10127. In general, the order of coding will be:

(1) Station identification.

(2) Time of entering pilot's report on WBAN-10.

(3) The term PIREPS, or authorized equivalent (AFREPS, etc.).

(4) Location or extent of phenomena with respect to a well-known point.

(5) Time of pilot's observation, whenever known.

(6) Phenomena reported.

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[1]Note.-Pilot reports of cloud heights used as a ceiling in aviation observations will be converted to feet above the surface by the observer and coded in accordance with par. 1440.

(7) Altitude.

(8) Type of aircraft, in reports of turbulence and icing only.

10121. ICING. Code pilots' reports of airfoil icing conditions as follows:

(1) Use the contraction "ICG" with indication of intensity and type, if known. For example:

ICG TRACE = Trace of ice.
LGT RIME ICG = Light rime icing condition.
MDT ICG = Moderate icing condition.
HVY ICG = Heavy icing condition.

(2) Code the height of the base and top of the icing area whenever known. Use slants to indicate that the base or top of the icing area is unknown.

EXAMPLES:

The pilot of a Stinson, flying between Seattle and Oakland, reports to Medford that at 0700 PST he encountered light icing conditions 5 to 20 miles north of Eugene, Ore., at 2000 feet MSL; the top of the icing was not reported:

MFR 0715P PIREPS 5-20 N EUG 0700P LGT ICG 20-// MSL STSN

The pilot of an F-51 flying between Oakland and Burbank reports that he encountered heavy icing conditions at 0925 PST over mountains north of Burbank, with the top of the icing at 11,500 MSL, base unknown (note that Air Force stations use GCT.):

SRF 1731Z AFREPS MTNS N BUR 1725Z HVY ICG //-115 MSL F-51

10122. ELECTRICAL DISCHARGE OR LIGHTNING STROKE. Use the word "DISCHARGE."

EXAMPLES:

A pilot flying a PBY between Richmond, Va., and Washington, D.C., reports to Washington that at 1620 EST his aircraft experienced an electrical discharge 20 miles south of Washington at an altitude of 5000 feet MSL:

DCA 1629E NYREPS 20 S DCA 1620E DISCHARGE 50 MSL

The pilot of a liaison aircraft enroute from St. Louis, Mo. to

Chicago, Ill., reports to Chicago that at 1515 CST his plane experienced an electrical discharge over the Kankakee River at an altitude of 2500 feet MSL:

CHI 1535C RMREPS 15 S JOT 1515C DISCHARGE 25 MSL

10123. TURBULENCE. Use the contraction "TURBC" preceded by an indication of intensity as illustrated in the following list:

LGT TURBC = Light turbulence.
MDT TURBC = Moderate turbulence.
HVY TURBC = Heavy turbulence.

EXAMPLES:

A pilot reports to Kansas City, Missouri, that his C-54 encountered heavy turbulence at 2330 CST, 10 miles northeast of Knoxville, Tenn., at 6000 feet MSL:

MKC 2335C AFREPS 10 NE TYS 2330C HVY TURBC 60 MSL C54

The pilot of a DC-3 flying at 10,000 feet MSL through Donner Summit Pass, Calif., reports to Reno, Nev., that light turbulence is being experienced 1050 PST.

RNO 1055P ALREPS OVR DOS 1050P LGT TURBC 100 MSL DC3.

10124. HAIL. Use the authorized teletype symbol for hail and indicate the intensity in the same manner as in weather reports of hail. Use the symbol "U" to indicate unknown intensity.

NOTE: It is quite possible that a pilot report of hail will be added to a report of turbulence and electrical discharge. All these phenomena may be included in the same pireps.

EXAMPLES:

The pilot of a DC-4 reports to Omaha, Nebr., at 1617 CST that he is flying through moderate hail 10 miles south at an altitude of 3500 feet MSL:

OMA 1619C PIREPS 10 S OMA 1617C A 35 MSL

At 1628 CST the same pilot reports that he is flying in light hail and heavy rain, with heavy turbulence at 3000 feet MSL, 15 miles southwest of Omaha, and that at 5000 feet MSL his plane had experienced a discharge:

OMA 1635C PIREPS 15 SW OMA 1628C HVY TURBC R+A- 30 MSL DISCHARGE 50 MSL DC4.

10125. WINDS ALOFT EXCEEDING 60 MILES PER HOUR OR 52 KNOTS. Code

winds aloft reported to exceed 60 m.p.h. or 52 knots as follows:

(1) Use the contraction "WND".

(2) Code true direction from which the wind is blowing in three figures representing the degrees of the compass, to the nearest 10 degrees.

(3) Use figures to code the wind speed in miles per hour or knots.

EXAMPLES:

At 0845 CST the pilot of a C-54 reports to Bismarck, N. Dak., that he is encountering an 82-knot wind west of Bismarck at 6000 feet MSL, wind direction 80 degrees:

BIS 0850C AFREPS W BIS 0845C WND 080 82 KNOTS 60 MSL

At 1215 CST the pilot of a PBY reports to Madison, Wis., that he is encountering a 72-knot wind from 240 degrees, 20 miles southeast of the station, at 8500 feet MSL:

MSN 1225C NYREPS 20 SE MSN 1215C WND 240 72 KNOTS 85 MSL

10126. BASES AND TOPS OF CLOUDS. Select appropriate sky-cover symbol from Table 1a. Enter heights of bases preceding the symbol, and heights of tops following the symbol, in hundreds of feet MSL. (Note - Intervals specified in par. 1440 for reporting cloud heights are not applicable to pilots' reports.)

EXAMPLES:

The pilot of a B-29 flying over Navasota, Texas, at 0613 CST reports to Houston that the top of the overcast is at 8500 feet MSL:

HOU 0618C AFREPS OVR AVS 0613C ⊕ 85 MSL

If the plane had been 15 miles southeast of Navasota when the pilot determined the height of the top of the overcast, the coded report would read:

HOU 0618C AFREPS 15 SE AVS 0613C ⊕ 85 MSL

The pilot of a DC-3 flying over Washington, D.C. reports at 1110 EST to Washington that the ceiling is 1500 feet MSL, and top of overcast 4500 feet MSL:

DCA 1118E PIREPS OVR DCA 1110E 15⊕45 MSL

A pilot flying between Casper and Sheridan, Wyo., reports to Sheridan that the ceiling over Kaycee is 14,000 feet MSL. The type of aircraft was not reported, nor the time of the observation.

SHR 1850M PIREPS 65 S SHR 140 ⊕ MSL

10127. In addition to the elements indicated in pars. 10121-10126, any other elements of meteorological or operational significance will be coded in the general form outlined in par. 10120.

10200. DISSEMINATION

10210. All pireps, including those pertaining to ceilings within 1-1/2 miles of any runway of the airport, will be disseminated locally in the same manner as special observations. (See par. 1444.1 for conditions under which pilots' reports of ceiling will also be incorporated into the current aviation observation.) In addition, stations having local Service F facilities will transmit these reports to ARTC for relay to FAWS and inclusion in the pireps summary (AIREPS). Stations not having Service F will enter pireps on Service A or, if Service A is not available, transmit them to the station designated to receive its scheduled observations. Air Force stations will disseminate pireps in accordance with instructions issued by wing or group commanders.

10300. ENTRY ON WBAN-10A

10310. Pilot reports of weather within 1-1/2 miles of any runway of the airport will be entered on the same WBAN-10A as the other observations of the day. Record the time of entry of the pilot report on the form in column 2, and enter the term PIREPS, or authorized equivalent followed by the report coded in accordance with instructions in Sec. 10100. Entry of pireps on Form WBAN-10A may extend across the entire page, and need not be restricted to column 14.

10320. All pireps pertaining to weather more than 1-1/2 miles from any runway of the airport will be similarly entered on a supplementary WBAN-10A distinct from that used for official observations. This supplementary form will be treated in all respects as part of the observational record. The supplementary WBAN-10A for pireps will be started the first of each month, and pireps for as many days as possible entered on each page. The period covered by each page will be indicated in the space provided for the date. Pireps for consecutive days will be separated by a line space and the date pertaining to the succeeding entries will be entered in this space near the center of the form. Dates will not be entered for days on which pireps are not received.

W B FORM 1130 A Revised 7-1-48

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

WBAN 10 A

SURFACE WEATHER OBSERVATIONS

STATION WBAS, Los Angeles, Calif. DATE June 8-11, 1951

TYPE 1	TIME (LST) 2	CEILING (Hundreds of Feet) 3	SKY 4	VISIBILITY (Miles) 5	WEATHER and OBSTRUCTIONS TO VISION 6	SEA LEVEL PRESS. (mbs.) 7	TEMP. (°F) 8	DEW PT. (°F) 9	WIND DIRECTION 10	WIND SPEED (m.p.h.) 11	WIND CHARACTER AND SHIFTS 12	ALTIMETER SET. (ins.) 13	REMARKS AND SUPPLEMENTAL CODED DATA M	MA	MB	OBSERVERS INITIALS 15
					June 8											
	0316		ALREPS	40-60	S OAK			0305P	LGT	ICG			115-130 MSL DC6			AFD
	0612		AFREPS	20	E BUR			0605P	WND	270			80 MPH 100 MSL			
	1350		ALREPS	45	NW LAS			1345P	LGT	TURBC			90 MSL DC4			MCJ
					June 9											
	1725		PIREPS	50	NW SFO			1714P	DISCHARGE			50	MSL LGT TURBC 35 MSL		BCFT	PS
	2115		NYREPS	75	S LAX			2104P	⊕55	MSL						PS
	2320		AFREPS	85	E SFO			2312P	LGT	ICG		//	-140 MSL B29			
					June 11											
	0910		PIREPS	OVR	BFL			0904P	28⊕	MSL						ECP
	1026		AFREPS	10	S LAX			1010P	60⊕85	MSL						ECP
	1138		RMREPS	15	SW BUR			1130P	SKY	CLR						AKN
	1700		ALREPS	5	E LAX			1655P	TOP	KLYR		15	MSL 45⊕			SMC

Fig. 5. Entries of pilot reports on WBAN-10A.

CHAPTER 11. ENTRIES ON FORM WBAN-10

11000. GENERAL

11001. Form WBAN-10 consisting of parts A, B, and D, will constitute the basic original record of surface observations at all stations taking aviation observations. A new WBAN-10A and B will be started for recording each day's observations, beginning with the first observation at or following 0000 local standard time. One page of WBAN-10B and as many pages of WBAN-10A as are needed will be used for each day. WBAN-10D will be prepared as of the last day of each month at first-order Weather Bureau stations and annually as of December 31st at second-order (including CAA) stations in accordance with instructions on the form.

11002. Instructions in this chapter relate primarily to entry of nonmeteorological data. Instructions relating to meteorological elements will be found in the chapters pertaining to these elements.

11003. Enter observations as legibly as possible in chronological order, restricting data, so far as possible, to the columns appropriate to them as indicated by the column headings. Ditto marks will not be used. Civil and Air Force stations will use a black-lead drawing pencil (Venus 3H or equivalent), and Navy stations will use black ink. Sufficient pressure should be used to ensure legible copies and ample contrast for photographic reproduction. At stations where the form is used by the communications operator directly, slants to separate data in the airway code may be used as specified in Chapter 9.

11004. The name of the station and date will be entered in the spaces provided.

11010. MISSING DATA. The symbol "M" will be entered only for missing data normally recorded. Appropriate notes explaining the missing data will be entered in column 90.

11020. STATISTICAL DATA. Data entered in parentheses are for statistical purposes only, and are not to be transmitted as an element of an aviation observation.

11030. CORRECTION OF ENTRIES. When incorrect data have been entered, corrections will be made as follows:

11031. If the error is discovered before the report is transmitted, the erroneous entry will be neatly erased from all copies and correct entry made.

11032. If an error is discovered in an observation after the report is transmitted, a red line will be drawn through the erroneous entry only

and the correction entered in red immediately above it. If a correction is transmitted, enter the phrase "COR (Time)" in red in column 14 of the erroneous observation. Carbon copies, if prepared will also be corrected in red.

11100. WBAN-10A

11101. TYPE. (Col. 1) The type of report will be indicated by one of the following designations:

(1) R Record observation.

(2) S (followed by serial number) Special observation. Serial numbers are assigned consecutively for each day. Number 1 is the first special (or record-special) filed for transmission on or after 0000 LST, of a given day.

(3) RS (followed by serial number) Record-special observation.

(4) L Local extra observation.

(5) ✓ Check observation. (If a check observation requires local extra procedure, enter "L.")

11102. TIME ENTRIES. (Col. 2) The time ascribed to an observation is that of the last entry on WBAN-10. Entries will be in local standard time to the nearest minute in terms of the 24-hour clock, unless use of GCT is specifically authorized. The first two figures will indicate the hour, and the last two, the minutes. For example, 0000 indicates the beginning of the day; 0235 indicates 2:35 a.m.; 1346 indicates 1:46 p.m.; 2359 indicates the end of the day. The time based upon any of the standard time meridians can be converted to GCT by adding one hour for each 15° of longitude west of Greenwich. (See Table 17.)

TABLE 17. Meridians of standard time zones and conversion to GCT

Standard Time Zone	Letter Designator	Meridian	To Convert To GCT, add -
Atlantic Standard Time	- -	60°	4 hours.
Eastern Standard Time	E	75°	5 hours.
Central Standard Time	C	90°	6 hours.
Mountain Standard Time	M	105°	7 hours.
Pacific Standard Time	P	120°	8 hours.
Yukon Standard Time	Y	135°	9 hours.
Alaskan Standard Time	A	150°	10 hours.
Bering Standard Time	B	165°	11 hours.

11103. REMARKS. (Col. 14) Enter remarks in symbols or abbreviations specified in the CAA publication "Contractions" whenever possible; otherwise, use plain English. If necessary, use additional lines; it is not intended that the physical dimensions of the column shall limit in any way the information to be reported. Enter also additive data groups and raob data. Contractions pertaining to non-meteorological data, such as notices to airmen concerning broadcast facilities, may also be entered in the column if desired.

11103.1. Enter additive data in accordance with Table 18. Consult the 1949 Synoptic Code (or the abridgement that is provided stations that transmit additive data only) for coding instructions on individual elements.

TABLE 18. Additive Data Requirements

(Note: The following specifications represent maximum additive data requirements; they do not apply to SAWRS, nor to other second-order civil stations that have been individually authorized to omit certain elements listed below.)

Type of Station	Additive data at 6-hourly periods (0030Z, 0630Z, etc.)	Additive data at 3-hourly periods (0330Z, 0930Z, etc.)
(1) All Air Force and Navy stations; all civil stations in Alaska and overseas; and all first-order Weather Bureau stations that do not file either 3- or 6-hourly synoptic observations on Service C.	Pressure tendency and change; precipitation; clouds; and maximum and minimum temperatures. (appRR* $C_LC_MC_HD_C$ $T_{n/x}T_{n/x}$)	Pressure tendency and change; clouds (app* $C_LC_MC_HD_C$)
(2) First-order Weather Bureau stations filing both 3- and 6-hourly synoptic observations on Service C.	None	None
(3) First-order Weather Bureau stations filing 6-hourly but not 3-hourly synoptic observations on Service C.	None	Pressure tendency and change; clouds (app* $C_LC_MC_HD_C$)
(4)** All second order civil stations designated to transmit additive data.	Pressure tendency and change; precipitation; maximum and minimum temperatures. (appRR* $T_{n/x}T_{n/x}$)	Pressure tendency and change (app)

*Plain language precipitation data and group 99ppp will be used to supplement these groups in accordance with synoptic coding instructions.

**At combined Weather Bureau-CAA stations, when observations are taken by CAA personnel, additive data will be transmitted in accordance with (4), except that if CAA personnel file synoptic observations on Service C all additive data on Service A for the corresponding time will be omitted; when observations are taken by Weather Bureau personnel at this type of station, additive data will be filed in accordance with (1)-(3).

11103.11. In addition to the above basic groups, snow depth ($9S_pS_ps_ps_p$) and 850-mb. data ($2h_{85}h_{85}h_{85}a_3$) will be sent by all stations when necessary in accordance with synoptic coding instructions. These additional groups will be transmitted in the following order:

6-hourly symbolic form:

appRR (99ppp and plain language precipitation data)

$C_LC_MC_HD_C$ $9S_pS_ps_ps_p$ $T_n/xT_n/x$ $2h_{85}h_{85}h_{85}a_3$

3-hourly symbolic form:

app (99ppp) $C_LC_MC_HD_C$ $2h_{85}h_{85}h_{85}a_3$

11103.2. At specified international aerodromes, cloud group $8N_sCh_sh_s$ will be sent with record and special observations. This group will be transmitted as the final item in the report, following remarks, 3- and 6-hourly additive data, or field conditions. Use slants to separate group $8N_sCh_sh_s$ from altimeter setting or remarks, but not from 3- and 6-hourly additive data or field conditions.

11104. OBSERVER'S INITIALS. (Col. 15) Enter initials of observer taking the observation in this column.

11200. WBAN-10B

11201. TIME. (Col. 16) Entries in this column will be in chronological order, to the nearest minute. The times will be the same as times of corresponding record observations. (See par. 11102.) Note that the first two figures of the time group are printed on the form.

11202. TIME. (Cols. 41 and 42) Entries in column 41 will be omitted unless otherwise instructed. In column 42 in the block captioned "Mid to.....," enter the time of the beginning of the first 6-hourly observation after 0000 LST. In the next four blocks below, enter the time of the beginning of the 6-hourly synoptic observation. The entries will be to the nearest minute in terms of the 24-hour clock.

11203. STATE OF GROUND. (Col. 50) At first-order Weather Bureau stations, enter state of ground in accordance with Table 19. Omit this entry at stations having only concrete, macadam, or similar artificial surfaces in the vicinity of the station.

TABLE 19. State of ground

Code figures	Description
0....	Surface of ground dry (no appreciable amount of dust or loose sand).
1....	Surface of ground moist.
2....	Surface of ground wet (standing water in small or large pools on surface).
3....	Surface of ground bare and frozen.
4....	Glaze on ground but no ice, slush, or snow.
5....	Ice, slush, or snow covering less than one-half of ground.
6....	Ice, slush, or firm or settled snow covering more than one-half of ground (but not completely).
7....	Ice, slush, or firm or settled snow covering ground completely.
*8...	Loose dry snow covering more than one-half of surface (but not completely).
*9...	Loose dry snow covering surface completely.

*Figures 8 and 9 may be used to indicate dust or loose sand on the surface of the ground in the proportions indicated. Under these conditions, when the temperature is below 32°F., enter the words "State of ground - dust" or "State of ground - loose sand" in column 90.

NOTE. - Numbers 0 to 4 apply to representative bare ground and numbers 5 to 9 to an open representative area.

11204. SEA, STATE AND DIRECTION[1]. (Col. 51) State and direction of the sea refer only to the condition of the sea surface resulting from the action of winds prevailing in the immediate local area. It should be noted that it is possible for a "flat, oily" sea to co-exist with a "light," "moderate," or even "heavy" swell.

11204.1. The state of the sea will be recorded as a code figure in accordance with Table 20.

[1]Entries in columns 51-54 are made at designated Weather Bureau and Navy stations only.

11204.2. The direction of the sea is the direction, to eight points of the compass, from which the sea is coming. It is recorded as an arrow.

EXAMPLE: A rough sea (waves 5-8 feet) from the southwest would be recorded as "5↗."

TABLE 20. State of sea

Code figures	Description	Approximate average wave height, feet
0....	Flat, oily.....	0
1....	Calm rippled.....	0
2....	Smooth (wavelets).....	1
3....	Slight.....	1-3
4....	Moderate.....	3-5
5....	Rough.....	5-8
6....	Very rough.....	8-12
7....	High.....	12-20
8....	Very high.....	20-40
9....	Mountainous.....	More than 40

11205. SWELL, HEIGHT AND DIRECTION. (Col. 52) The term "swell" is restricted in usage to the wave motion that underlies the "sea" raised and driven by the local wind. Swell usually has traveled over a considerable distance from the point where it was generated by the wind, and its direction and height may often differ widely from those of the local wind-driven waves ("sea").

11205.1. Height of swell is recorded as the estimated average height of swell in the open sea, measured in whole feet from crest to trough.

11205.2. Direction of swell is the direction, to eight points of the compass, from which the swell is coming. It is recorded as an arrow.

EXAMPLE: A three-foot swell from the west would be recorded as "3→."

11206. SWELL PERIOD. (Col. 53) Swell period is the average time between successive crests, measured to the nearest second. The swell period usually can be observed best by watching the rise and fall in the swell of a patch of foam or other floating object. When the elapsed time, measured by a stop watch, of ten successive rises of such an object has been obtained, a good average period may be recorded by taking one-tenth of the value.

11207. SURF. (Col. 54) A five-figure code comprises the "Primary Data Group" of the combined Surf Code (SURFCO). Enter it every six hours at stations (and ships when appropriate) with means of observing surf condition.

11207.1. PRIMARY SURF DATA GROUP. A five-figure code group, symbol form $H_sH_sM_sP_sD_s$.

11207.2. SYMBOL H_sH_s. Average height of waves in feet. Ninety-nine indicates average height impossible to estimate. Two figures to be entered for whole feet.

EXAMPLE: 01 for 1 foot, 12 for 12 feet, etc.

11207.3. SYMBOL M_s. Difference between height of maximum waves and average waves in a 5-minute interval. Third figure in group to be entered in accordance with code Table 21.

TABLE 21. Surf (M_s)

Code No.	Difference between height of maximum waves and average waves	Code No.	Difference between height of maximum waves and average waves
0	0	7	7 feet.
1	1 foot.	8	8 feet.
2	2 feet.	9	Greater than 8 feet except when H_sH_s is reported as 99, in which case this figure means that an estimate is impossible.
3	3 feet.		
4	4 feet.		
5	5 feet.		
6	6 feet.		

11207.4. SYMBOL P_s. Period, i.e., time between passage of successive breakers at a fixed point. Fourth figure of group to be entered in accordance with code Table 22.

TABLE 22. Surf (P_s)

Code No.	Time between successive breakers	Code No.	Time between successive breakers
0	No surf.	5	11 or 12 seconds.
1	Less than 5 seconds.	6	13 to 15 seconds.
2	5 or 6 seconds.	7	16 to 18 seconds.
3	7 or 8 seconds.	8	Greater than 18 seconds.
4	9 or 10 seconds.	9	Time impossible to estimate.

11207.5. SYMBOL D_s. Angle of breakers with the beach and direction of wave travel (referred to observer on beach facing the sea.)

Enter fifth figure of group in accordance with Table 23.

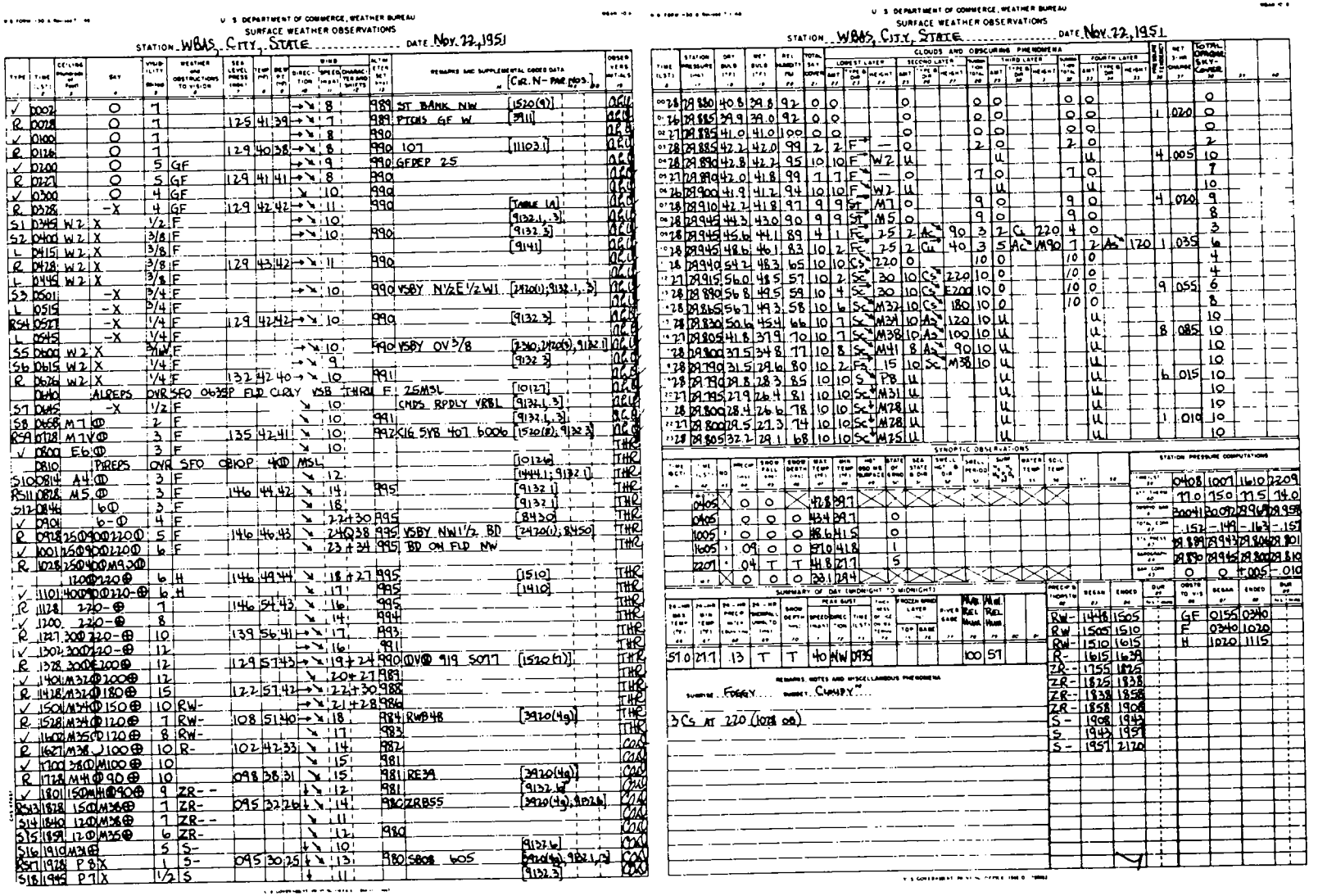
TABLE 23. Surf (D_S)

Code No.	Angle of breakers with the beach	Code No.	Angle of breakers with the beach
0	Calm.	5	0° up to 10° }
1	0° up to 10° }	6	10° up to 20° } from the right.
2	10° up to 20° } from the left.	7	More than 20° }
3	More than 20° }	8	Confused, but predominantly from the right.
4	Confused, but predominantly from the left.	9	Not known.

11208. THICKNESS OF ICE ON WATER. (Col. 74) At designated Weather Bureau and Navy stations, enter this datum to the nearest 0.1 inch.

11209. FROZEN GROUND LAYER. (Cols. 75-76) At designated Weather Bureau and Navy stations, enter this datum to the nearest whole inch.

11210. RIVER GAGE. (Col. 77) At Weather Bureau stations where a river gage is read, enter the river gage reading to the nearest 0.1 foot.



U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
STATION WBAS, CITY, STATE ..... DATE Nov. 22, 1951

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
STATION WBAS, CITY, STATE ..... DATE Nov. 22, 1951

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CHANGE

Change No. → 1

U. S. Department of Commerce
Weather Bureau

MANUAL OF SURFACE OBSERVATIONS
(WBAN)

Circular N
6th Edition
(Revised)

(This page may be discarded)

Washington, D.C.
November 1, 1951

To conform with the recent edition of the CAA publication CONTRACTIONS, make the following change in ink:

Page 39, in item 5(f), change "PTCH" to "PATCH."

In the index, pages 121-123, make the following changes in ink:

Under "Ceiling," rearrange sub-items in alphabetical order.

To "Lightning, entry on WBAN-10B" add par. "3934.3."

To "Missing data" enter par. "9160," and delete "transmission 10021."

Delete "Summary of day 11466-77."

Under "Temperature" place "soil, entry on WBAN-10B 5570" in proper alphabetical sequence, that is, just preceding "water."

To "Tornadoes: reporting in remarks" add par. "3934.2."

In addition to column reference changes in paragraphs listed in "Errata" sheet of July 2, 1951, appropriate changes should also be made in paragraphs 9180 and 11032 when revised WBAN 10A and 10B are placed in use.

Page 102, paragraph 9163, change "preceding" to "following".

3840. RAINBOW. A semicircular arc seen opposite the sun, usually exhibiting all the primary colors, with red on the outside. It is caused by diffraction, refraction and reflection of light within raindrops, which often produces a secondary bow outside the primary one. In this case the colors are reversed.

3850. FOG BOW. A whitish, semicircular arc, seen opposite the sun in fog. Its outer margin has a reddish and its inner a bluish tinge. The middle of the band is white. An additional bow, with the colors reversed, sometimes appears inside the first.

3860. AURORA. A luminescence, frequently called Northern Lights. It is usually seen in the northern skies in lower latitudes, and overhead, or even to the southward of the zenith, in higher latitudes. It may appear in such forms as arcs, rays, curtains, coronas, etc. It is usually of a whitish color but may have various other colors. The lower edges of the arcs and curtains of the aurora are usually fairly well defined, while the upper edges are ill-defined.

3900. ENTRIES ON WBAN-10

3910. WEATHER AND OBSTRUCTIONS TO VISION. (Col. 6) Enter precipitation and obstructions to vision in accordance with the symbols in Tables 8a and 8b. Use + after precipitation symbols to indicate heavy intensity, - to indicate light, and - - to indicate very light; the absence of a sign indicates moderate intensity. Precipitation will be entered in this column only if actually occurring at the time of the observation. (See par. 3920 for entry of remarks concerning intermittent precipitation.) Two or more entries for a single observation will be made in the following order:

(1) Tornado (or waterspout)

(2) Thunderstorm

(3) Liquid precipitation, in order of decreasing intensity

(4) Freezing precipitation, in order of decreasing intensity

(5) Frozen precipitation, in order of decreasing intensity

(6) Obstructions to vision, in order of decreasing predominance if discernible.

*3911. Omit entry of obstructions to vision in Col. 6 whenever the visibility recorded in Col. 5 is seven miles or more. If the visibility is less than seven miles, weather or obstructions to vision must be reported either in Col. 6 or Col. 14 (see par. 3920). If the visibility is reduced by phenomena not occurring at the station, enter an explanatory note in remarks, e.g., "GF BANK N".

TABLE 8a. Symbols for weather

TORNADO or WATERSPOUT (always written out in full) followed by direction from station.

T+	Heavy Thunderstorm	EW	Sleet Showers
T	Thunderstorm	S	Snow
R	Rain	SW	Snow Showers
RW	Rain Showers	SP	Snow Pellets
L	Drizzle	SG	Snow Grains
ZR	Freezing Rain	IC	Ice Crystals
ZL	Freezing Drizzle	A	Hail
E	Sleet	AP	Small Hail

TABLE 8b. Symbols for obstructions to vision

F	Fog	IF	Ice Fog
GF	Ground Fog	H	Haze
BS	Blowing Snow	K	Smoke
BN	Blowing Sand	D	Dust
BD	Blowing Dust		

3920. REMARKS (Col. 14). Enter data pertaining to weather and obstructions to vision as follows:

Observed	Instructions for Entry
(1) Tornado and waterspout	
(a) Observed from station	Enter direction toward which it is moving, e.g., MOVG NEWD
(b) Reported by public	Enter (1) location with respect to weather-reporting station or a city or town, (2) direction toward which it is moving, (3) time tornado was observed, e.g., UNCONFIRMED TORNADO 15 MIS W DCA MOVG N 1600E
*(c) Began following the most recent record observation, but not occurring during current observation. (Enter this remark for all observations up to and including the next record observation, even though the phenomenon was previously reported in a special observation. See par. 9180.)	Enter the time of occurrence (or time of beginning and ending), peak speed of gusts, and direction of movement, e.g., TORNADO 1155E G120 MOVD NE.
*(2) Thunderstorm	
(a) In progress at station	Enter direction, if observable: (1) with respect to station (2) direction toward which storm is moving, e.g., T OVHD MOVG EWD or T SW MOVMT VRBL (omit remark concerning movement if movement unknown)

(b) Heavy thunderstorm began following the most recent record observation, but not occurring during current observation. (Enter this remark for all observations up to and including the next record observation, even though the phenomenon was previously reported in a special observation. See par. 9180.)	Enter the time of beginning and ending, peak speed of gusts, and direction of movement, e.g., T+ B34E50 G45 MOVD N
(3) Lightning, with or without audible thunder	Enter if observable: (1) Frequency (2) Type (cloud to cloud, etc.) (3) Direction from station Use authorized abbreviations, e.g., OCNL LTGCG, FQT LTGIC NW, etc.
#(4) Precipitation	
(a) Hail	Enter diameter in inches of largest hailstones, e.g., HLSTO 1 1/4
(b) Intermittent and showery	Enter abbreviation for intermittent, followed by type of precipitation (e.g., INTMT R-), if intermittent precipitation has occurred within the previous 15 minutes. This entry will be made to report intermittent precipitation regardless of whether precipitation is entered in Col. 6 (see par. 3910). Enter "OCNL RW", etc. if showers have occurred within the previous 15 minutes and are not reported in Col. 6.
(c) Wet snow	Enter WET SNW
(d) Snow depth increase	Enter abbreviation SNOINCR, followed by average depth of snow accumulated during the past hour, to the nearest whole inch (e.g., SNOINCR 5). This remark will be used only if average snow depth has increased during past hour by two or more inches.
(e) Variation of intensity	Enter appropriate abbreviations, e.g., R- OCNLY R+

#In reporting data pertaining to snow, snow showers, or sleet in remarks, use the symbols S, SW, and E only when there is no possibility of their being confused with points of the compass. Otherwise, use established English abbreviations (SNW, SNW SHWRS, etc.).

*(f) Precipitation at a distance but not at station

Enter form and intensity of precipitation if known and direction with respect to station. Use "U" following precipitation symbols to indicate unknown intensity, e.g., RU OVR RDG N or PCPN W INTSTY UNKN

(g) Times of beginning or ending of precipitation

Enter remarks in the next succeeding record observation to report times of beginning or ending of precipitation that has occurred within the past hour and has not been reported by means of special observations in accordance with par. 9132.6. Use the symbol "E" followed by the time in minutes past the hour to signify time of ending, and the symbol "B" similarly to signify time of beginning. Disregard intensities and changes in character (e.g. S to SW) but not changes in type (e.g., R to S); also disregard intervals of 15 minutes or less between cessation and recommencement (see examples 3 and 4 below).

Examples

1. RW- reported in 1228 obs; RW- ended at 1305. Enter remark in 1328 obs: "RWE05".

2. No precipitation reported in 1228 obs; S- began at 1235 and continued through 1330. Enter remark in 1328 obs: "SB35".

3. No precipitation reported in 1228 obs; S began at 1240 ended 1255; began 1305 and ended at 1315. Enter remark in 1328 obs: "SB40E15"

4. RW- began 0515E and ended 0620E; no precipitation falling at actual time of 0628E observation, but recommencement within 15 minutes of 0620E appeared probable at time of observation. Enter remarks:

identifier and time. If the observation to be corrected is a special, record-special, or local extra report, the correcting report will also include type of report. If an error in a record, or record-special observation is discovered within the hour after the observation has been transmitted on the teletype, a correction will be filed immediately, regardless of special observations that might have been transmitted in the meantime. If an error is discovered in a special or local extra observation before the next succeeding observation is given teletype or local distribution, a correction will be filed. If an error is discovered in a check observation, a correction will be given to the broadcaster. When more than an hour has elapsed before an error in a transmitted observation has been discovered at the originating station, a corrected report will not be transmitted.

9163.1. A correction message may consist of a complete, corrected observation, or of a single element properly identified (e.g., COR 1328E ALSTG 969), whichever procedure is the shorter.

9170. CODING. Instructions in Chapters 1-8 will be observed in coding individual elements of observations for teletype and radio distribution. Instructions for the coding of station identification, type of report, and time are given in pars. 9171-9173.

9171. STATION IDENTIFICATION. The station identification is a three letter symbol assigned to the station for use in teletype transmissions. These symbols are listed in the Civil Aeronautics Administration publication "Location Identifiers."

9172. TYPE. Record observations are not identified by any symbol in teletype transmission. Special and record-special reports are identified by the letter "S" followed by a serial number (see par. 11101). Local extra reports transmitted on local teletype circuits are identified by the contraction "LCL."

9173. TIME. The time of record and record-special observations is not included in the report, since the time of the sequence in which the reports are included appears at the heading of the sequence collection. However, a corrected report of a record observation will include the sequence time of the record observation immediately following the station identification. In special and local extra reports, when coded for teletype transmission, the time, in four figures, is followed by the correct time zone indicator selected from Table 17, except that Air Force stations and other designated stations will use Greenwich mean time and the indicator "Z."

9174. DELAYED OBSERVATIONS. When an observation is not available for transmission at the scheduled time but will be available later, file the abbreviation "DLAD" at the time of the scheduled observation.

*9180. DISSEMINATION. Record and special aviation observations will

be transmitted by teletype or radio where suitable facilities are available. These transmissions will be made in accordance with communication manuals specified by the individual services. When transmission is delayed until time for the next record or special observation, transmit only the latest observation and enter "FIBI" in column 14 of the observation not transmitted. When the observation not transmitted pertains to the phenomena listed in pars. 9132.4 to 9132.7, enter in remarks of the next succeeding transmitted observation: (a) the time of the observation not transmitted, (b) weather, obstructions to vision, and wind reported in that observation. (This remark may be omitted or abridged insofar as it duplicates data pertaining to tornadoes, waterspouts, or heavy thunderstorms, entered in accordance with Item 1(c) and 2(b) of par. 3920.)

Examples

S5 1437E M15⊕2RW+ ↘25Q55↑1432E (FIBI)

S6 1448E M20⊕6RW- ↘15/1437E RW+ ↘25Q55↑1432E.

9181. LOCAL DISTRIBUTION. All observations will be distributed by a common airport communications system, when available, to local operational offices desiring them. If a single airport communications system is not available, observations will always be furnished to the tower, GCA units, and air-ground positions if desired by these units, and to other local operations if time and station workload permits.

9200. SYNOPTIC OBSERVATIONS
(Not applicable at Air Force stations)

9210. Data to be included in synoptic observations are those specified in current synoptic codes. The required data will be observed and evaluated in accordance with instructions in this manual. Synoptic observations are coded directly from the corresponding hourly aviation observation, and are not separately recorded on WBAN-10A. In the event that rapidly changing conditions require that the synoptic observation differ from the corresponding aviation observation, enter a brief explanatory note in column 90.

9300. MIDNIGHT OBSERVATION

9310. At midnight, local standard time, an observation of maximum and minimum temperatures and of precipitation will be taken at all stations having personnel in duty status at that time, except that this observation may be omitted at stations in time zones where a synoptic observation is begun within ten minutes of local midnight. If no midnight observation is taken, omit all entries from WBAN-10B on the lines captioned "Mid" and "Mid to".

Add To c.1; c.2 done

Change No. → 2

U. S. Department of Commerce
Weather Bureau

MANUAL OF SURFACE OBSERVATIONS
(WBAN)

Circular N
6th Edition
(Revised)

(This page may be discarded)

Washington, D.C.
January 1, 1952

Change No. 2, Circular N, 6th Edition (Revised June 1951):

(1) Insert Chapter 12, Marine Observations as an addition to the manual.

(2) Make the following changes in ink:

(a) Page 69 - change the footnote to read "Civil stations and Naval ships only."

(b) Page 111, par. 11003, third sentence - delete "and Navy stations will use black ink."

(c) Unless the Index has been superseded by a comprehensive index to both the WBAN Manual and Addendum instructions of the service concerned, retain the Index for use with Chapters 1 to 11 and renumber pages 121 to 123 as pages 163 to 165 respectively.

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CHAPTER 12. MARINE OBSERVATIONS

12000. GENERAL

12010. These instructions apply to all observations taken by Naval aerological personnel on Naval vessels and by Weather Bureau personnel on ocean station vessels. Instructions in Chapters 1 - 11 will be followed in taking marine observations except as specifically noted in this chapter.

12011. Greenwich Civil Time will be used on all observational records including autographic records.

12100. OBSERVATIONAL PROGRAM

12110. NAVY. The observational program on Naval vessels is outlined in the Navy addendum.

12120. WEATHER BUREAU. The surface observational program conducted by Weather Bureau personnel on ocean station vessels consists of:

(a) Scheduled observations (combined record and synoptic observations) filed with the ship's communicator at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 GCT.

(b) Special observations as required by par. 12122. (Aviation observations referred to in pars. 9132 - 9150 will not be taken.)

12121. SCHEDULED OBSERVATIONS. Scheduled observations will be taken and transmitted in accordance with par. 12120 as soon as the vessel departs from base port, and continued until return to base port, except when the vessel is temporarily in another port where surface observations are taken by a land station.

12122. SPECIAL OBSERVATIONS. Special surface observations will be taken and filed promptly with the communicator whenever requested by aircraft, by ships engaged in search and rescue operations, or by a Weather Bureau forecast office. Special surface observations will be transmitted:

(1) To aircraft (except those contemplating ditching, see next paragraph) and to surface vessels, in plain language, the elements following the same order in which they are coded in scheduled synoptic observations; or, when specifically requested, in the AERO code form: (Ocean station Identifier) Nddff VVwwW $8N_sCh_sh_s$. 1/

1/ Group $OTTT_dT_d$, Q signals, and plain language remarks are optional.

(2) To aircraft contemplating ditching, in plain language or, when language difficulties are anticipated, in "Q" code. The report will consist of the following elements in the order given:

(a) Surface wind direction in degrees.

(b) Surface wind speed in knots.

(c) Swell - length, height, and speed of swell waves and direction from which they are moving.

(d) State of sea - length, height, and speed of sea waves and direction from which they are moving.

(e) Visibility.

(f) Present weather.

(g) Amount, and height of base of low cloud (both the predominant layer and any scattered clouds below).

(h) Sea-level pressure.

(i) Remarks.

(3) To Weather Bureau forecast offices, in the same code used for scheduled synoptic observations.

12200. WBAN-11A and B, and WBAN-10D

12210. WBAN-11. WBAN-11A and B constitute the basic observational record for all marine observations taken in accordance with sections 12000, and 12100.

12211. PREPARATION. Only one copy of WBAN-11 need be prepared unless otherwise specified. Pencil will be used in accordance with par. 11003 unless modified by addendum instructions. In the heading, enter ship, station (when ship is assigned to an ocean station), latitude and longitude of the station to degrees and minutes, and date (GCT) corresponding to the first synoptic observation on the form.

12211.1. A new WBAN-11A will be started on the first day of each month (GCT). A new WBAN-11B will be started with the first observation of each day (GCT).

12211.11. On Naval ships with major aerological units aboard, a new WBAN-11A will be started on the first observation of the day (GCT). As many pages will be used daily as necessary.

12211.12. On Weather Bureau patrols and on Naval ships with minor aerological units aboard, observations for more than one day will be entered on WBAN-11A. Observations for successive days will be separated by a line space, and the date of the following observations will be entered in this space (see Fig. 8).

12212. ENTRY OF DATA. Instructions for the entry of data in many of the correspondingly numbered columns of WBAN-10 and WBAN-11 are the same, either entirely or in part. The extent to which the instructions in Chapters 1 - 11 for the entry of data on WBAN-10 are applicable to WBAN-11 is stated in sec. 12300.

12213. DISPOSITION. Completed forms will be submitted in accordance with instructions in the addendum.

12220. WBAN-10D. In accordance with the instructions on WBAN-10D, this form will be prepared as of the last day of each month on Naval vessels, and as of the last day of Weather Bureau patrols. It will be submitted with the observational records for the corresponding period as specified in the addendum.

12300. COLUMN ENTRIES ON WBAN-11A AND B

12300. GENERAL. Enter data on WBAN-11A for all observations, and on WBAN-11B for record and synoptic observations only. In addition, certain summary data will be entered daily in columns 105 - 128 of WBAN-11B.

12301. POSITION (Col. 1A). Enter coded digits in the symbolic form QLLll. These symbols have the following meaning:

(a) Q - Octant of the globe in accordance with Table 24.

(b) LL - Latitude to the nearest whole degree (e.g., enter 8°22' as 08).

(c) ll - Longitude to the nearest whole degree, omitting the hundreds digit (e.g., enter 145°36' as 46).

TABLE 24

SYMBOL Q.—*Octant of the globe*

Longitude	Code figure
North latitude:	
0° W. to 90° W	0
90° W. to 180° W	1
180° E. to 90° E	2
90° E. to 0° E	3
South latitude:	
0° W. to 90° W	5
90° W. to 180° W	6
180° E. to 90° E	7
90° E. to 0° E	8

12302. COURSE (Col. 1B). Enter true compass course to the nearest whole degree. Enter a dash if ship is not underway.

12303. SHIP'S SPEED (Col. 1C). Enter ship's speed to the nearest whole knot. Enter a dash if ship is not underway.

12304. TYPE (Col. 1). Enter R, S, or RS in accordance with par. 11101, except that special observations will be serially numbered with respect to GCT rather than LST.

12305. TIME (Col. 2). Enter the time (24-hour clock) to 4 figures GCT. Enter the time of scheduled observations to the nearest hour (e.g., 0000, 0300, etc.), and the time of special observations to the nearest minute (e.g., 2343).

12306. SKY AND CEILING (Col. 3). Enter ceiling and sky-cover data in accordance with pars. 1510 and 1511. Determine cloud data in accordance with Chapter 1 with the following exceptions:

(a) Instructions in section 1300 concerning determination of cloud direction do not apply to ships. Directions will be regarded as unknown unless determined from rawinsonde observations.

(b) Cloud heights will be determined by balloons for scheduled observations in accordance with par. 1451 even though the observations are not transmitted.

12307. VISIBILITY (Col. 4). Enter prevailing visibility in nautical miles in accordance with par. 2410. Determine prevailing visibility in accordance with Chapter 2, except that instructions in par. 2110 concerning visibility charts are not applicable. In estimating visibility use radar or stadiometer distances, or other distances to known objects such as ships in the company, horizon, etc. Estimates will be based on the

apparent size of the ship (or other object), and the portion visible. Use Table 25 as a guide in determining distances (e.g., in accordance with line 7 of Table 25, the horizon when viewed from a bridge 40 feet above sea level is 7.6 nautical miles away).

TABLE 25. Distance to objects on the horizon at sea (nautical miles)

Height of observer's eyes above sea level (feet)	Height of object above sea level (feet)														
	0 [1]	10	20	30	40	60	80	100	150	200	300	400	600	800	1,000
10	3.8	7.2	8.7	9.9	10.8	12.5	13.9	15.1	17.7	19.8	23.5	26.5	31.6	36.0	39.8
15	4.6	8.0	9.5	10.7	11.6	13.3	14.7	15.9	18.5	20.6	24.3	27.3	32.4	36.8	40.6
20	5.4	8.7	10.2	11.4	12.3	14.0	15.4	16.6	19.2	21.3	25.0	28.0	33.1	37.5	41.3
25	6.0	9.3	10.8	12.0	12.9	14.6	16.0	17.2	19.8	21.9	25.6	28.6	33.7	38.1	41.9
30	6.6	9.9	11.4	12.6	13.5	15.2	16.6	17.8	20.4	22.5	26.2	29.2	34.3	38.7	42.5
35	7.1	10.4	11.9	13.1	14.0	15.7	17.1	18.3	20.9	23.0	26.7	29.7	34.8	39.2	43.0
40	7.6	10.8	12.3	13.5	14.4	16.1	17.5	18.7	21.3	23.4	27.1	30.1	35.2	39.6	43.4
45	8.0	11.3	12.8	14.0	14.9	16.6	18.0	19.2	21.8	23.9	27.6	30.6	35.7	40.1	43.9
50	8.5	11.7	13.2	14.4	15.3	17.0	18.4	19.6	22.2	24.3	28.0	31.0	36.1	40.5	44.3
60	9.3	12.5	14.0	15.2	16.1	17.8	19.2	20.4	23.0	25.1	28.8	31.8	36.9	41.3	45.1
70	10.0	13.2	14.7	15.9	16.8	18.5	19.9	21.1	23.7	25.8	29.5	32.5	37.6	42.0	45.8
80	10.7	13.9	15.4	16.6	17.5	19.2	20.6	21.8	24.4	26.5	30.2	33.2	38.3	42.7	46.5
90	11.4	14.5	16.0	17.2	18.1	19.8	21.2	22.4	25.0	27.1	30.8	33.8	38.9	43.3	47.1
100	12.0	15.1	16.6	17.8	18.7	20.4	21.8	23.0	25.6	27.7	31.4	34.4	39.5	43.9	47.7

[1] Horizon.

12308. WEATHER AND OBSTRUCTIONS TO VISION (Col. 5). Enter weather and obstructions to vision in accordance with pars. 3910 and 3911. Remarks referred to in par. 3920 are not required in marine observations, nor will precipitation measurements referred to in Chapter 4 be made unless specifically authorized.

12309. SEA-LEVEL PRESSURE (Col. 6). Enter sea-level pressure in accordance with par. 7710, as determined from an aneroid barometer which has been compared with a mercurial barometer as specified in the addendum.

12310. TEMPERATURE AND DEW POINT (Cols. 7 and 8). Enter dry-bulb and dew-point temperature in accordance with pars. 5510 and 6410.

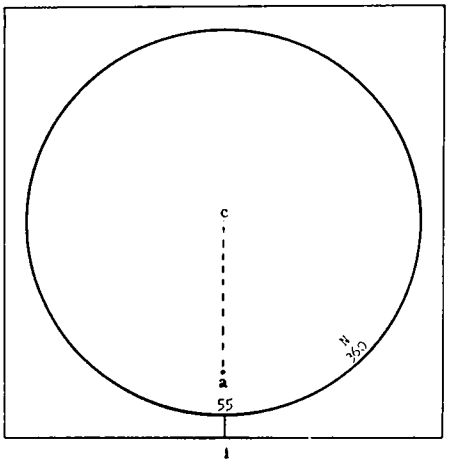
12311. WIND (Cols. 9 - 11). Enter true wind direction, speed (in knots), wind shifts, and gustiness in accordance with section 8400. Compute true wind from apparent wind in accordance with par. 12311.1. Obtain apparent wind from instrumental equipment whenever available and adequately exposed; otherwise, estimate the apparent wind direction to the nearest ten degrees off the bow, and the apparent wind speed to the nearest five knots in accordance with Table 26. Use the values in Table 27 as a check on computed true wind speeds.

TABLE 26. Apparent wind speed

Speed (knots)	Indication
Less than 1	Calm; smoke rises vertically.
1–3	Smoke drifts from funnel.
4–6	Wind felt on face.
7–10	Wind extends light flag.
11–16	Wind raises dust, cinders, loose paper.
17–21	Wind waves and snaps flag briskly.
22–27	Whistling in rigging.
28–33	Inconvenience felt walking against wind.
34–40	Generally impedes progress.

TABLE 27. Determination of wind speed by sea condition

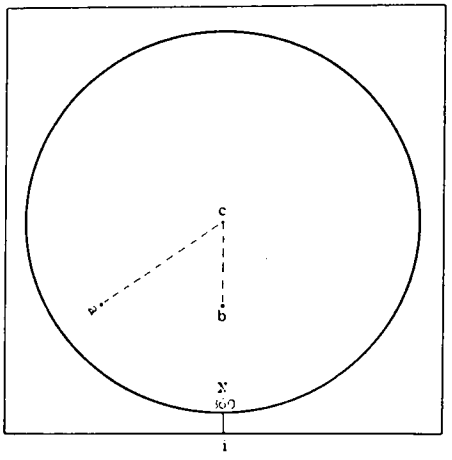
Speed in knots	Descriptive terms	Sea conditions	Wind force (Beaufort)
Less than 1	Calm	Sea smooth and mirror-like	0
1–3	Light air	Scale-like ripples without foam crests	1
4–6	Light breeze	Small, short wavelets; crests have a glassy appearance and do not break.	2
7–10	Gentle breeze	Large wavelets; some crests begin to break; foam of glassy appearance. Occasional white foam crests.	3
11–16	Moderate breeze	Small waves, becoming longer; fairly frequent white foam crests.	4
17–21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white foam crests; there may be some spray.	5
22–27	Strong breeze	Large waves begin to form; white foam crests are more extensive everywhere; there may be some spray.	6
28–33	Moderate gale	Sea heaps up and white foam from breaking waves begin to be blown in streaks along the direction of the wind; spindrift begins.	7
34–40	Fresh gale	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind.	8
41–47	Strong gale	High waves; dense streaks of foam along the direction of the wind; sea begins to roll; spray may reduce visibility.	9
48–55	Whole gale	Very high waves with long overhanging crests. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole, the surface of the sea is white in appearance. The rolling of the sea becomes heavy and shocklike. Visibility is reduced.	10
56–63	Storm	Exceptionally high waves that may obscure small and medium-sized ships. The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility reduced.	11
64 and above	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very much reduced.	12

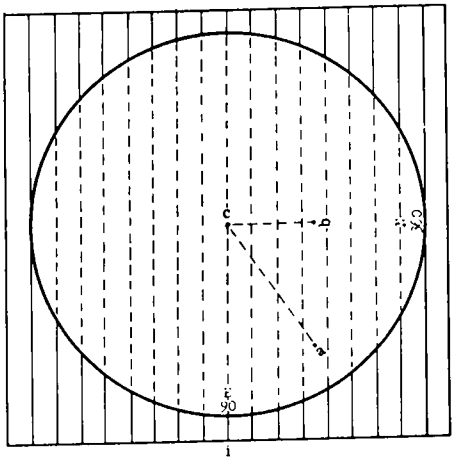


Given: Ship's course 360°, 14 knots.
Apparent wind 55°, 25 knots.
Computation:

Step 1.—Rotate the protractor until 55° is at the bottom of the protractor and is aligned with index line "ic". Using any convenient scale, locate and identify point "a" on line "ic" 25 units distant from the center of the protractor "c" and toward point "i".

Step 2.—Rotate the protractor until the ship's course (360°) is indicated at the bottom of the protractor along line "ic". Using the same scale as in (1), locate and identify point "B" on line "ic" 14 units distant from point "c" and toward point "i".





Step 3.—Rotate the protractor until the line determined by points "a" and "b" is parallel to the parallel lines on the plotting board (beneath the protractor), and until point "b" is above point "a". The true wind direction is the angle indicated at the bottom of the protractor along index line "ic"; i.e., 90°. The true wind speed in knots is equal to the distance "ab" measured with the same scale used in (1) and (2); i.e., 20 knots.

Fig. 7. Computation of true wind speed and direction from apparent wind.

12311.1. To compute true wind from apparent wind, adjust a rotary protractor such as the winds-aloft plotting board so that the apparent wind direction in degrees coincides with the index line at the edge of the protractor closest to the observer. Using any suitable scale, and starting from the center of the protractor, lay off a distance equal to the apparent wind speed along this index line. Plot a point at the correct distance and label it "a". (See Fig. 7.) Turn the protractor until the ship's course in degrees coincides with the index line at the edge of the protractor closest to the observer. Using the same scale and procedure as before, lay off a distance equal to the ship's speed and label the end of this line "b". Using the same scale, obtain the true wind speed by measuring the distance between "a" and "b". Turn the protractor so that point "b" is above point "a" and a line connecting them would be parallel to the index line (see Fig. 7). Read the true wind direction above the index line at the edge of the protractor closest to the observer.

12312. ALTIMETER SETTING (Col. 12). Enter altimeter setting in accordance with par. 7720 on Naval vessels from which aircraft are operated. Omit entry on all other ships.

12312.1. Compute altimeter setting by applying a constant correction to the aneroid barometer reading. Compute this correction by determining the difference in height to the nearest foot between (a) the aneroid barometer and (b) a point ten feet above the landing area (flight deck, landing platform, or ocean surface). Multiply this difference by .001" and round to the nearest .01". Subtract this correction from the aneroid barometer reading if (a) is lower than (b), and add it if (a) is higher than (b).

EXAMPLE:

Given:

(a) Aneroid barometer height - 50 feet

(b) Flight deck height - 55 feet

(c) Aneroid barometer reading - 30.00

Computations:

(a) 55 feet (height of flight deck) + 10 feet = 65 feet

(b) 65 - 50 = 15 feet

(c) 15 x .001 = .015 (or .02 by rounding)

(d) Altimeter setting = 30.00 - .02 = 29.98

12313. REMARKS (Col. 13). Enter appropriate remarks in accordance with par. 11103. Additive data referred to in pars. 11103.1 - 11103.2 are not entered at ship stations.

12314. OBSERVER'S INITIALS (Col. 15). Enter initials of observer taking observation.

12315. TIME (Col. 16). Make no entries in this column. The values printed in the column are the time of scheduled observations to the nearest hour.

12316. STATION PRESSURE (Col. 17). Enter station pressure in inches in accordance with par. 7740.

12317. DRY- AND WET-BULB TEMPERATURES (Cols. 18 and 19). Enter dry- and wet-bulb temperatures in accordance with pars. 5530 and 5540. Determine these temperatures on the windward side of the ship, at a sufficient height to avoid sea spray in accordance with the general procedures in pars. 5150 - 5151.6. (The psychrometer muslin should be changed whenever sea spray falls on it.)

12318. RELATIVE HUMIDITY (Col. 20). Enter relative humidity in accordance with par. 6420.

12319. SKY-COVER DATA (Cols. 21 - 36). Enter sky-cover data in accordance with pars. 1530 - 1544.

12320. (Cols. 39 and 40). Use these columns for data needed locally.

12321. SEA-WATER TEMPERATURE (Col. 40A). Enter sea-water temperature to the nearest whole degree Fahrenheit, as obtained from the condenser-intake thermometer. Whenever a condenser-intake reading cannot be made, enter a reading obtained by the following bucket method:

(a) From as far forward as possible, heave overboard a bucket with line attached and allow time for the bucket to come to sea temperature.

(b) Haul in the bucket of water rapidly.

(c) Carry the bucket immediately to a sheltered place where wind or sunshine will not affect the water temperature.

(d) Stir the water with the thermometer until the thermometer has acquired the water temperature, then read the thermometer with the bulb still under water.

12322. WAVES (Col. 40B). Enter direction, period, and height of waves as follows: (Enter "calm" for no waves. For confused sea, enter "CNFSD" and estimated height of maximum waves, thus CNFSD 28, CNFSD 75, etc.)

(a) Direction.—Direction from which waves are coming, in tens of degrees with reference to true north. Determine this direction by eye observation, or by sighting with a compass parallel to the wave crests and adding or subtracting 90° as appropriate.

(b) Period.—Time in whole seconds between the passage of two successive crests of well-formed waves past a fixed point. Use as a fixed point any object floating on the water (wood, seaweed, foam, etc.), preferably off the bow. Determine with stop watch or seconds hand the interval between successive appearances of the object on the crest, until the object has disappeared or until at least fifteen measurements have been made. Use the average value.

(c) Height.—Average vertical distance in feet between the wave crest and the adjacent trough; whenever possible, obtain this distance by observing the waves near the side of another ship, and estimate their height with respect to known dimensions of the ship - e.g., if the height of the bridge above the water line is 28 feet and the wave crest reaches one quarter of this distance, the wave height is seven feet. If another ship is not available, take the observations at a time when roll and pitch are slight and from a point amidships and near the center line, as follows:

(1) When the distance between successive crests is the same as or less than the length of the ship, estimate the wave height by looking over the side and determining relative heights of the crest and trough with respect to known heights along the ship (e.g., height of sea ladder above water line, height of port holes above water line, etc.).

(2) When the distance between crests is greater than the length of the ship, move up and down the superstructure until the wave crest is aligned with the horizon when the ship is on even keel and in a trough. The wave height will be the height of the eyes above the water line. (Height estimates will be erroneous if the ship is not on even keel when the wave crest is aligned with the horizon.)

EXAMPLE:

Given: Wave direction 40°, period 9 seconds, height 21 feet.

Entry in Column 40B: 040921.

12322.1. Instructions in pars. 11204 - 11207.5 are not applicable to observations recorded on WBAN-11B. Specifically, no distinction should be made between "sea" and "swell" except for the special aviation observations required by par. 12122(2). Waves referred to in par. 12322 are the combined results of "sea" and "swell". Only one wave system will be reported unless the height, direction, and period of a second system are clearly defined, in which case data for the second system will be recorded in column 90 in accordance with par. 12334.1. All wave data will be with respect to large, well-formed waves; disregard the lower, poorly-formed waves.

12323. REMARKS, NOTES, AND MISCELLANEOUS PHENOMENA (Col. 90). Enter data in this column in accordance with pars. 3934 - 3934.7, except that time of sunrise and sunset, rather than character, will be entered.

12324. $YQL_aL_aL_a$ (Col. 91). Enter coded data in accordance with column heading, where the symbols have the following meaning:

(a) Y - Day of week (GCT) in accordance with Table 28.

(b) Q - Octant of the globe in accordance with Table 24.

(c) $L_aL_aL_a$ - Latitude to the nearest tenth of degree. Convert minutes to tenths by dividing by 6 and rounding in accordance with the Introduction - e.g., Code 9°28' as 095.

TABLE 28

SYMBOL Y.— *Day of the week*

Day	Code figure
Sunday	1
Monday	2
Tuesday	3
Wednesday	4
Thursday	5
Friday	6
Saturday	7

12325. $L_oL_oL_oGG$ (Col. 92). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meading:

(a) $L_oL_oL_o$ - Longitude to the nearest tenth of degree. Omit hundreds digit, and convert minutes to tenths in accordance with par. 12324(c) - e.g., Code 125°42' as 267.

(b) GG - The corresponding time entered in column 2 to the nearest whole hour, GCT.

12326. Nddff (Col. 93). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) N - Total amount of clouds, as recorded in column 21 and coded in accordance with Table 29.

(b) dd - Wind direction, as recorded in column 9 and coded in accordance with Table 30.

(c) ff - Wind speed in knots, as recorded in column 10, except that whenever the wind speed is from 100 to 199 knots, inclusive, add 50 to the coded direction and omit the hundreds digit for wind speed - e.g., code wind direction of 270°, speed 105 knots, as 7705.

TABLE 29

SYMBOL "N"—TOTAL AMOUNT OF CLOUD
SYMBOL "N_h"—AMOUNT OF CLOUD WHOSE HEIGHT IS REPORTED BY "h"
SYMBOL "N_s"—AMOUNT OF THE SIGNIFICANT CLOUD LAYER

Code figure	Amount of Sky Covered (in tenths)	Code figure	Amount of Sky Covered (in tenths)
0	No clouds	5	6
1	1- and 1	6	7 and 8
2	2 and 3	7	9 and 9+
3	4	8	10
4	5	[1]9	Sky obscured

[1] Code Figure 9 will be used when the sky is completely hidden with obscuring phenomena. If the sky is only partially hidden, disregard the obscuring phenomena and code cloud data as observed - e.g., "0" if no clouds are present, even though half the sky is hidden.

TABLE 30
Symbol dd - Direction from which wind is blowing. 1/

Code Figure	Direction	Code Figure	Direction
00	Calm	18	S
02	NNE	20	SSW
05	NE	23	SW
07	ENE	25	WSW
09	E	27	W
11	ESE	29	WNW
14	SE	32	NW
16	SSE	34	NNW
		36	N

1/ Wind speeds from 100 to 199 knots, inclusive, are reported by adding 50 to the code figure for "dd" and coding the observed speed minus 100 for "ff". See par. 12326(c).

12327. VVwwW (Col. 94). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) VV - Prevailing visibility, as recorded in column 4 and coded in accordance with Table 31.

(b) ww - Present weather (occurring at the actual time of observation or within one hour of it), coded in accordance with Table 32. Use entries in column 5 as a guide in selecting the proper code figure. If more than one code figure is applicable, use the largest numerical figure.

(c) W - Past weather (occurring within the past 3 or 6 hours), coded in accordance with Table 33. At 0000, 0600, 1200 and 1800 GCT, W refers to the preceding six hours, while at intermediate times (0300, 0900, etc.) W refers to the preceding three hours. Use the largest applicable numerical code figure, except that W and ww should be selected so that the combined code figures describe present and past weather as completely as possible. For example, when the weather occurring at the time of observation (rather than for the previous hour) is coded as ww, the weather during the past six (or three) hours will be coded as W; while if the weather that occurred during the preceding hour is coded as ww, the weather during the five (or two) hours ending one hour before should be coded as W.

TABLE 31
Symbol VV - Visibility

Code Figure	Visibility in Nautical Miles and Fractions	Code Figure	Visibility in Nautical Miles and Fractions
00	Less than 1/8	37	4
01	1/8 and 3/16	46	5
02	1/4	55	6
03	3/8	64	7
04	1/2	74	8
05	5/8	80	9 and 10
06	3/4	81	11 to 20, inclusive
09	1	82	25 and 30
11	1 1/4	83	35 and 40
13	1 1/2	84	45 and 50
16	1 3/4	85	55 to 80, inclusive
18	2	86	85 to 105, inclusive
20	2 1/4	87	110 to 160, inclusive
23	2 1/2	88	165 to 265, inclusive
27	3	89	270 or more

TABLE 32

SYMBOL WW—*Present weather*

00–49 NO PRECIPITATION AT THE SHIP AT THE TIME OF OBSERVATION

00–19: NO PRECIPITATION, FOG, DUSTSTORM, SANDSTORM OR DRIFTING SNOW AT THE SHIP AT THE TIME OF OBSERVATION OR DURING THE PRECEDING HOUR, EXCEPT FOR 09–12.

No hydrometeors except clouds.

- 00 No clouds or cloud development not observed
- 01 Clouds generally dissolving or becoming less developed
- 02 State of sky on the whole unchanged
- 03 Clouds generally forming or developing

} Characteristic change of the state of sky during the past hour.

Haze, dust, sand or smoke.

- 04 Visibility reduced by smoke, e. g., veldt or forest fires, industrial smoke, or volcanic ashes.
- 05 Dry haze.
- 06 Widespread dust in suspension in the air, not raised by wind at or near the ship at the time of observation.
- 07 Dust or sand raised by wind at or near the ship at the time of observation, but no well developed dust devil(s) and no duststorm or sandstorm seen.
- 08 Well developed dust devil(s) seen at or near the ship within last hour, but no duststorm or sandstorm.
- 09 Duststorm or sandstorm within sight of ship or at ship during the last hour.

- 10 Light fog, visibility 1,000 meters (1,100 yards) or more.
- 11 Patches of
- 12 More or less continous

} Shallow fog at the ship not deeper than about 10 meters (33 feet).

- 13 Lightning visible, no thunder heard.
- 14 Precipitation within sight, but not reaching sea at the ship.
- 15 Precipitation within sight, reaching sea, but distant [i. e., estimated to be more than 5 kilometers (3 miles) from ship].
- 16 Precipitation within sight, reaching sea, near to but not at the ship.
- 17 Thunder heard, but no precipitation at the ship.
- 18 Squall(s)
- 19 Funnel cloud(s) (tornado or waterspout)

} within sight during the past hour.

20–29: PRECIPITATION, FOG OR THUNDERSTORM AT THE SHIP DURING THE PRECEDING HOUR BUT *NOT* AT THE TIME OF OBSERVATION.

- 20 Drizzle (not freezing)
- 21 Rain (not freezing)
- 22 Snow
- 23 Rain and snow
- 24 Freezing drizzle or freezing rain

} not falling as showers.

- 25 Shower(s) of rain.
- 26 Shower(s) of snow, or of rain and snow.
- 27 Shower(s) of hail, or of hail and rain.
- 28 Fog.
- 29 Thunderstorm (with or without precipitation).

30–39: DUSTSTORM, SANDSTORM, OR DRIFTING SNOW.

- 30 Slight or moderate duststorm or sandstorm— has decreased during the preceding hour.
- 31 Slight or moderate duststorm or sandstorm— no appreciable change during the preceding hour.
- 32 Slight or moderate duststorm or sandstorm— has increased during the preceding hour.
- 33 Severe duststorm or sandstorm— has decreased during the preceding hour.
- 34 Severe duststorm or sandstorm— no appreciable change during preceding hour.
- 35 Severe duststorm or sandstorm— has increased during the preceding hour.
- 36 Slight or moderate drifting snow
- 37 Heavy drifting snow

} generally low.

- 38 Slight or moderate drifting snow
- 39 Heavy drifting snow

} generally high.

40–49: FOG AT THE TIME OF OBSERVATION.

- 40 Fog at a distance at the time of observation, but not at the ship during the last hour, the fog extending to a level above that of the observer.
- 41 Fog in patches.

See note 1.

- 42 Fog, sky discernible
- 43 Fog, sky not discernible

} has become thinner during the preceding hour.

- 44 Fog, sky discernible
- 45 Fog, sky not discernible

} no appreciable change during the preceding hour.

- 46 Fog, sky discernible
- 47 Fog, sky not discernible

} has begun or has become thicker during the preceding hour.

- 48 Fog, depositing rime, sky discernible.
- 49 Fog, depositing rime, sky not discernible.

[1] Visibility less than ⅝ miles.

TABLE 32 (continued)

50–99 PRECIPITATION AT THE SHIP AT THE TIME OF OBSERVATION

50–59: DRIZZLE AT TIME OF OBSERVATION.

50	Drizzle, not freezing, intermittent	slight at time of observation.
51	Drizzle, not freezing, continuous	
52	Drizzle, not freezing, intermittent	moderate at time of observation.
53	Drizzle, not freezing, continuous	
54	Drizzle, not freezing, intermittent	thick at time of observation.
55	Drizzle, not freezing, continuous	
56	Drizzle, freezing, slight.	
57	Drizzle, freezing, moderate or thick.	
58	Drizzle and rain, slight.	
59	Drizzle and rain, moderate or heavy.	

60–69: RAIN AT TIME OF OBSERVATION.

60	Rain, not freezing, intermittent	slight at time of observation.
61	Rain, not freezing, continuous	
62	Rain, not freezing, intermittent	moderate at time of observation.
63	Rain, not freezing, continuous	
64	Rain, not freezing, intermittent	heavy at time of observation.
65	Rain, not freezing, continuous	
66	Rain, freezing, slight.	
67	Rain, freezing, moderate or heavy.	
68	Rain or drizzle and snow, slight.	
69	Rain or drizzle and snow, moderate or heavy.	

70–79: SOLID PRECIPITATION NOT IN SHOWERS AT TIME OF OBSERVATION.

70	Intermittent fall of snowflakes	slight at time of observation.
71	Continuous fall of snowflakes	
72	Intermittent fall of snowflakes	moderate at time of observation.
73	Continuous fall of snowflakes	
74	Intermittent fall of snowflakes	heavy at time of observation.
75	Continuous fall of snowflakes	
76	Ice needles (with or without fog).	
77	Granular snow (with or without fog).	
78	Isolated starlike snow crystals (with or without fog).	
79	Ice pellets.	

80–99: SHOWERY PRECIPITATION, OR PRECIPITATION WITH CURRENT OR RECENT THUNDERSTORM.

80	Rain shower(s), slight.	
81	Rain shower(s), moderate or heavy.	
82	Rain shower(s), violent.	
83	Shower(s) of rain and snow mixed, slight.	
84	Shower(s) of rain and snow mixed, moderate or heavy.	
85	Snow shower(s), slight.	
86	Snow shower(s), moderate or heavy.	
87	Shower(s) of soft or small hail, with or without rain, or rain and snow mixed— slight.	
88	Shower(s) of soft or small hail, with or without rain, or rain and snow mixed— moderate or heavy.	
89	Shower(s) of hail, with or without rain, or rain and snow mixed, not associated with thunder— slight.	
90	Shower(s) of hail, with or without rain, or rain and snow mixed, not associated with thunder— moderate or heavy.	
91	Slight rain at time of observation	thunderstorm during the preceding hour but not at time of observation.
92	Moderate or heavy rain at time of observation	
93	Slight snow or rain and snow mixed or hail* at time of observation	
94	Moderate or heavy snow, or rain and snow mixed or hail* at time of observation	
95	Thunderstorm, slight or moderate, without hail* but with rain and/or snow* at time of observation	thunderstorm at time of observation.
96	Thunderstorm, slight or moderate, with hail* at time of observation	
97	Thunderstorm, heavy, without hail* but with rain and/or snow at time of observation	
98	Thunderstorm combined with duststorm or sandstorm—at time of observation	
99	Thunderstorm, heavy, with hail* at time of observation	

* Hail, small hail, soft hail.

TABLE 33
Symbol W - Past Weather
(During 3 or 6 hours preceding the ACTUAL time of observation)

Code Figure	Past Weather
0	0 or 1- clouds
1	0.1 to 0.5 clouds
2	More than 0.5 clouds
3	Sandstorm, or duststorm, or drifting or blowing snow
4	Fog, or smoke, or thick dust haze
5	Drizzle
6	Rain
7	Snow, or rain and snow mixed, or sleet
8	Shower(s)
9	Thunderstorm, with or without precipitation

NOTE: When precipitation or thunderstorms have occurred and have not been reported by ww, code figures 5 to 9 will be used as appropriate even though they do not represent the generally prevailing weather.

12328. PPPTT (Col. 95). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) PPP - Sea-level pressure in tens, units, and tenths of millibars. Omit hundreds and thousands digits. Convert inches to millibars in accordance with Table 34.

(b) TT - Temperature to the nearest whole degree Fahrenheit. Omit the hundreds digit for temperatures above 99°; when the temperature is below zero, subtract the actual temperature from 100 and code the remainder - e.g., code 105° as 05; -2° as 98.

TABLE 34

SYMBOL PPP.—*Corrected barometer reading*

[Code in "tens," "units," and "tenths" of millibars, omit initial 9 or 10]

[1 inch=33.86395 mb. 1 mb.=0.0295299 inch]

in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.
27.50	931.3	28.00	948.2	28.50	965.1	29.00	982.1	29.50	999.0	30.00	1015.9	30.50	1032.9	31.00	1049.8
27.51	931.6	28.01	948.5	28.51	965.5	29.01	982.4	29.51	999.3	30.01	1016.3	30.51	1033.2	31.01	1050.1
27.52	931.9	28.02	948.9	28.52	965.8	29.02	982.7	29.52	999.7	30.02	1016.6	30.52	1033.5	31.02	1050.5
27.53	932.3	28.03	949.2	28.53	966.1	29.03	983.1	29.53	1000.0	30.03	1016.9	30.53	1033.9	31.03	1050.8
27.54	932.6	28.04	949.5	28.54	966.5	29.04	983.4	29.54	1000.3	30.04	1017.3	30.54	1034.2	31.04	1051.1
27.55	933.0	28.05	949.9	28.55	966.8	29.05	983.7	29.55	1000.7	30.05	1017.6	30.55	1034.5	31.05	1051.5
27.56	933.3	28.06	950.2	28.56	967.2	29.06	984.1	29.56	1001.0	30.06	1018.0	30.56	1034.9	31.06	1051.8
27.57	933.6	28.07	950.6	28.57	967.5	29.07	984.4	29.57	1001.4	30.07	1018.3	30.57	1035.2	31.07	1052.2
27.58	934.0	28.08	950.9	28.58	967.8	29.08	984.8	29.58	1001.7	30.08	1018.6	30.58	1035.6	31.08	1052.5
27.59	934.3	28.09	951.2	28.59	968.2	29.09	885.1	29.59	1002.0	30.09	1019.0	30.59	1035.9	31.09	1052.8
27.60	934.6	28.10	951.6	28.60	968.5	29.10	985.4	29.60	1002.4	30.10	1019.3	30.60	1036.2	31.10	1053.2
27.61	935.0	28.11	951.9	28.61	968.8	29.11	985.8	29.61	1002.7	30.11	1019.6	30.61	1036.6	31.11	1053.5
27.62	935.3	28.12	952.3	28.62	969.2	29.12	986.1	29.62	1003.1	30.12	1020.0	30.62	1036.9	31.12	1053.8
27.63	935.7	28.13	952.6	28.63	969.5	29.13	986.5	29.63	1003.4	30.13	1020.3	30.63	1037.3	31.13	1054.2
27.64	936.0	28.14	952.9	28.64	969.9	29.14	986.8	29.64	1003.7	30.14	1020.7	30.64	1037.6	31.14	1054.5
27.65	936.3	28.15	953.3	28.65	970.2	29.15	987.1	29.65	1004.1	30.15	1021.0	30.65	1037.9	31.15	1054.9
27.66	936.7	28.16	953.6	28.66	970.5	29.16	987.5	29.66	1004.4	30.16	1021.3	30.66	1038.3	31.16	1055.2
27.67	937.0	28.17	953.9	28.67	970.9	29.17	987.8	29.67	1004.7	30.17	1021.7	30.67	1038.6	31.17	1055.5
27.68	937.4	28.18	954.3	28.68	971.2	29.18	988.2	29.68	1605.1	30.18	1022.0	30.68	1038.9	31.18	1055.9
27.69	937.7	28.19	954.6	28.69	971.6	29.19	988.5	29.69	1095.4	30.19	1022.4	30.69	1039.3	31.19	1056.2
27.70	938.0	28.20	955.0	28.70	971.9	29.20	988.8	29.70	1005.8	30.20	1022.7	30.70	1039.6	31.20	1056.6
27.71	938.4	28.21	955.3	28.71	972.2	29.21	989.2	29.71	1006.1	30.21	1023.0	30.71	1040.0	31.21	1056.9
27.72	938.7	28.22	955.6	28.72	972.6	29.22	989.5	29.72	1006.4	30.22	1023.4	30.72	1040.3	31.22	1057.2
27.73	939.0	28.23	956.0	28.73	972.9	29.23	989.8	29.73	1006.8	30.23	1023.7	30.73	1040.6	31.23	1057.6
27.74	939.4	28.24	956.3	28.74	973.2	29.24	990.2	29.74	1007.1	30.24	1024.0	30.74	1041.0	31.24	1057.9
27.75	939.7	28.25	956.7	28.75	973.6	29.25	990.5	29.75	1007.5	30.25	1024.4	30.75	1041.3	31.25	1058.2
27.76	940.1	28.26	957.0	28.76	973.9	29.26	990.9	29.76	1007.8	30.26	1024.7	30.76	1041.7	31.26	1058.6
27.77	940.4	28.27	957.3	28.77	974.3	29.27	991.2	29.77	1008.1	30.27	1025.1	30.77	1042.0	31.27	1058.9
27.78	940.7	28.28	957.7	28.78	974.6	29.28	991.5	29.78	1008.5	30.28	1025.4	30.78	1042.3	31.28	1059.3
27.79	941.1	28.29	958.0	28.79	974.9	29.29	991.9	29.79	1008.8	30.29	1025.7	30.79	1042.7	31.29	1059.6
27.80	941.4	28.30	958.3	28.80	975.3	29.30	992.2	29.80	1009.1	30.30	1026.1	30.80	1043.0	31.30	1059.9
27.81	941.8	28.31	958.7	28.81	975.6	29.31	992.6	29.81	1009.5	30.31	1026.4	30.81	1043.3	31.31	1060.3
27.82	942.1	28.32	959.0	28.82	976.0	29.32	992.9	29.82	1009.8	30.32	1026.8	30.82	1043.7	31.32	1060.6
27.83	942.4	28.33	959.4	28.83	976.3	29.33	993.2	29.83	1010.2	30.33	1027.1	30.83	1044.0	31.33	1061.0
27.84	942.8	28.34	959.7	28.84	976.6	29.34	993.6	29.84	1010.5	30.34	1027.4	30.84	1044.4	31.34	1061.3
27.85	943.1	28.35	960.0	28.85	977.0	29.35	993.9	29.85	1010.8	30.35	1027.8	30.85	1044.7	31.35	1061.6
27.86	943.4	28.36	960.4	28.86	977.3	29.36	994.2	29.86	1011.2	30.36	1028.1	30.86	1045.0	31.36	1062.0
27.87	943.8	28.37	960.7	28.87	977.7	29.37	994.6	29.87	1011.5	30.37	1028.4	30.87	1045.4	31.37	1062.3
27.88	944.1	28.38	961.1	28.88	978.0	29.38	994.9	29.88	1011.9	30.38	1028.8	30.88	1045.7	31.38	1062.7
27.89	944.5	28.39	961.4	28.89	978.3	29.39	995.3	29.89	1012.2	30.39	1029.1	30.89	1046.1	31.39	1063.0
27.90	944.8	28.40	961.7	28.90	978.7	29.40	995.6	29.90	1012.5	30.40	1029.5	30.90	1046.4	31.40	1063.3
27.91	945.1	28.41	962.1	28.91	979.0	29.41	995.9	29.91	1012.9	30.41	1029.8	30.91	1046.7	31.41	1063.7
27.92	945.5	28.42	962.4	28.92	979.3	29.42	996.3	29.92	1013.2	30.42	1030.1	30.92	1047.1	31.42	1064.0
27.93	945.8	28.43	962.8	28.93	979.7	29.43	996.6	29.93	1013.5	30.43	1030.5	30.93	1047.4	31.43	1064.3
27.94	946.2	28.44	963.1	28.94	980.0	29.44	997.0	29.94	1013.9	30.44	1030.8	30.94	1047.8	31.44	1064.7
27.95	946.5	28.45	963.4	28.95	980.4	29.45	997.3	29.95	1014.2	30.45	1031.2	30.95	1048.1	31.45	1065.0
27.96	946.8	28.46	963.8	28.96	980.7	29.46	997.6	29.96	1014.6	30.46	1031.5	30.96	1048.4	31.46	1065.4
27.97	947.2	28.47	964.1	28.97	981.0	29.47	998.0	29.97	1014.9	30.47	1031.8	30.97	1048.8	31.47	1065.7
27.98	947.5	28.48	964.4	28.98	981.4	29.48	998.3	29.98	1015.2	30.48	1032.2	30.98	1049.1	31.48	1066.0
27.99	947.9	28.49	964.8	28.99	981.7	29.49	998.6	29.99	1015.6	30.49	1032.5	30.99	1049.5	31.49	1066.4

12329. $N_hC_LhC_MC_H$[1/] (Col. 96). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) N_h - Total amount of clouds whose height is reported by h (see (c) below), coded in accordance with Table 29. When two or more cloud types are present below 8000 feet, select a code figure for N_h corresponding to the total amount of clouds reported by C_L (or C_M, if appropriate in accordance with (c) below).

(b) C_L - The predominant C_L cloud, coded in accordance with Table 35. When two or more types of C_L clouds cover equal amounts of sky, report the highest with respect to altitude.

(c) h - The height of C_L clouds, coded in accordance with Table 36, except that if no C_L clouds covering one tenth or more of the sky are present below 8000 feet, the height of C_M clouds below that elevation will be reported.

(d) C_M - The predominant C_M cloud, coded in accordance with Table 37. When two or more types of C_M clouds cover equal amounts of sky, report the highest with respect to altitude.

(e) C_H - The predominant C_H cloud, coded in accordance with Table 38. When two or more types of C_H clouds cover equal amounts of sky, report the highest with respect to altitude.

1/ This group will be sent even if no clouds are present.

TABLE 35

Symbol C_L - Clouds of types stratocumulus, stratus, cumulus, and cumulonimbus 1/

Code figures	Technical specifications
0	No clouds C_L
1	Cumulus humilis
2 2/	Cumulus congestus, with or without cumulus humilis or stratocumulus at the same level of base
3 3/	Cumulonimbus calvus, with or without cumulus, stratocumulus or stratus
4	Stratocumulus cumulogenitus or vesperalis
5	Stratocumulus other than cumulogenitus and vesperalis
6	Stratus and/or fractostratus, but not fractostratus of bad weather
7	Fractostratus and/or fractocumulus of bad weather ("scud") usually under altostratus and nimbostratus
8	Cumulus humilis or congestus and stratocumulus other than cumulogenitus and vesperalis with bases at different levels
9 3/	Cumulonimbus capillatus (often with anvil) with or without cumulus, stratocumulus, stratus or "scud"
/	Clouds of C_L type cannot be observed due to the sky being obscured by rain, snow, fog, duststorm, sandstorm, smoke, or other phenomena

1/ See Weather Bureau Circular S for nontechnical specifications and other explanatory remarks.

2/ Code figure 2 will be used to indicate the presence of any cumulus of considerable vertical development, even though cumulus-humilis predominated.

3/ Code figure 3 or 9 will be used to report the presence of any cumulonimbus even though other low clouds predominate.

TABLE 36

Symbol h - Height of base of cloud above sea 1/

Code figure	Height in feet	Approximate height in meters
[2]0	0 - 149	0 - 49
1	150 - 299	50 - 99
2	300 - 599	100 - 199
3	600 - 999	200 - 299
4	1000 - 1999	300 - 599
5	2000 - 3499	600 - 999
6	3500 - 4999	1000 - 1499
7	5000 - 6499	1500 - 1999
8	6500 - 7999	2000 - 2500
9	No clouds, or clouds at 8,000 or higher	No clouds, or clouds at 2,500 or higher.

1/ When the code figure for C_L describes two or more kinds of clouds - e.g., $C_L = 8$, code the height corresponding to the cloud covering the greater portion of the sky; if exactly equal amounts are covered, code the height corresponding to the highest layer. Similar procedures will be followed if two layers of the same cloud type are present - e.g., $C_L = 5$ at 2000 and 5000 feet.

2/ When the sky is completely hidden by obscuring phenomena and, in addition, no clouds below 8000 feet are visible, use code figure 0; otherwise, disregard the obscuring phenomena and code h as observed - e.g., use code figure 9 if no clouds are observable even though half the sky is hidden by fog.

TABLE 37
Symbol C_M - Clouds of types altocumulus, altostratus, and nimbostratus 1/

Code figures	Technical specifications
0	No clouds C_M
1	Altostratus translucidus
2	Altostratus opacus, or nimbostratus
3	Altocumulus translucidus more or less stable and at a single level
4	Altocumulus translucidus in patches (often lenticular) continually transforming and/or occurring at different levels.
5	Altocumulus translucidus in bands or in a layer systematically invading the sky and usually thickening as a whole, even partly into altocumulus opacus or duplicatus
6	Altocumulus cumulogenitus
7	Altocumulus duplicatus or opacus, not increasing; or altostratus and altocumulus
8 2/	Altocumulus cumiliformis (floccus or castellatus)
9 2/	Altocumulus of a chaotic sky; generally at different levels; cirrus densus in patches usually present
/	Clouds of C_M type cannot be observed due to (a) an intervening cover (usually more than 9/10) "C_L" type clouds, or (b) the sky is obscured by rain, snow, fog, duststorm sandstorm, or other phenomena

1/ See Weather Bureau Circular S for nontechnical specifications and other explanatory remarks.

2/ Use code figure 9 whenever clouds of a chaotic sky are observable irrespective of other C_M type clouds present. In the absence of clouds coded as 9, use code figure 8 whenever the corresponding clouds are observable even though they do not predominate.

TABLE 38
Symbol C_H - Clouds of types cirrus, cirrostratus, and cirrocumulus 1/

Code figure	Technical specifications
0	No clouds C_H
1	Cirrus filosus, scattered and not increasing
2	Cirrus densus in patches or twisted sheaves usually not increasing, sometimes presumably being the remains of the upper part of cumulonimbus
3	Cirrus nothus: either the remains of cumulonimbus or part of a distant cumulonimbus the rest of which is not visible
4	Cirrus (often cirrus uncinus) systematically invading the sky and usually thickening as a whole
5	Cirrus, often in polar bands, and/or cirrostratus systematically invading the sky and usually thickening as a whole, but the continuous layer not reaching 45° altitude
6	Cirrus, often in polar bands, and/or cirrostratus systematically invading the sky and usually thickening as a whole, and the continuous layer exceeding 45° altitude
7	Cirrostratus covering the whole sky
8	Cirrostratus not increasing and not covering the whole sky
9	Cirrocumulus the dominant cirriform cloud
/	Clouds of "C_H" type cannot be observed due to (a) an intervening cover (usually more than 9/10) of "C_L" or "C_M" types of clouds, or (b) the sky is obscured by rain, snow, fog, duststorm, sandstorm, smoke, or other phenomena

1/ See Weather Bureau Circular S for nontechnical specifications and other explanatory remarks.

12330. $D_S v_S$app (Col. 97). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) D_S - Ship's course, as recorded in column 1B and coded in accordance with Table 39.

(b) v_S - Ship's speed, as recorded in column 1C and coded in accordance with Table 40.

(c) a - Pressure tendency, determined in accordance with sec. 7600.

(d) pp - Pressure change, determined in accordance with sec. 7600 and coded in accordance with Table 41. When the change equals or exceeds 9.9 millibars, insert the group 99ppp immediately following group $D_S v_S$app. For ppp, enter the pressure change in tens, units, and tenths of millibars, and code pp as 99 in group $D_S v_S$app, (e.g., if the pressure change is 23.4, code the two groups as $D_S v_S$a99 99234). For record purposes, enter group 99ppp in column 90 with an asterisk in column 97 to indicate its relative position in the message.

TABLE 39

SYMBOL D_s.—*Ship's course—direction toward which ship is moving*

Code figures	True direction	Code figures	True direction
0	Ship hove to.	5	SW.
1	NE.	6	W.
2	E.	7	NW.
3	SE.	8	N.
4	S.	9	No information.

TABLE 40

SYMBOL v_s.—*Ship's speed*

Code figures	Speed	Code figures	Speed
0	Ship stopped.	5	13 to 15 knots.
1	1 to 3 knots.	6	16 to 18 knots.
2	4 to 6 knots.	7	19 to 21 knots.
3	7 to 9 knots.	8	22 to 24 knots.
4	10 to 12 knots.	9	More than 24 knots.

TABLE 41

Symbols "pp" and "ppp." —*Amount of barometric change in the last 3 hours*

Amount of rise or fall											
pp						ppp					
Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars
00	0.000	0.0				100	0.295	10.0			
02	0.005	0.2	52	0.155	5.2	102	.300	10.2			
03	0.010	0.3	54	0.160	5.4						
05	0.015	0.5	56	0.165	5.6	103	.305	10.3	154	0.455	15.4
07	0.020	0.7	58	0.170	5.8	105	.310	10.5	156	.460	15.6
08	0.025	0.8	59	0.175	5.9	107	.315	10.7	157	.465	15.7
						108	.320	10.8	159	.470	15.9
10	0.030	1.0	61	0.180	6.1	110	.325	11.0	161	.475	16.1
12	0.035	1.2	63	0.185	6.3						
14	0.040	1.4	64	0.190	6.4	112	.330	11.2	163	.480	16.3
15	0.045	1.5	66	0.195	6.6	113	.335	11.3	164	.485	16.4
17	0.050	1.7	68	0.200	6.8	115	.340	11.5	166	.490	16.6
						117	.345	11.7	168	.495	16.8
19	0.055	1.9	69	0.205	6.9	119	.350	11.9	169	.500	16.9
20	0.060	2.0	71	0.210	7.1						
22	0.065	2.2	73	0.215	7.3	120	.355	12.0	171	.505	17.1
24	0.070	2.4	75	0.220	7.5	122	.360	12.2	173	.510	17.3
25	0.075	2.5	76	0.225	7.6	124	.365	12.4	174	.515	17.4
						125	.370	12.5	176	.520	17.6
27	0.080	2.7	78	0.230	7.8	127	.375	12.7	178	.525	17.8
29	0.085	2.9	80	0.235	8.0						
30	0.090	3.0	81	0.240	8.1	129	.380	12.9	179	.530	17.9
32	0.095	3.2	83	0.245	8.3	130	.385	13.0	181	.535	18.1
34	0.100	3.4	85	0.250	8.5	132	.390	13.2	183	.540	18.3
						134	.395	13.4	185	.545	18.5
36	0.105	3.6	86	0.255	8.6	135	.400	13.5	186	.550	18.6
37	0.110	3.7	88	0.260	8.8						
39	0.115	3.9	90	0.265	9.0	137	.405	13.7	188	.555	18.8
41	0.120	4.1	91	0.270	9.1	139	.410	13.9	190	.560	19.0
42	0.125	4.2	93	0.275	9.3	141	.415	14.1	191	.565	19.1
						142	.420	14.2	193	.570	19.3
44	0.130	4.4	95	0.280	9.5	144	.425	14.4	195	.575	19.5
46	0.135	4.6	97	0.285	9.7						
47	0.140	4.7	98	0.290	9.8	146	.430	14.6	196	.580	19.6
49	0.145	4.9		0.295	10.0	147	.435	14.7	198	.585	19.8
51	0.150	5.1	[1]99	0.300	10.2	149	.440	14.9	200	.590	20.0
				etc.	etc.	151	.445	15.1	201	.595	20.1
						152	.450	15.2	203	.600	20.3

[1] When the amount of the barometric pressure change equals or exceeds 9.9 millibars, the group "99ppp" should be inserted in the message following the "D_sv_sapp" group. The "99" is the group identifier, and "ppp" is the total amount of the pressure change (in tens, units, and tenths of millibars) during the preceding 3 hours. When the group is inserted, "99" should be reported for "pp" in the "D_sv_sapp" group. *For example:* If the total amount of the pressure change is 13.4 millibars, the groups should be coded "D_sv_sa99 99134." If the amount is 9.9 millibars, the groups are coded "D_sv_sa99 99099." ("D_sv_sa" should be given appropriate values.)

12331. $8N_sCh_sh_s$ 1/ (Col. 98). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) N_s - Amount of significant cloud, selected in accordance with the following criteria and coded in accordance with Table 29:

(1) The lowest cloud layer below 20,000 feet covering more than 1/2 of the sky. 2/

(2) The lowest layer of cloud, if any, below the layer described in (1).

(3) If no layer below 20,000 feet covers more than 1/2 the sky, the significant cloud layer is the lowest layer below 20,000 feet. 2/

(4) If both the layers described in (1) and (2) are present, report two 8-groups in the above order. For record purposes, enter the second 8-group in column 90 with an asterisk in column 98 to indicate its proper position in the report.

(b) C - Type of significant cloud, coded in accordance with Table 42.

(c) h_sh_s - Height of significant cloud, coded in accordance with Table 43.

TABLE 42
Symbol "C" - Genus (type) of significant cloud

Code Figure	Type of Cloud	Code Figure	Type of Cloud
1	Cirrus (Ci)	7	Nimbostratus (Ns)
2	Cirrostratus (Cs)	8	Cumulus or Fracto-cumulus (Cu or Fc)
3	Cirrocumulus (Cc)		
4	Altocumulus (Ac)	9	Cumulonimbus (Cb)
5	Altostratus (As)	0	Stratus or Fracto-stratus (St or Fs)
6	Stratocumulus (Sc)	/	Whenever sky is obscured and significant cloud is not visible

1/ Omit this group if no significant clouds are present.
2/ Obtain the amount of cloud cover in each layer from the corresponding entries in cols. 22, 25, 29, and 33.

TABLE 43

(International Code 40)

SYMBOL "h,h,"—HEIGHT ABOVE STATION OF THE LAYER OF SIGNIFICANT CLOUD REPORTED BY "N," [1]

Code figure	Height in feet	Code figure	Height in feet
00	Lower than 100	78	7800
01	100	79	7900
02	200	80	8000
03	300	81	9000
04	400	(82)	Not specified
05	500	83	10,000; 11,000; 12,000
06	600	84	13,000; 14,000; 15,000
07	700	85	16,000; 17,000; 18,000; and 19,000
08	800		
09	900	86	20,000; 21,000; 22,000
10	1000	87	23,000; 24,000; 25,000
11	1100	88	26,000; 27,000; 28,000; and 29,000
etc.	etc.		
		89	30,000 or higher

1/ When the sky is obscured by rain, snow, etc., use the foregoing code figures to report vertical visibility.

12332. $9S_pS_ps_ps_p$ (Col. 99). Special phenomena groups will be sent only when the phenomenon is not reported elsewhere in the message and is important for forecast activities. If more than one group is sent, enter the additional groups in column 90 with an asterisk in column 99 to indicate its proper position in the message. In general, the following special phenomena groups are sent by ships.

(1) Direction and speed of maximum wind during the previous three hours, provided it exceeded 33 knots for a one-minute period.

(2) Pronounced variation in wind direction and speed, visibility, and pressure.

12332.1. Code symbols in this group are defined as follows:

(a) S_pS_p - General description of special phenomena, selected from Table 44.

(b) s_ps_p - Detailed description of special phenomena, selected from Table 45. (Symbols following individual elements in Table 44 indicate the corresponding portion of Table 45 to be used.)

TABLE 44

SYMBOL S_pS_p—SPECIAL PHENOMENA TABLE, "GENERAL" DESCRIPTION

Code figure	"General" description with "detailed" code used (Symbol of detailed code shown in parentheses)
	00 to 39: Direction of maximum wind and special wind data
*00	Maximum wind direction in tens of degrees (00–36). (dd, Table 30).
*01	Maximum wind velocity. (ff)
02	Maximum wind from the north-northeast. (ff)
04	Maximum wind from the northeast. (ff)
06	Maximum wind from the east-northeast. (ff)
08	Maximum wind from the east. (ff)
10	Maximum wind from the east-southeast. (ff)
12	Maximum wind from the southeast. (ff)
14	Maximum wind from the south-southeast. (ff)
16	Maximum wind from the south. (ff)
18	Maximum wind from the south-southwest. (ff)
20	Maximum wind from the southwest. (ff)
22	Maximum wind from the west-southwest. (ff)
24	Maximum wind from the west. (ff)
26	Maximum wind from the west-northwest. (ff)
28	Maximum wind from the northwest. (ff)
30	Maximum wind from the north-northwest. (ff)
32	Maximum wind from the north. (ff)
33	Direction of maximum wind unknown. (D_mD_m)
34	Velocity of maximum wind unknown. (ff)
35	Wind direction in past hour, or Wind direction one hour ago. (zz or D_mD_m)
36	Wind velocity in past hour. (zz)
37	Time of highest wind. (tt)
38	Pronounced shift in wind direction. (tt, zz)
39	Wind velocity at time of observation. (ff)
	40 to 49: Fog, smoke, haze, dust, sand, and blowing snow
40	Fog. (D_sD_s, zz)
41	Fog began. (tt, zz)
42	Fog ended. (tt, zz)
43	Fog bank in distance. (D_sD_s, zz)
44	Smoke. (D_sD_s, zz)
45	Haze. (D_sD_s, zz)
46	Blowing dust or sand. (D_sD_s, zz)
47	Storm of blowing dust or sand. (tt, zz)
48	Storm of drifting or blowing snow. (tt, zz)
	50 to 59: Clouds, ceiling, and cloud height
50	Direction of C_L *and* C_M clouds (each to 8 points in D_C code). (D_L & D_M)
51	Clouds, or Direction of clouds *from station*. (zz or D_sD_s)
52	Direction of C_L clouds (to 16 points), or C_L clouds. (D_mD_m or zz)
53	Direction of C_M clouds (to 16 points), or C_M clouds. (D_mD_m or zz)
54	Direction of C_H clouds (to 16 points), or C_H clouds. (D_mD_m or zz)
55	Ceiling. (zz)
56	Height of lowest clouds above ground (in "hundreds" of feet). (nn)
57	Height of highest clouds above ground (in "thousands" of feet). (nn)
58	Height of "ceiling," if under 950 feet (in "tens" of feet). (nn)
59	Tops of overcast (reported by pilot) in "thousands" of feet. (nn)
	60 to 69: Precipitation
60	Precipitation. (D_sD_s, zz)
61	Precipitation began. (tt, zz)
62	Precipitation ended. (tt, zz)
63	Rain, or Rain began. (zz or tt)
64	Snow, or Snow began. (zz or tt)
65	Freezing rain, or Freezing rain began. (zz or tt)
66	Sleet, or Sleet began. (zz or tt)
67	Wet snow, or Wet snow began. (zz or tt)
68	Hail, or Hail began. (zz or tt)
69	Rain and snow mixed, or Rain and snow mixed began. (zz or tt)
	70 to 79: Visibility, temperature, and pressure
70	Visibility. (zz)
71	Reduced visibility. (D_sD_s, zz)
72	Visibility in "whole miles". (nn)
73	Visibility in "tens" of feet. (nn)
74	Vertical visibility. (zz)
75	Water temperature in degrees Fahrenheit. (nn)
76	
77	Surface "station pressure" in "tenths" and "hundredths" of an inch. (nn)
78	Lowest sea level pressure in last 6 hours (in "tens" and "units" of mb). (nn)
79	Barometer, or Time of lowest pressure. (zz or tt)
	80 to 89: Miscellaneous
80	Supplementary "present weather" at time of observation. ("ww" code)
81	Frost. (tt, zz)
82	Glaze. (tt, zz)
83	State of Sea or Period of Sea Swell. (S_sS_s or K_pK_p)
84	
85	Depth of snow on ground (in whole inches). (nn)
86	Front passed station, or Front. (tt, zz)
87	Cold front passed station, or Cold front. (tt, zz)
88	Warm front passed station, or Warm front. (tt, zz)
89	Direction and Orientation of Cloud Shield. (D_C, and D_o)
	90 to 99: Thunderstorms
90	Thunderstorm. (D_sD_s, zz)
91	Thunder first heard at station (with precipitation at station). (tt, zz)
92	Thunder last heard at station (with precipitation at station). (tt, zz)
93	Thunder first heard (but without precipitation at station). (tt, zz)
94	Thunder last heard (but without precipitation at station). (tt, zz)
95	Direction of movement of thunderstorm. (D_mD_m)
96	Distant lightning. (D_sD_s, zz)
97	Distant thunderstorm. (D_sD_s, zz)
98	Approaching thunderstorm. (D_sD_s, zz)
99	Tornado. (tt, zz)

* To conform to WMO resolutions, U. S. Weather Bureau stations will use code figures 00 and 01 to report maximum wind direction and velocity.

NOTE: The above Special Phenomena Code will be used until a revised Special Phenomena Code is adopted in Region IV of the WMO.

TABLE 45

Symbol "$s_p s_p$" = Special Phenomena Table, "Detailed" Description

Several individual code tables are required to report data for "$s_p s_p$". For ease of identification the individual "$s_p s_p$" code tables are considered to be parts of one general "$s_p s_p$" code table (No. 45) and have been designated by letter (e.g., 45a, 45b, etc.) The individual "$s_p s_p$" code tables are:

45a Wind Speed Table.....(ff)

45b Numerical Table.....(nn)

45c Time Table.....(tt)

45d Direction of Movement Table.....($D_m D_m$)

45d Direction from Station Table.....($D_S D_S$)

45e Variation Table.....(zz)

45f Direction of Cloud Movement Table.....(D_L and D_H)

45f Direction of Cloud Shield from Station.....(D_{CS})

45g Orientation of Cloud Shield Table.....(D_O)

TABLE 45a

"WIND SPEED" TABLE

Symbol "ff" – Wind Speed in knots. (00 to 99)

Code Figure	Wind Speed	Code Figure	Wind Speed
00	Calm; or unknown	97	97 knots
01	1 knot	98	98 knots
02	2 knots	99	99 knots; or 100 knots
03	3 knots	01	101 knots*
04	4 knots	02	102 knots*
etc.	etc.	03	103 knots*
95	95 knots	04	104 knots*
96	96 knots	etc.	etc.

*When the wind speed is greater than 100 knots TWO Special Phenomena groups are included in the message and the same code figure is reported for "S_PS_P" in both groups. In the first group "99" is reported for "s_ps_p" and in the second group the speed in EXCESS of 100 knots is reported for "s_ps_p". For example: In reporting a maximum wind of 124 knots, the groups are coded "90199 90124."

TABLE 45b

"NUMERICAL" TABLE

Symbol "nn" – Units of specific value. (00 to 99)

Code figure	Value (depending on "general" code figure used)
00	Zero or less than 1 unit
01	"1"; "10"; "100"; or "1,000"
02	"2"; "20"; "200"; or "2000"
etc.	etc
12	"12"; "120"; "1,200"; or "12,000"
13	"13"; "130"; "1,300"; or "13,000"
etc.	etc
98	"98"; "980"; "9,800"; or "98,000"
*99	"99" or more; "990" or more; "9,900" or more; "99,000" or more

* When the value to be coded for symbol "nn" is "more than 99, etc." the appropriate number of $98S_PS_{Pnn}$ groups will be used; i.e., in the first group (or groups) "99" will be reported for "nn" and the amount in excess of 100 (or 200, etc., as appropriate) will be reported for "nn" in the last group of the series. For example: 100 inches of snow on ground would be coded 98599 98500; 105 inches, 98599 98505; 210 inches, 98599 98599 98510, etc.

TABLE 45c

"TIME" TABLE

Symbol "tt" = "units" and "tenths" of hours *before* observation.* (00 to 75)

Code figure	Hours and minutes *before* observation*	Code figure	Hours and minutes *before* observation*
00	At observation.	42	4 hours 12 minutes.
01	0 hour 6 minutes.	43	4 hours 18 minutes.
02	0 hour 12 minutes.	44	4 hours 24 minutes.
03	0 hour 18 minutes.	45	4 hours 30 minutes.
04	0 hour 24 minutes.	46	4 hours 36 minutes.
05	0 hour 30 minutes.	47	4 hours 42 minutes.
06	0 hour 36 minutes.	48	4 hours 48 minutes.
07	0 hour 42 minutes.	49	4 hours 54 minutes.
08	0 hour 48 minutes.	50	5 hours 0 minutes.
09	0 hour 54 minutes.	51	5 hours 6 minutes.
10	1 hour 0 minutes.	52	5 hours 12 minutes.
11	1 hour 6 minutes.	53	5 hours 18 minutes.
12	1 hour 12 minutes.	54	5 hours 24 minutes.
13	1 hour 18 minutes.	55	5 hours 30 minutes.
14	1 hour 24 minutes.	56	5 hours 36 minutes.
15	1 hour 30 minutes.	57	5 hours 42 minutes.
16	1 hour 36 minutes.	58	5 hours 48 minutes.
17	1 hour 42 minutes.	59	5 hours 54 minutes.
18	1 hour 48 minutes.	60	6 hours 0 minutes.
19	1 hour 54 minutes.	61	6 to 7 hours.
20	2 hours 0 minutes.	62	7 to 8 hours.
21	2 hours 6 minutes.	63	8 to 9 hours.
22	2 hours 12 minutes.	64	9 to 10 hours.
23	2 hours 18 minutes.	65	10 to 11 hours.
24	2 hours 24 minutes.	66	11 to 12 hours.
25	2 hours 30 minutes.	67	12 to 18 hours.
26	2 hours 36 minutes.	68	More than 18 hours.
27	2 hours 42 minutes.	69	Time unknown.
28	2 hours 48 minutes.		
29	2 hours 54 minutes.	70	Began during observation.†
30	3 hours 0 minutes.	71	Ended during observation.†
31	3 hours 6 minutes.	72	Began and ended during observation.†
32	3 hours 12 minutes.	73	Changed considerably during observation.†
33	3 hours 18 minutes.	74	Began after observation.†
34	3 hours 24 minutes.	75	Ended after observation.†
35	3 hours 30 minutes.		
36	3 hours 36 minutes.		
37	3 hours 42 minutes.		
38	3 hours 48 minutes.		
39	3 hours 54 minutes.		
40	4 hours 0 minutes.		
41	4 hours 6 minutes.		

*"Before observation" in this code table means "before the reference time of observation" and is not necessarily the time "before the observation was actually taken."

†Code figures 70 to 75, refer to the PRECISE (or ACTUAL) time the element is observed.

TABLE 45d

"DIRECTION" TABLES

Symbol "D_mD_m" Direction *of movement.** (00 to 39)
Symbol "D_sD_s" = Direction *from station.*† (00 to 39)

Code figure	Direction	Code figure	Direction	Code figure	Direction
00	Calm.†	18	SSW.	33	Variable.
02	NNE.	20	SW.	34	Unknown.
04	NE.	22	WSW.	35	In several directions.
06	ENE.	24	W.	36	In several directions, but not at station.
08	E.	26	WNW.		
10	ESE.	28	NW.	37	Over nearby water area.
12	SE.	30	NNW.		
14	SSE.	32	N.	38	Over nearby valleys.
16	S.			39	Over nearby hills or mountains.

*Direction of movement is "direction *from which* item is moving"
†For symbol "D_sD_s" code figure 00 means "at station".

TABLE 45e

"VARIATION" TABLE

Symbol "zz" = Variation in phenomena. (70 to 99

Code figure	Description
70	Began while observation was being taken.†
71	Ended while observation was being taken.†
72	Began and ended while observation was being taken.†
73	Changed considerably while observation was being taken.†
74	Began *after* observation was taken.†
75	Ended *after* observation was taken.†
76	At station.
77	At station, but not in distance.
78	In all directions.
79	In all directions, but not at station.
80	Approaching station.
81	Receding from station.
82	Passing station in distance.
83	Seen in distance.
84	Reported in neighborhood, but not at station.
85	Aloft, but not near ground.
86	Near ground, but not aloft.
87	Occasional; occasionally.
88	Intermittent; intermittently.
89	Frequent; frequently; at frequent intervals.
90	Steady; steady in intensity; steadily; no appreciable change.
91	Increasing; increasing in intensity; has increased.
92	Decreasing; decreasing in intensity; has decreased.
93	Fluctuating; variable.
94	Continuous; continuously.
95	Very light; very weak; greatly below normal; very thin; very poor.
96	Light; weak; below normal; thin; poor.
97	Moderate; normal; average thickness; fair; gradually.
98	Heavy; severe; thick; above normal; good; suddenly.
99	Very heavy; killing; very severe; dense; greatly above normal; very thick; very good.

†Code figures 70 to 75 refer to the PRECISE (or ACTUAL) time the element is observed.

TABLE 45f

"DIRECTION OF CLOUD MOVEMENT" AND "DIRECTION OF CLOUD SHIELD FROM STATION" TABLE

Symbol "D_L"=Direction From Which C_L Type Clouds Are Moving. (0 to 9)
Symbol "D_H"=Direction From Which C_H Type Clouds Are Moving. (0 to 9)
Symbol "D_{C_s}"=Direction of Cloud Shield From Station. (0 to 9)

Code figure	Direction	Code Figure	Direction
0	No clouds, or calm.	5	Southwest.
1	Northeast.	6	West.
2	East.	7	Northwest.
3	Southeast.	8	North.
4	South.	9	Unknown or variable.

TABLE 45g

ORIENTATION OF CLOUD SHIELD TABLE

Symbol "D_o"=Orientation of Cloud Shield. (0 to 9)

Code Figures	Orientation
0	No observation
1	NNE–SSW or reverse
2	NE–SW or reverse
3	ENE–WSW or reverse
4	E–W or reverse
5	ESE–WNW or reverse
6	SE–NW or reverse
7	SSE–NNW or reverse
8	S–N or reverse
9	Uncertain

12333. $0T_sT_sT_dT_d$ (Col. 100). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) T_sT_s = Difference between sea and air temperature as recorded in columns 7 & 40A. When the air temperature is higher than the sea temperature, enter the actual difference; when the air temperature is lower than the sea temperature, add

50 to the difference before entering in column 100 - e.g., when the air temperature is 5° above the sea temperature, enter 05; when the air temperature is 5° below sea temperature, enter 55.

(b) T_dT_d - Dew point temperature, as recorded in column 8. Code values below zero in accordance with par. 12328(b).

12334. $1d_wd_wP_wH_w$ (Col. 101). Enter coded data as specified by the symbols shown in the column headings. These symbols have the following meaning:

(a) d_wd_w - Direction of waves in tens of degrees as recorded in column 40B, except that 50 will be added to this value when the height of waves exceeds 15 feet (see Table 47). When the direction of the waves is indeterminate, enter 49 if the height is 15 feet or less and 99 if the height is greater than 15 feet. Enter 00 when no waves are present.

(b) P_w - Period of waves, as entered in column 40B and coded in accordance with Table 46.

(c) H_w - Height of waves, as entered in column 40B and coded in accordance with Table 47.

12334.1. When more than one wave system is observed as indicated in par. 12322, two wave groups will be sent in the coded message. Enter coded data pertaining to the predominant wave system in column 101, and an asterisk to indicate the position in the coded message of the data for the second system. Enter an asterisk and the coded data for the less pronounced system in column 90.

TABLE 46

(International Code 69)

SYMBOL "P_w"—PERIOD OF THE WAVES

Code figure	Period
2	5 seconds or less
3	5 - 7 seconds
4	7 - 9 seconds
5	9 - 11 seconds
6	11 - 13 seconds
7	13 - 15 seconds
8	15 - 17 seconds
9	17 - 19 seconds
0	19 - 21 seconds
1	Over 21 seconds.
X	Calm or Period not determined.

NOTE: If the exact number of seconds for the period of the waves could be reported by two code figures, the lower code figure will be reported.

TABLE 47
Symbol "H_w" - Mean maximum height of the waves 1/

Code Figure	Height in feet	Code Figure	Height in feet (when 50 is added to $d_w d_w$)
0	Less than 1	0	16
1	1-1/2	1	17-1/2
2	3	2	19
3	5	3	21
4	6-1/2	4	22-1/2
5	8	5	24
6	9-1/2	6	25-1/2
7	11	7	27
8	13	8	29
9	14	9 2/	30-1/2
X	Height indeterminable		

1/ If the wave height is exactly midway between the heights corresponding to two code figures, the lower code figure is reported.

2/ For wave heights greater than 31 feet, add 50 to the coded direction $d_w d_w$; code H_w as 9. Immediately following this group add the word WAVES and their height in feet; e.g., with 37 foot waves from 80° having a period of more than 21 seconds, code the data for group $1d_w d_w P_w H_w$ as "15819 WAVES 37."

12335. c_2KD_1re [1/] (Col. 102). Prefix the identifier "ICE" to this group, and enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) c_2 - Kind of ice, in accordance with Table 48.

(b) K - Effect of ice on navigation, in accordance with Table 49.

(c) D_1 - Bearing to the nearest edge of the ice, coded in accordance with Table 50. If an ice blink is reported for c_2, report the bearing of the blink. When more than one ice area is observed, report 9 unless one area is of outstanding importance to navigation, in which case the bearing of that area should be reported.

(d) r - Distance in nautical miles corresponding to the bearing reported for D_1 and coded in accordance with Table 51.

(e) e - Orientation of ice edge whose bearing and distance are reported for symbols D_1 and r, and coded in accordance with Table 52.

1/ Omit this group when no ice is observed.

TABLE 48

Symbol c_2. -- Description of kind of ice

Code figure	Description	Definition
0	None or "ice blink"	The white or yellowish-white glare on the sky produced by the reflection from considerable areas of sea ice.
1	Slush or young ice	An accumulation of ice crystals which are only slightly, if at all, frozen together to form a thin layer. The slush lends a leaden-tinted color to the sea surface, from which wind ripples are absent.
2	Fast-ice	A stretch of unbroken ice that is limited by the shore line on one side. Fast-ice is formed in bays, sounds, and shallow water, and remains fast in the position of growth. Fast-ice is sometimes called "Land-ice," "Shore-ice," "Bay-ice," or "Coast-ice."
3	Drift-ice	Sea-ice which is not limited by the shore line.
4	Packed (compact) slush or strips of hummocked ice	
5	Open lead near shore	Open channels in the ice near the shore such as might be caused by wind, currents, ship movement, etc.
6	Heavy fast-ice	
7	Heavy drift-ice	
8	Hummocked ice	Ice characterized by ridges caused by ice pressure. If melting or weathering has occurred, hummocks assume a rounded shape.
9	Ice jamming	The action of unusual accumulations of hummocked ice that have been forced by wind against the shore or into small bays or inlets.

TABLE 49

SYMBOL K.—Effect of ice on navigation

Code figure	Description
0	Navigation unobstructed.
1	Navigation slightly obstructed.
2	Navigation difficult for low powered ships.
3	Navigation possible only for powerful ships.
4	Navigation possible only for ships constructed to withstand ice pressure.
5	Navigation possible with the assistance of ice-breakers.
6	Channel open in the solid ice.
7	Navigation temporarily closed.
8	Navigation closed.
9	Navigation conditions unknown (e. g., owing to bad weather).

TABLE 50

SYMBOL D_i.—*Bearing of ice limit*

Code figure	Description
0	Unknown.
1	Ice limit toward NE.
2	Ice limit toward E.
3	Ice limit toward SE.
4	Ice limit toward S.
5	Ice limit toward SW.
6	Ice limit toward W.
7	Ice limit toward NW.
8	Ice limit toward N.
9	Ice limit in several directions.

NOTE.—If more than one ice limit can be stated, the nearest or most important is reported.

TABLE 51

SYMBOL r.—*Distance to ice limit from reporting ship*

Code figure	Distance
0	0 to 1 mile.
1	1 to 2 miles.
2	2 to 4 miles.
3	4 to 6 miles.
4	6 to 8 miles.
5	8 to 12 miles.
6	12 to 16 miles.
7	16 to 20 miles.
8	More than 20 miles.
9	Unknown.

NOTE.—If the exact bounding distance for the ice limit corresponds to two code figures, the lower code figure is reported.

TABLE 52

SYMBOL e.—*Orientation of ice limit*

Code figure	Orientation of ice limit
0	Orientation of ice limit impossible to estimate—ship *outside* the ice.
1	Ice edge lying in a direction NE to SW with ice situated to the NW.
2	Ice edge lying in a direction E to W with ice situated to the northward.
3	Ice edge lying in a direction SE to NW with ice situated to the NE.
4	Ice edge lying in a direction S to N with ice situated to the eastward.
5	Ice edge lying in a direction SW to NE with ice situated to the SE.
6	Ice edge lying in a direction W to E with ice situated to the southward.
7	Ice edge lying in a direction NW to SE with ice situated to the SW.
8	Ice edge lying in a direction N to S with ice situated to the westward.
9	Orientation of ice limit impossible to estimate—ship *inside* the ice.

12336. Bergs. (Col. 103). Icebergs are large masses of ice that have broken away from the forward edge of a glacier and moved into the sea. When icebergs are observed, enter the number in column 103, and size and height above sea in column 90. In the transmitted message, report the number of icebergs in plain language at the end of the report; e.g., "1 berg," "2 bergs," etc.

12337. Times of beginning and ending of weather and obstructions to vision. (Cols. 105 - 111). Enter the times of beginnings and endings (GCT) of weather and obstructions to vision in accordance with pars. 3930 - 3932. Enter positions to the nearest whole degree latitude and longitude.

12338. Summary of the Day. (Cols. 112 - 128). Enter data for the period midnight to midnight GCT as follows:

(a) Maximum Wind - Enter the following data for the highest observed one-minute wind speed:

(1) Column 112 - Time to the nearest minute GCT.

(2) Column 113 - Direction and speed, using the same recording procedures as for columns 9 and 10.

(3) Columns 114 and 115 - Position to the nearest whole degree latitude and longitude.

(b) Lowest pressure - Enter the following data for the lowest observed pressure, as determined from the barogram after corrections have been applied:

(1) Column 116 - Time to the nearest minute GCT.

(2) Column 117 - Lowest pressure in millibars and tenths.

(3) Column 118 - Wind direction and speed at the time of lowest pressure, using the same recording procedures as for columns 9 and 10.

(4) Columns 119 and 120 - Position to the nearest whole degree latitude and longitude.

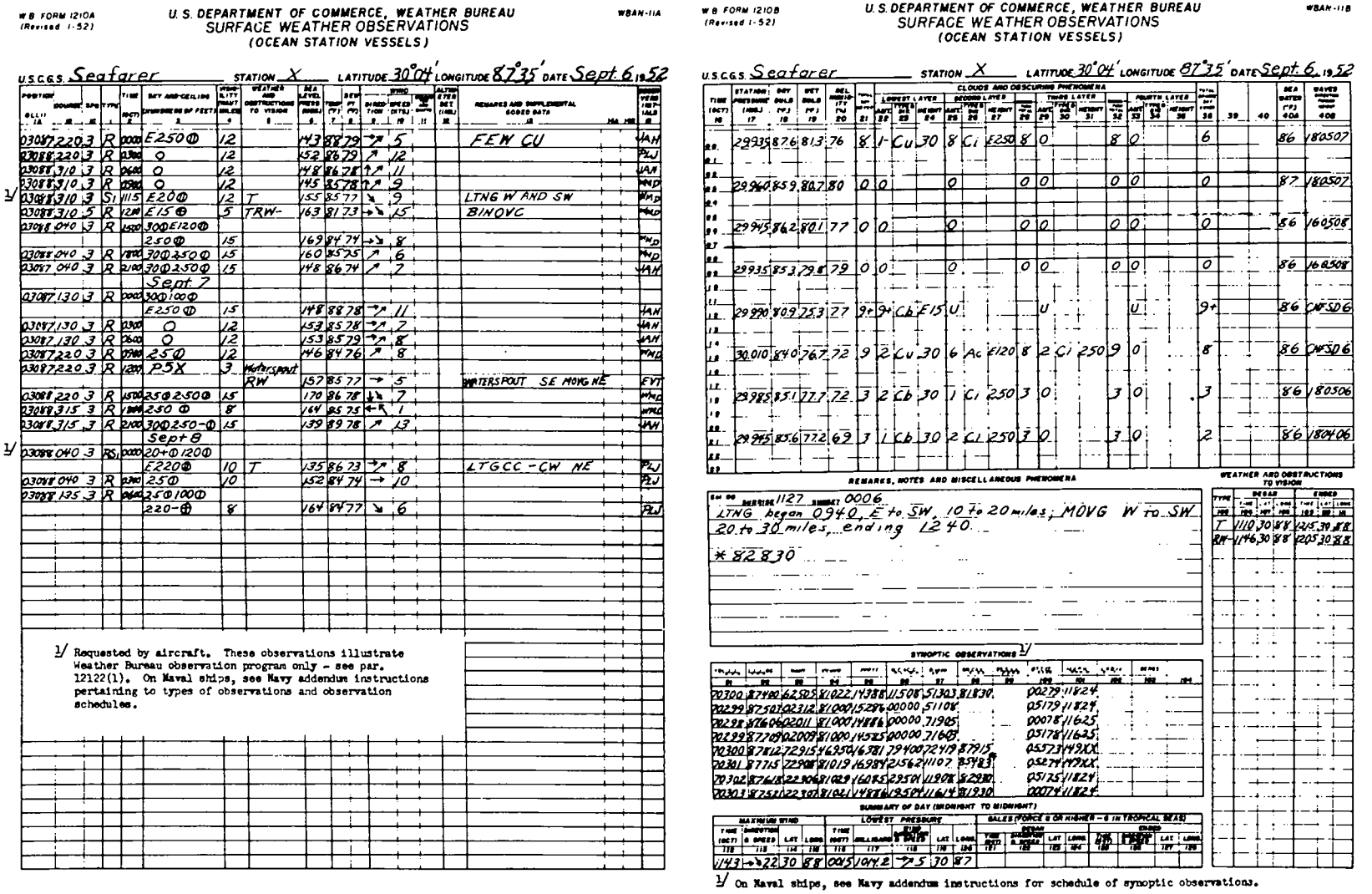
(c) Gales - Enter the following data whenever the wind speed averages force 8 or more (force 6 in tropical seas) for at least one hour during the day. If several such periods occur, enter data for additional periods in column 90.

(1) Column 121 - Time at which force 8 wind began, to the nearest minute GCT.

(2) Column 122 - Direction and speed of wind at the above time, recorded similarly to columns 9 and 10.

(3) Columns 123 and 124 - Position at above time to the nearest whole degree latitude and longitude.

(4) Columns 125 - 128 - Enter data pertaining to time at which force 8 wind ended, similarly to entries in columns 121 - 124.



WB FORM 1210A (Revised 1-52) — U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU — SURFACE WEATHER OBSERVATIONS (OCEAN STATION VESSELS) — WBAN-11A

U.S.C.G.S. Seafarer STATION X LATITUDE 30°04' LONGITUDE 87°35' DATE Sept. 6, 1952

030872203	R	0000	E250Ⓓ	12		143	88	79	→	5			FEW CU											JAH
030882203	R	0300	O	12		152	86	79	↗	12														PJJ
030883103	R	0600	O	12		148	86	78	↑↗	11														JAH
030883103	R	0900	O	12		145	85	78	↑↗	9														WND
1/ 030883103	S	1115	E20Ⓓ	12	T	155	85	77	↘	9			LTNG W AND SW											WND
030883105	R	1200	E15Ⓑ	5	TRW-	163	81	73	→↘	15			BINOVC											WND
030880403	R	1500	300E120Ⓓ																					
			250Ⓓ	15		169	84	74	→↘	8														WND
030880403	R	1800	300Ⓓ250Ⓓ	15		160	85	75	↗	6														WND
030870403	R	2100	300Ⓓ250Ⓓ	15		148	86	74	↗	7														JAH
			Sept 7																					
070871303	R	0000	300Ⓓ100Ⓓ																					
			E250Ⓓ	15		148	88	78	→↗	11														JAH
030871303	R	0300	O	12		153	85	78	→↗	7														JAH
030871303	R	0600	O	12		153	85	79	→↗	8														JAH
030872203	R	0900	25Ⓓ	12		146	84	76	↗	8														WND
030872203	R	1200	P5X	3	Waterspout																			
				RW		157	85	77	→	5			WATERSPOUT SE MOVG NE											EVT
030882203	R	1500	250Ⓓ250Ⓓ	15		170	86	78	↓↘	7														WND
030881153	R	1800	250 Ⓓ	8		164	85	75	←↖	1														WND
030881153	R	2100	300Ⓓ250-Ⓓ	15		139	89	78	↗	13														JAH
			Sept 8																					
1/ 030880403	RS	0000	20+Ⓓ120Ⓓ																					
			E220Ⓓ	10	T	135	86	73	→↗	8			LTGCC-CW NE											PJJ
030880403	R	0300	25Ⓓ	10		152	84	74	→	10														PJJ
030881353	R	0600	25Ⓓ100Ⓓ																					
			220-Ⓓ	8		164	84	77	↘	6														PJJ

1/ Requested by aircraft. These observations illustrate Weather Bureau observation program only - see par. 12122(1). On Naval ships, see Navy addendum instructions pertaining to types of observations and observation schedules.

WB FORM 1210B (Revised 1-52) — U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU — SURFACE WEATHER OBSERVATIONS (OCEAN STATION VESSELS) — WBAN-11B

U.S.C.G.S. Seafarer STATION X LATITUDE 30°04' LONGITUDE 87°35' DATE Sept. 6, 1952

29.93	58	76	81	76	8	1	Cu	30	8	Ci	E250	8	0			8	0		6			86	180507
29.96	08	59	80	78	0	0			0			0	0			0	0		0			87	180507
29.94	58	62	80	77	0	0			0			0	0			0	0		0			86	160508
29.93	58	53	79	81	0	0			0			0	0			0	0		0			86	160508
29.99	08	09	75	3 77	9+	9+	Cb	E15	U				U				U		9+			86	CM506
30.01	08	40	76	7 72	9	2	Cu	30	6	Ac	E120	8	2	Ci	250	9	0		8			86	CM506
29.98	58	51	77	7 72	3	2	Cb	30	1	Ci	250	3	0			3	0		3			86	180506
29.99	58	56	77	2 69	3	1	Cb	30	2	Ci	250	3	0			3	0		2			86	180406

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

BEGIN MORNING 1127 SUNSET 0006

LTNG began 0940, E to SW, 10 to 20 miles; MOVG W to SW 20 to 30 miles, ending 1240.

*82830

WEATHER AND OBSTRUCTIONS TO VISION

TYPE	BEGAN	ENDED
T	1110, 30	88 1225, 30 88
RW	1146, 30	88 1205, 30 88

SYNOPTIC OBSERVATIONS 1/

70300	87	40	62	50	5	81022	14388	11508	51303	81830												00279	11624			
70299	87	50	70	23	12	81000	15296	00000	51108													05179	11824			
70298	87	60	60	20	11	81000	14886	00000	71905													00078	11625			
70299	87	70	80	20	09	81000	14585	00000	71605													05178	11625			
70300	87	81	27	29	15	46950	16381	79400	72419	87915												05573	49XX			
70301	87	71	5	27	90	81019	16984	25621	11107	83483												05274	49XX			
70302	87	61	8	22	90	68102	9160	85	29501	11908	82980											05125	11824			
70303	87	52	1	22	30	78104	14886	25041	11614	81930												00074	11824			

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

MAXIMUM WIND				LOWEST PRESSURE				GALES (FORCE 8 OR HIGHER — 6 IN TROPICAL SEAS)							
TIME (GCT)	DIRECTION & SPEED	LAT	LONG	TIME (GCT)	MILLIBARS	STEP IN 3 HRS.	LAT	LONG	TIME (GCT)	DIRECTION & SPEED	LAT	LONG	TIME (GCT)	DIRECTION & SPEED	LAT	LONG
1143	→22	30	88	0015	1044.2	-2.5	30	87								

1/ On Naval ships, see Navy addendum instructions for schedule of synoptic observations.

Fig. 8. Entries on WBAN-11A and B.

Change No. → 2

U. S. Department of Commerce
Weather Bureau

MANUAL OF SURFACE OBSERVATIONS
(WBAN)

Circular N
6th Edition
(Revised)

(This page may be discarded)

Washington, D.C.
January 1, 1952

Change No. 2, Circular N, 6th Edition (Revised June 1951):

(1) Insert Chapter 12, Marine Observations as an addition to the manual.

(2) Make the following changes in ink:

(a) Page 69 - change the footnote to read "Civil stations and Naval ships only."

(b) Page 111, par. 11003, third sentence - delete "and Navy stations will use black ink."

(c) Unless the Index has been superseded by a comprehensive index to both the WBAN Manual and Addendum instructions of the service concerned, retain the Index for use with Chapters 1 to 11 and renumber pages 121 to 123 as pages 163 to 165 respectively.

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CHAPTER 12. MARINE OBSERVATIONS

12000. GENERAL

12010. These instructions apply to all observations taken by Naval aerological personnel on Naval vessels and by Weather Bureau personnel on ocean station vessels. Instructions in Chapters 1 - 11 will be followed in taking marine observations except as specifically noted in this chapter.

12011. Greenwich Civil Time will be used on all observational records including autographic records.

12100. OBSERVATIONAL PROGRAM

12110. NAVY. The observational program on Naval vessels is outlined in the Navy addendum.

12120. WEATHER BUREAU. The surface observational program conducted by Weather Bureau personnel on ocean station vessels consists of:

(a) Scheduled observations (combined record and synoptic observations) filed with the ship's communicator at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 GCT.

(b) Special observations as required by par. 12122. (Aviation observations referred to in pars. 9132 - 9150 will not be taken.)

12121. SCHEDULED OBSERVATIONS. Scheduled observations will be taken and transmitted in accordance with par. 12120 as soon as the vessel departs from base port, and continued until return to base port, except when the vessel is temporarily in another port where surface observations are taken by a land station.

12122. SPECIAL OBSERVATIONS. Special surface observations will be taken and filed promptly with the communicator whenever requested by aircraft, by ships engaged in search and rescue operations, or by a Weather Bureau forecast office. Special surface observations will be transmitted:

(1) To aircraft (except those contemplating ditching, see next paragraph) and to surface vessels, in plain language, the elements following the same order in which they are coded in scheduled synoptic observations; or, when specifically requested, in the AERO code form: (Ocean station Identifier) Nddff VVwwW $8N_sCh_sh_s$. 1/

1/ Group $OTTT_dT_d$, Q signals, and plain language remarks are optional.

(2) To aircraft contemplating ditching, in plain language or, when language difficulties are anticipated, in "Q" code. The report will consist of the following elements in the order given:

(a) Surface wind direction in degrees.

(b) Surface wind speed in knots.

(c) Swell - length, height, and speed of swell waves and direction from which they are moving.

(d) State of sea - length, height, and speed of sea waves and direction from which they are moving.

(e) Visibility.

(f) Present weather.

(g) Amount, and height of base of low cloud (both the predominant layer and any scattered clouds below).

(h) Sea-level pressure.

(i) Remarks.

(3) To Weather Bureau forecast offices, in the same code used for scheduled synoptic observations.

12200. WBAN-11A and B, and WBAN-10D

12210. WBAN-11. WBAN-11A and B constitute the basic observational record for all marine observations taken in accordance with sections 12000, and 12100.

12211. PREPARATION. Only one copy of WBAN-11 need be prepared unless otherwise specified. Pencil will be used in accordance with par. 11003 unless modified by addendum instructions. In the heading, enter ship, station (when ship is assigned to an ocean station), latitude and longitude of the station to degrees and minutes, and date (GCT) corresponding to the first synoptic observation on the form.

12211.1. A new WBAN-11A will be started on the first day of each month (GCT). A new WBAN-11B will be started with the first observation of each day (GCT).

12211.11. On Naval ships with major aerological units aboard, a new WBAN-11A will be started on the first observation of the day (GCT). As many pages will be used daily as necessary.

12211.12. On Weather Bureau patrols and on Naval ships with minor aerological units aboard, observations for more than one day will be entered on WBAN-11A. Observations for successive days will be separated by a line space, and the date of the following observations will be entered in this space (see Fig. 8).

12212. ENTRY OF DATA. Instructions for the entry of data in many of the correspondingly numbered columns of WBAN-10 and WBAN-11 are the same, either entirely or in part. The extent to which the instructions in Chapters 1 - 11 for the entry of data on WBAN-10 are applicable to WBAN-11 is stated in sec. 12300.

12213. DISPOSITION. Completed forms will be submitted in accordance with instructions in the addendum.

12220. WBAN-10D. In accordance with the instructions on WBAN-10D, this form will be prepared as of the last day of each month on Naval vessels, and as of the last day of Weather Bureau patrols. It will be submitted with the observational records for the corresponding period as specified in the addendum.

12300. COLUMN ENTRIES ON WBAN-11A AND B

12300. GENERAL. Enter data on WBAN-11A for all observations, and on WBAN-11B for record and synoptic observations only. In addition, certain summary data will be entered daily in columns 105 - 128 of WBAN-11B.

12301. POSITION (Col. 1A). Enter coded digits in the symbolic form QLLll. These symbols have the following meaning:

(a) Q - Octant of the globe in accordance with Table 24.

(b) LL - Latitude to the nearest whole degree (e.g., enter 8°22' as 08).

(c) ll - Longitude to the nearest whole degree, omitting the hundreds digit (e.g., enter 145°36' as 46).

TABLE 24

SYMBOL Q.—*Octant of the globe*

Longitude	Code figure
North latitude:	
0° W. to 90° W	0
90° W. to 180° W	1
180° E. to 90° E	2
90° E. to 0° E	3
South latitude:	
0° W. to 90° W	5
90° W. to 180° W	6
180° E. to 90° E	7
90° E. to 0° E	8

12302. COURSE (Col. 1B). Enter true compass course to the nearest whole degree. Enter a dash if ship is not underway.

12303. SHIP'S SPEED (Col. 1C). Enter ship's speed to the nearest whole knot. Enter a dash if ship is not underway.

12304. TYPE (Col. 1). Enter R, S, or RS in accordance with par. 11101, except that special observations will be serially numbered with respect to GCT rather than LST.

12305. TIME (Col. 2). Enter the time (24-hour clock) to 4 figures GCT. Enter the time of scheduled observations to the nearest hour (e.g., 0000, 0300, etc.), and the time of special observations to the nearest minute (e.g., 2343).

12306. SKY AND CEILING (Col. 3). Enter ceiling and sky-cover data in accordance with pars. 1510 and 1511. Determine cloud data in accordance with Chapter 1 with the following exceptions:

(a) Instructions in section 1300 concerning determination of cloud direction do not apply to ships. Directions will be regarded as unknown unless determined from rawinsonde observations.

(b) Cloud heights will be determined by balloons for scheduled observations in accordance with par. 1451 even though the observations are not transmitted.

12307. VISIBILITY (Col. 4). Enter prevailing visibility in nautical miles in accordance with par. 2410. Determine prevailing visibility in accordance with Chapter 2, except that instructions in par. 2110 concerning visibility charts are not applicable. In estimating visibility use radar or stadiometer distances, or other distances to known objects such as ships in the company, horizon, etc. Estimates will be based on the

apparent size of the ship (or other object), and the portion visible. Use Table 25 as a guide in determining distances (e.g., in accordance with line 7 of Table 25, the horizon when viewed from a bridge 40 feet above sea level is 7.6 nautical miles away).

TABLE 25. Distance to objects on the horizon at sea (nautical miles)

Height of observer's eyes above sea level (feet)	Height of object above sea level (feet)														
	0 [1]	10	20	30	40	60	80	100	150	200	300	400	600	800	1,000
10	3.8	7.2	8.7	9.9	10.8	12.5	13.9	15.1	17.7	19.8	23.5	26.5	31.6	36.0	39.8
15	4.6	8.0	9.5	10.7	11.6	13.3	14.7	15.9	18.5	20.6	24.3	27.3	32.4	36.8	40.6
20	5.4	8.7	10.2	11.4	12.3	14.0	15.4	16.6	19.2	21.3	25.0	28.0	33.1	37.5	41.3
25	6.0	9.3	10.8	12.0	12.9	14.6	16.0	17.2	19.8	21.9	25.6	28.6	33.7	38.1	41.9
30	6.6	9.9	11.4	12.6	13.5	15.2	16.6	17.8	20.4	22.5	26.2	29.2	34.3	38.7	42.5
35	7.1	10.4	11.9	13.1	14.0	15.7	17.1	18.3	20.9	23.0	26.7	29.7	34.8	39.2	43.0
40	7.6	10.8	12.3	13.5	14.4	16.1	17.5	18.7	21.3	23.4	27.1	30.1	35.2	39.6	43.4
45	8.0	11.3	12.8	14.0	14.9	16.6	18.0	19.2	21.8	23.9	27.6	30.6	35.7	40.1	43.9
50	8.5	11.7	13.2	14.4	15.3	17.0	18.4	19.6	22.2	24.3	28.0	31.0	36.1	40.5	44.3
60	9.3	12.5	14.0	15.2	16.1	17.8	19.2	20.4	23.0	25.1	28.8	31.8	36.9	41.3	45.1
70	10.0	13.2	14.7	15.9	16.8	18.5	19.9	21.1	23.7	25.8	29.5	32.5	37.6	42.0	45.8
80	10.7	13.9	15.4	16.6	17.5	19.2	20.6	21.8	24.4	26.5	30.2	33.2	38.3	42.7	46.5
90	11.4	14.5	16.0	17.2	18.1	19.8	21.2	22.4	25.0	27.1	30.8	33.8	38.9	43.3	47.1
100	12.0	15.1	16.6	17.8	18.7	20.4	21.8	23.0	25.6	27.7	31.4	34.4	39.5	43.9	47.7

[1] Horizon.

12308. WEATHER AND OBSTRUCTIONS TO VISION (Col. 5). Enter weather and obstructions to vision in accordance with pars. 3910 and 3911. Remarks referred to in par. 3920 are not required in marine observations, nor will precipitation measurements referred to in Chapter 4 be made unless specifically authorized.

12309. SEA-LEVEL PRESSURE (Col. 6). Enter sea-level pressure in accordance with par. 7710, as determined from an aneroid barometer which has been compared with a mercurial barometer as specified in the addendum.

12310. TEMPERATURE AND DEW POINT (Cols. 7 and 8). Enter dry-bulb and dew-point temperature in accordance with pars. 5510 and 6410.

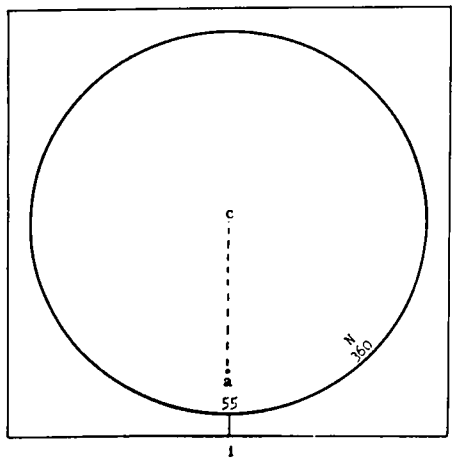
12311. WIND (Cols. 9 - 11). Enter true wind direction, speed (in knots), wind shifts, and gustiness in accordance with section 8400. Compute true wind from apparent wind in accordance with par. 12311.1. Obtain apparent wind from instrumental equipment whenever available and adequately exposed; otherwise, estimate the apparent wind direction to the nearest ten degrees off the bow, and the apparent wind speed to the nearest five knots in accordance with Table 26. Use the values in Table 27 as a check on computed true wind speeds.

TABLE 26. Apparent wind speed

Speed (knots)	Indication
Less than 1	Calm; smoke rises vertically.
1–3	Smoke drifts from funnel.
4–6	Wind felt on face.
7–10	Wind extends light flag.
11–16	Wind raises dust, cinders, loose paper.
17–21	Wind waves and snaps flag briskly.
22–27	Whistling in rigging.
28–33	Inconvenience felt walking against wind.
34–40	Generally impedes progress.

TABLE 27. Determination of wind speed by sea condition

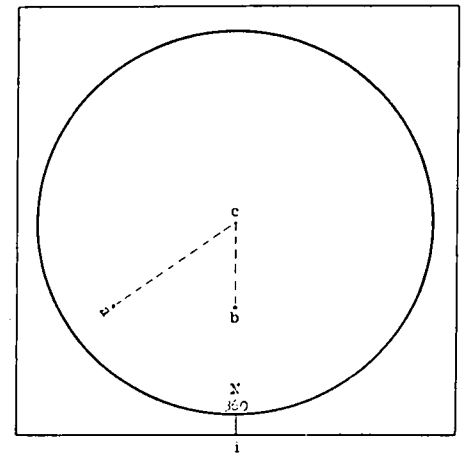
Speed in knots	Descriptive terms	Sea conditions	Wind force (Beaufort)
Less than 1	Calm	Sea smooth and mirror-like	0
1–3	Light air	Scale-like ripples without foam crests	1
4–6	Light breeze	Small, short wavelets; crests have a glassy appearance and do not break.	2
7–10	Gentle breeze	Large wavelets; some crests begin to break; foam of glassy appearance. Occasional white foam crests.	3
11–16	Moderate breeze	Small waves, becoming longer; fairly frequent white foam crests.	4
17–21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white foam crests; there may be some spray.	5
22–27	Strong breeze	Large waves begin to form; white foam crests are more extensive everywhere; there may be some spray.	6
28–33	Moderate gale	Sea heaps up and white foam from breaking waves begin to be blown in streaks along the direction of the wind; spindrift begins.	7
34–40	Fresh gale	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind.	8
41–47	Strong gale	High waves; dense streaks of foam along the direction of the wind; sea begins to roll; spray may reduce visibility.	9
48–55	Whole gale	Very high waves with long overhanging crests. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole, the surface of the sea is white in appearance. The rolling of the sea becomes heavy and shocklike. Visibility is reduced.	10
56–63	Storm	Exceptionally high waves that may obscure small and medium-sized ships. The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility reduced.	11
64 and above	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very much reduced.	12

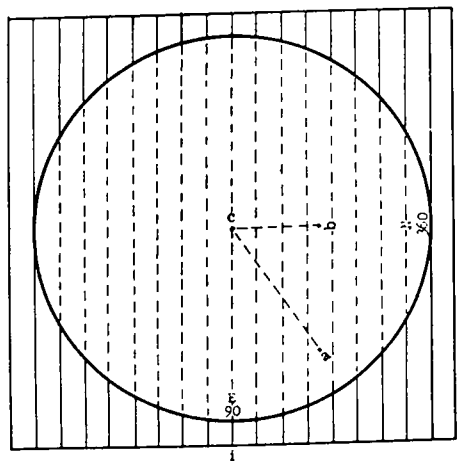


Given: Ship's course 360°, 14 knots.
Apparent wind 55°, 25 knots.
Computation:

Step 1.—Rotate the protractor until 55° is at the bottom of the protractor and is aligned with index line "ic". Using any convenient scale, locate and identify point "a" on line "ic" 25 units distant from the center of the protractor "c" and toward point "i".

Step 2.—Rotate the protractor until the ship's course (360°) is indicated at the bottom of the protractor along line "ic". Using the same scale as in (1), locate and identify point "B" on line "ic" 14 units distant from point "c" and toward point "i".





Step 3.—Rotate the protractor until the line determined by points "a" and "b" is parallel to the parallel lines on the plotting board (beneath the protractor), and until point "b" is above point "a". The true wind direction is the angle indicated at the bottom of the protractor along index line "ic"; i.e., 90°. The true wind speed in knots is equal to the distance "ab" measured with the same scale used in (1) and (2); i.e., 20 knots.

Fig. 7. Computation of true wind speed and direction from apparent wind.

12311.1. To compute true wind from apparent wind, adjust a rotary protractor such as the winds-aloft plotting board so that the apparent wind direction in degrees coincides with the index line at the edge of the protractor closest to the observer. Using any suitable scale, and starting from the center of the protractor, lay off a distance equal to the apparent wind speed along this index line. Plot a point at the correct distance and label it "a". (See Fig. 7.) Turn the protractor until the ship's course in degrees coincides with the index line at the edge of the protractor closest to the observer. Using the same scale and procedure as before, lay off a distance equal to the ship's speed and label the end of this line "b". Using the same scale, obtain the true wind speed by measuring the distance between "a" and "b". Turn the protractor so that point "b" is above point "a" and a line connecting them would be parallel to the index line (see Fig. 7). Read the true wind direction above the index line at the edge of the protractor closest to the observer.

12312. ALTIMETER SETTING (Col. 12). Enter altimeter setting in accordance with par. 7720 on Naval vessels from which aircraft are operated. Omit entry on all other ships.

12312.1. Compute altimeter setting by applying a constant correction to the aneroid barometer reading. Compute this correction by determining the difference in height to the nearest foot between (a) the aneroid barometer and (b) a point ten feet above the landing area (flight deck, landing platform, or ocean surface). Multiply this difference by .001" and round to the nearest .01". Subtract this correction from the aneroid barometer reading if (a) is lower than (b), and add it if (a) is higher than (b).

EXAMPLE:

Given:

(a) Aneroid barometer height - 50 feet

(b) Flight deck height - 55 feet

(c) Aneroid barometer reading - 30.00

Computations:

(a) 55 feet (height of flight deck) + 10 feet = 65 feet

(b) 65 - 50 = 15 feet

(c) 15 x .001 = .015 (or .02 by rounding)

(d) Altimeter setting = 30.00 - .02 = 29.98

12313. REMARKS (Col. 13). Enter appropriate remarks in accordance with par. 11103. Additive data referred to in pars. 11103.1 - 11103.2 are not entered at ship stations.

12314. OBSERVER'S INITIALS (Col. 15). Enter initials of observer taking observation.

12315. TIME (Col. 16). Make no entries in this column. The values printed in the column are the time of scheduled observations to the nearest hour.

12316. STATION PRESSURE (Col. 17). Enter station pressure in inches in accordance with par. 7740.

12317. DRY- AND WET-BULB TEMPERATURES (Cols. 18 and 19). Enter dry- and wet-bulb temperatures in accordance with pars. 5530 and 5540. Determine these temperatures on the windward side of the ship, at a sufficient height to avoid sea spray in accordance with the general procedures in pars. 5150 - 5151.6. (The psychrometer muslin should be changed whenever sea spray falls on it.)

12318. RELATIVE HUMIDITY (Col. 20). Enter relative humidity in accordance with par. 6420.

12319. SKY-COVER DATA (Cols. 21 - 36). Enter sky-cover data in accordance with pars. 1530 - 1544.

12320. (Cols. 39 and 40). Use these columns for data needed locally.

12321. SEA-WATER TEMPERATURE (Col. 40A). Enter sea-water temperature to the nearest whole degree Fahrenheit, as obtained from the condenser-intake thermometer. Whenever a condenser-intake reading cannot be made, enter a reading obtained by the following bucket method:

(a) From as far forward as possible, heave overboard a bucket with line attached and allow time for the bucket to come to sea temperature.

(b) Haul in the bucket of water rapidly.

(c) Carry the bucket immediately to a sheltered place where wind or sunshine will not affect the water temperature.

(d) Stir the water with the thermometer until the thermometer has acquired the water temperature, then read the thermometer with the bulb still under water.

12322. WAVES (Col. 40B). Enter direction, period, and height of waves as follows: (Enter "calm" for no waves. For confused sea, enter "CNFSD" and estimated height of maximum waves, thus CNFSD 28, CNFSD 75, etc.)

(a) Direction.—Direction from which waves are coming, in tens of degrees with reference to true north. Determine this direction by eye observation, or by sighting with a compass parallel to the wave crests and adding or subtracting 90° as appropriate.

(b) Period.—Time in whole seconds between the passage of two successive crests of well-formed waves past a fixed point. Use as a fixed point any object floating on the water (wood, seaweed, foam, etc.), preferably off the bow. Determine with stop watch or seconds hand the interval between successive appearances of the object on the crest, until the object has disappeared or until at least fifteen measurements have been made. Use the average value.

(c) Height.—Average vertical distance in feet between the wave crest and the adjacent trough; whenever possible, obtain this distance by observing the waves near the side of another ship, and estimate their height with respect to known dimensions of the ship - e.g., if the height of the bridge above the water line is 28 feet and the wave crest reaches one quarter of this distance, the wave height is seven feet. If another ship is not available, take the observations at a time when roll and pitch are slight and from a point amidships and near the center line, as follows:

(1) When the distance between successive crests is the same as or less than the length of the ship, estimate the wave height by looking over the side and determining relative heights of the crest and trough with respect to known heights along the ship (e.g., height of sea ladder above water line, height of port holes above water line, etc.).

(2) When the distance between crests is greater than the length of the ship, move up and down the superstructure until the wave crest is aligned with the horizon when the ship is on even keel and in a trough. The wave height will be the height of the eyes above the water line. (Height estimates will be erroneous if the ship is not on even keel when the wave crest is aligned with the horizon.)

EXAMPLE:

Given: Wave direction 40°, period 9 seconds, height 21 feet.

Entry in Column 40B: 040921.

12322.1. Instructions in pars. 11204 - 11207.5 are not applicable to observations recorded on WBAN-11B. Specifically, no distinction should be made between "sea" and "swell" except for the special aviation observations required by par. 12122(2). Waves referred to in par. 12322 are the combined results of "sea" and "swell". Only one wave system will be reported unless the height, direction, and period of a second system are clearly defined, in which case data for the second system will be recorded in column 90 in accordance with par. 12334.1. All wave data will be with respect to large, well-formed waves; disregard the lower, poorly-formed waves.

12323. REMARKS, NOTES, AND MISCELLANEOUS PHENOMENA (Col. 90). Enter data in this column in accordance with pars. 3934 - 3934.7, except that time of sunrise and sunset, rather than character, will be entered.

12324. $YQL_aL_aL_a$ (Col. 91). Enter coded data in accordance with column heading, where the symbols have the following meaning:

(a) Y - Day of week (GCT) in accordance with Table 28.

(b) Q - Octant of the globe in accordance with Table 24.

(c) $L_aL_aL_a$ - Latitude to the nearest tenth of degree. Convert minutes to tenths by dividing by 6 and rounding in accordance with the Introduction - e.g., Code 9°28' as 095.

TABLE 28

SYMBOL Y.—*Day of the week*

Day	Code figure
Sunday	1
Monday	2
Tuesday	3
Wednesday	4
Thursday	5
Friday	6
Saturday	7

12325. $L_oL_oL_oGG$ (Col. 92). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meading:

(a) $L_oL_oL_o$ - Longitude to the nearest tenth of degree. Omit hundreds digit, and convert minutes to tenths in accordance with par. 12324(c) - e.g., Code 125°42' as 267.

(b) GG - The corresponding time entered in column 2 to the nearest whole hour, GCT.

12326. Nddff (Col. 93). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) N - Total amount of clouds, as recorded in column 21 and coded in accordance with Table 29.

(b) dd - Wind direction, as recorded in column 9 and coded in accordance with Table 30.

(c) ff - Wind speed in knots, as recorded in column 10, except that whenever the wind speed is from 100 to 199 knots, inclusive, add 50 to the coded direction and omit the hundreds digit for wind speed - e.g., code wind direction of 270°, speed 105 knots, as 7705.

TABLE 29

SYMBOL "N"—TOTAL AMOUNT OF CLOUD
SYMBOL "N_h"—AMOUNT OF CLOUD WHOSE HEIGHT IS REPORTED BY "h"
SYMBOL "N_s"—AMOUNT OF THE SIGNIFICANT CLOUD LAYER

Code figure	Amount of Sky Covered (in tenths)	Code figure	Amount of Sky Covered (in tenths)
0	No clouds	5	6
1	1– and 1	6	7 and 8
2	2 and 3	7	9 and 9+
3	4	8	10
4	5	[1]9	Sky obscured

[1] Code Figure 9 will be used when the sky is completely hidden with obscuring phenomena. If the sky is only partially hidden, disregard the obscuring phenomena and code cloud data as observed - e.g., "0" if no clouds are present, even though half the sky is hidden.

TABLE 30
Symbol dd - Direction from which wind is blowing. 1/

Code Figure	Direction	Code Figure	Direction
00	Calm	18	S
02	NNE	20	SSW
05	NE	23	SW
07	ENE	25	WSW
09	E	27	W
11	ESE	29	WNW
14	SE	32	NW
16	SSE	34	NNW
		36	N

1/ Wind speeds from 100 to 199 knots, inclusive, are reported by adding 50 to the code figure for "dd" and coding the observed speed minus 100 for "ff". See par. 12326(c).

12327. VVwwW (Col. 94). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) VV - Prevailing visibility, as recorded in column 4 and coded in accordance with Table 31.

(b) ww - Present weather (occurring at the actual time of observation or within one hour of it), coded in accordance with Table 32. Use entries in column 5 as a guide in selecting the proper code figure. If more than one code figure is applicable, use the largest numerical figure.

(c) W - Past weather (occurring within the past 3 or 6 hours), coded in accordance with Table 33. At 0000, 0600, 1200 and 1800 GCT, W refers to the preceding six hours, while at intermediate times (0300, 0900, etc.) W refers to the preceding three hours. Use the largest applicable numerical code figure, except that W and ww should be selected so that the combined code figures describe present and past weather as completely as possible. For example, when the weather occurring at the time of observation (rather than for the previous hour) is coded as ww, the weather during the past six (or three) hours will be coded as W; while if the weather that occurred during the preceding hour is coded as ww, the weather during the five (or two) hours ending one hour before should be coded as W.

TABLE 31
Symbol VV - Visibility

Code Figure	Visibility in Nautical Miles and Fractions	Code Figure	Visibility in Nautical Miles and Fractions
00	Less than 1/8	37	4
01	1/8 and 3/16	46	5
02	1/4	55	6
03	3/8	64	7
04	1/2	74	8
05	5/8	80	9 and 10
06	3/4	81	11 to 20, inclusive
09	1	82	25 and 30
11	1 1/4	83	35 and 40
13	1 1/2	84	45 and 50
16	1 3/4	85	55 to 80, inclusive
18	2	86	85 to 105, inclusive
20	2 1/4	87	110 to 160, inclusive
23	2 1/2	88	165 to 265, inclusive
27	3	89	270 or more

TABLE 32

SYMBOL WW—*Present weather*

00–49 NO PRECIPITATION AT THE SHIP AT THE TIME OF OBSERVATION

00–19: NO PRECIPITATION, FOG, DUSTSTORM, SANDSTORM OR DRIFTING SNOW AT THE SHIP AT THE TIME OF OBSERVATION OR DURING THE PRECEDING HOUR, EXCEPT FOR 09–12.

No hydrometeors except clouds.

- 00 No clouds or cloud development not observed
- 01 Clouds generally dissolving or becoming less developed
- 02 State of sky on the whole unchanged
- 03 Clouds generally forming or developing

} Characteristic change of the state of sky during the past hour.

Haze, dust, sand or smoke.

- 04 Visibility reduced by smoke, e. g., veldt or forest fires, industrial smoke, or volcanic ashes.
- 05 Dry haze.
- 06 Widespread dust in suspension in the air, not raised by wind at or near the ship at the time of observation.
- 07 Dust or sand raised by wind at or near the ship at the time of observation, but no well developed dust devil(s) and no duststorm or sandstorm seen.
- 08 Well developed dust devil(s) seen at or near the ship within last hour, but no duststorm or sandstorm.
- 09 Duststorm or sandstorm within sight of ship or at ship during the last hour.

- 10 Light fog, visibility 1,000 meters (1,100 yards) or more.
- 11 Patches of
- 12 More or less continous

} Shallow fog at the ship not deeper than about 10 meters (33 feet).

- 13 Lightning visible, no thunder heard.
- 14 Precipitation within sight, but not reaching sea at the ship.
- 15 Precipitation within sight, reaching sea, but distant [i. e., estimated to be more than 5 kilometers (3 miles) from ship].
- 16 Precipitation within sight, reaching sea, near to but not at the ship.
- 17 Thunder heard, but no precipitation at the ship.
- 18 Squall(s)
- 19 Funnel cloud(s) (tornado or waterspout)

} within sight during the past hour.

20–29: PRECIPITATION, FOG OR THUNDERSTORM AT THE SHIP DURING THE PRECEDING HOUR BUT *NOT* AT THE TIME OF OBSERVATION.

- 20 Drizzle (not freezing)
- 21 Rain (not freezing)
- 22 Snow
- 23 Rain and snow
- 24 Freezing drizzle or freezing rain

} not falling as showers.

- 25 Shower(s) of rain.
- 26 Shower(s) of snow, or of rain and snow.
- 27 Shower(s) of hail, or of hail and rain.
- 28 Fog.
- 29 Thunderstorm (with or without precipitation).

30–39: DUSTSTORM, SANDSTORM, OR DRIFTING SNOW.

- 30 Slight or moderate duststorm or sandstorm— has decreased during the preceding hour.
- 31 Slight or moderate duststorm or sandstorm— no appreciable change during the preceding hour.
- 32 Slight or moderate duststorm or sandstorm— has increased during the preceding hour.
- 33 Severe duststorm or sandstorm— has decreased during the preceding hour.
- 34 Severe duststorm or sandstorm— no appreciable change during preceding hour.
- 35 Severe duststorm or sandstorm— has increased during the preceding hour.
- 36 Slight or moderate drifting snow
- 37 Heavy drifting snow

} generally low.

- 38 Slight or moderate drifting snow
- 39 Heavy drifting snow

} generally high.

40–49: FOG AT THE TIME OF OBSERVATION.

- 40 Fog at a distance at the time of observation, but not at the ship during the last hour, the fog extending to a level above that of the observer.
- 41 Fog in patches.

See note 1.

- 42 Fog, sky discernible
- 43 Fog, sky not discernible

} has become thinner during the preceding hour.

- 44 Fog, sky discernible
- 45 Fog, sky not discernible

} no appreciable change during the preceding hour.

- 46 Fog, sky discernible
- 47 Fog, sky not discernible

} has begun or has become thicker during the preceding hour.

- 48 Fog, depositing rime, sky discernible.
- 49 Fog, depositing rime, sky not discernible.

[1] Visibility less than ⅝ miles.

TABLE 32 (continued)

50–99 PRECIPITATION AT THE SHIP AT THE TIME OF OBSERVATION

50–59: DRIZZLE AT TIME OF OBSERVATION.

50	Drizzle, not freezing, intermittent	slight at time of observation.
51	Drizzle, not freezing, continuous	
52	Drizzle, not freezing, intermittent	moderate at time of observation.
53	Drizzle, not freezing, continuous	
54	Drizzle, not freezing, intermittent	thick at time of observation.
55	Drizzle, not freezing, continuous	
56	Drizzle, freezing, slight.	
57	Drizzle, freezing, moderate or thick.	
58	Drizzle and rain, slight.	
59	Drizzle and rain, moderate or heavy.	

60–69: RAIN AT TIME OF OBSERVATION.

60	Rain, not freezing, intermittent	slight at time of observation.
61	Rain, not freezing, continuous	
62	Rain, not freezing, intermittent	moderate at time of observation.
63	Rain, not freezing, continuous	
64	Rain, not freezing, intermittent	heavy at time of observation.
65	Rain, not freezing, continuous	
66	Rain, freezing, slight.	
67	Rain, freezing, moderate or heavy.	
68	Rain or drizzle and snow, slight.	
69	Rain or drizzle and snow, moderate or heavy.	

70–79: SOLID PRECIPITATION NOT IN SHOWERS AT TIME OF OBSERVATION.

70	Intermittent fall of snowflakes	slight at time of observation.
71	Continuous fall of snowflakes	
72	Intermittent fall of snowflakes	moderate at time of observation.
73	Continuous fall of snowflakes	
74	Intermittent fall of snowflakes	heavy at time of observation.
75	Continuous fall of snowflakes	
76	Ice needles (with or without fog).	
77	Granular snow (with or without fog).	
78	Isolated starlike snow crystals (with or without fog).	
79	Ice pellets.	

80–99: SHOWERY PRECIPITATION, OR PRECIPITATION WITH CURRENT OR RECENT THUNDERSTORM.

80	Rain shower(s), slight.	
81	Rain shower(s), moderate or heavy.	
82	Rain shower(s), violent.	
83	Shower(s) of rain and snow mixed, slight.	
84	Shower(s) of rain and snow mixed, moderate or heavy.	
85	Snow shower(s), slight.	
86	Snow shower(s), moderate or heavy.	
87	Shower(s) of soft or small hail, with or without rain, or rain and snow mixed— slight.	
88	Shower(s) of soft or small hail, with or without rain, or rain and snow mixed— moderate or heavy.	
89	Shower(s) of hail, with or without rain, or rain and snow mixed, not associated with thunder— slight.	
90	Shower(s) of hail, with or without rain, or rain and snow mixed, not associated with thunder— moderate or heavy.	
91	Slight rain at time of observation	thunderstorm during the preceding hour but not at time of observation.
92	Moderate or heavy rain at time of observation	
93	Slight snow or rain and snow mixed or hail* at time of observation	
94	Moderate or heavy snow, or rain and snow mixed or hail* at time of observation	
95	Thunderstorm, slight or moderate, without hail* but with rain and/or snow* at time of observation	thunderstorm at time of observation.
96	Thunderstorm, slight or moderate, with hail* at time of observation	
97	Thunderstorm, heavy, without hail* but with rain and/or snow at time of observation	
98	Thunderstorm combined with duststorm or sandstorm—at time of observation	
99	Thunderstorm, heavy, with hail* at time of observation	

* Hail, small hail, soft hail.

TABLE 33
Symbol W - Past Weather
(During 3 or 6 hours preceding the ACTUAL time of observation)

Code Figure	Past Weather
0	0 or 1- clouds
1	0.1 to 0.5 clouds
2	More than 0.5 clouds
3	Sandstorm, or duststorm, or drifting or blowing snow
4	Fog, or smoke, or thick dust haze
5	Drizzle
6	Rain
7	Snow, or rain and snow mixed, or sleet
8	Shower(s)
9	Thunderstorm, with or without precipitation

NOTE: When precipitation or thunderstorms have occurred and have not been reported by ww, code figures 5 to 9 will be used as appropriate even though they do not represent the generally prevailing weather.

12328. PPPTT (Col. 95). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) PPP - Sea-level pressure in tens, units, and tenths of millibars. Omit hundreds and thousands digits. Convert inches to millibars in accordance with Table 34.

(b) TT - Temperature to the nearest whole degree Fahrenheit. Omit the hundreds digit for temperatures above 99°; when the temperature is below zero, subtract the actual temperature from 100 and code the remainder - e.g., code 105° as 05; -2° as 98.

TABLE 34

SYMBOL PPP.—*Corrected barometer reading*

[Code in "tens," "units," and "tenths" of millibars, omit initial 9 or 10]

[1 inch=33.86395 mb. 1 mb.=0.02952993 inch]

in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.
27. 50	931. 3	28. 00	948. 2	28. 50	965. 1	29. 00	982. 1	29. 50	999. 0	30. 00	1015. 9	30. 50	1032. 9	31. 00	1049. 8
27. 51	931. 6	28. 01	948. 5	28. 51	965. 5	29. 01	982. 4	29. 51	999. 3	30. 01	1016. 3	30. 51	1033. 2	31. 01	1050. 1
27. 52	931. 9	28. 02	948. 9	28. 52	965. 8	29. 02	982. 7	29. 52	999. 7	30. 02	1016. 6	30. 52	1033. 5	31. 02	1050. 5
27. 53	932. 3	28. 03	949. 2	28. 53	966. 1	29. 03	983. 1	29. 53	1000. 0	30. 03	1016. 9	30. 53	1033. 9	31. 03	1050. 8
27. 54	932. 6	28. 04	949. 5	28. 54	966. 5	29. 04	983. 4	29. 54	1000. 3	30. 04	1017. 3	30. 54	1034. 2	31. 04	1051. 1
27. 55	933. 0	28. 05	949. 9	28. 55	966. 8	29. 05	983. 7	29. 55	1000. 7	30. 05	1017. 6	30. 55	1034. 5	31. 05	1051. 5
27. 56	933. 3	28. 06	950. 2	28. 56	967. 2	29. 06	984. 1	29. 56	1001. 0	30. 06	1018. 0	30. 56	1034. 9	31. 06	1051. 8
27. 57	933. 6	28. 07	950. 6	28. 57	967. 5	29. 07	984. 4	29. 57	1001. 4	30. 07	1018. 3	30. 57	1035. 2	31. 07	1052. 2
27. 58	934. 0	28. 08	950. 9	28. 58	967. 8	29. 08	984. 8	29. 58	1001. 7	30. 08	1018. 6	30. 58	1035. 6	31. 08	1052. 5
27. 59	934. 3	28. 09	951. 2	28. 59	968. 2	29. 09	885. 1	29. 59	1002. 0	30. 09	1019. 0	30. 59	1035. 9	31. 09	1052. 8
27. 60	934. 6	28. 10	951. 6	28. 60	968. 5	29. 10	985. 4	29. 60	1002. 4	30. 10	1019. 3	30. 60	1036. 2	31. 10	1053. 2
27. 61	935. 0	28. 11	951. 9	28. 61	968. 8	29. 11	985. 8	29. 61	1002. 7	30. 11	1019. 6	30. 61	1036. 6	31. 11	1053. 5
27. 62	935. 3	28. 12	952. 3	28. 62	969. 2	29. 12	986. 1	29. 62	1003. 1	30. 12	1020. 0	30. 62	1036. 9	31. 12	1053. 8
27. 63	935. 7	28. 13	952. 6	28. 63	969. 5	29. 13	986. 5	29. 63	1003. 4	30. 13	1020. 3	30. 63	1037. 3	31. 13	1054. 2
27. 64	936. 0	28. 14	952. 9	28. 64	969. 9	29. 14	986. 8	29. 64	1003. 7	30. 14	1020. 7	30. 64	1037. 6	31. 14	1054. 5
27. 65	936. 3	28. 15	953. 3	28. 65	970. 2	29. 15	987. 1	29. 65	1004. 1	30. 15	1021. 0	30. 65	1037. 9	31. 15	1054. 9
27. 66	936. 7	28. 16	953. 6	28. 66	970. 5	29. 16	987. 5	29. 66	1004. 4	30. 16	1021. 3	30. 66	1038. 3	31. 16	1055. 2
27. 67	937. 0	28. 17	953. 9	28. 67	970. 9	29. 17	987. 8	29. 67	1004. 7	30. 17	1021. 7	30. 67	1038. 6	31. 17	1055. 5
27. 68	937. 4	28. 18	954. 3	28. 68	971. 2	29. 18	988. 2	29. 68	1005. 1	30. 18	1022. 0	30. 68	1038. 9	31. 18	1055. 9
27. 69	937. 7	28. 19	954. 6	28. 69	971. 6	29. 19	988. 5	29. 69	1005. 4	30. 19	1022. 4	30. 69	1039. 3	31. 19	1056. 2
27. 70	938. 0	28. 20	955. 0	28. 70	971. 9	29. 20	988. 8	29. 70	1005. 8	30. 20	1022. 7	30. 70	1039. 6	31. 20	1056. 6
27. 71	938. 4	28. 21	955. 3	28. 71	972. 2	29. 21	989. 2	29. 71	1006. 1	30. 21	1023. 0	30. 71	1040. 0	31. 21	1056. 9
27. 72	938. 7	28. 22	955. 6	28. 72	972. 6	29. 22	989. 5	29. 72	1006. 4	30. 22	1023. 4	30. 72	1040. 3	31. 22	1057. 2
27. 73	939. 0	28. 23	956. 0	28. 73	972. 9	29. 23	989. 8	29. 73	1006. 8	30. 23	1023. 7	30. 73	1040. 6	31. 23	1057. 6
27. 74	939. 4	28. 24	956. 3	28. 74	973. 2	29. 24	990. 2	29. 74	1007. 1	30. 24	1024. 0	30. 74	1041. 0	31. 24	1057. 9
27. 75	939. 7	28. 25	956. 7	28. 75	973. 6	29. 25	990. 5	29. 75	1007. 5	30. 25	1024. 4	30. 75	1041. 3	31. 25	1058. 2
27. 76	940. 1	28. 26	957. 0	28. 76	973. 9	29. 26	990. 9	29. 76	1007. 8	30. 26	1024. 7	30. 76	1041. 7	31. 26	1058. 6
27. 77	940. 4	28. 27	957. 3	28. 77	974. 3	29. 27	991. 2	29. 77	1008. 1	30. 27	1025. 1	30. 77	1042. 0	31. 27	1058. 9
27. 78	940. 7	28. 28	957. 7	28. 78	974. 6	29. 28	991. 5	29. 78	1008. 5	30. 28	1025. 4	30. 78	1042. 3	31. 28	1059. 3
27. 79	941. 1	28. 29	958. 0	28. 79	974. 9	29. 29	991. 9	29. 79	1008. 8	30. 29	1025. 7	30. 79	1042. 7	31. 29	1059. 6
27. 80	941. 4	28. 30	958. 3	28. 80	975. 3	29. 30	992. 2	29. 80	1009. 1	30. 30	1026. 1	30. 80	1043. 0	31. 30	1059. 9
27. 81	941. 8	28. 31	958. 7	28. 81	975. 6	29. 31	992. 6	29. 81	1009. 5	30. 31	1026. 4	30. 81	1043. 3	31. 31	1060. 3
27. 82	942. 1	28. 32	959. 0	28. 82	976. 0	29. 32	992. 9	29. 82	1009. 8	30. 32	1026. 8	30. 82	1043. 7	31. 32	1060. 6
27. 83	942. 4	28. 33	959. 4	28. 83	976. 3	29. 33	993. 2	29. 83	1010. 2	30. 33	1027. 1	30. 83	1044. 0	31. 33	1061. 0
27. 84	942. 8	28. 34	959. 7	28. 84	976. 6	29. 34	993. 6	29. 84	1010. 5	30. 34	1027. 4	30. 84	1044. 4	31. 34	1061. 3
27. 85	943. 1	28. 35	960. 0	28. 85	977. 0	29. 35	993. 9	29. 85	1010. 8	30. 35	1027. 8	30. 85	1044. 7	31. 35	1061. 6
27. 86	943. 4	28. 36	960. 4	28. 86	977. 3	29. 36	994. 2	29. 86	1011. 2	30. 36	1028. 1	30. 86	1045. 0	31. 36	1062. 0
27. 87	943. 8	28. 37	960. 7	28. 87	977. 7	29. 37	994. 6	29. 87	1011. 5	30. 37	1028. 4	30. 87	1045. 4	31. 37	1062. 3
27. 88	944. 1	28. 38	961. 1	28. 88	978. 0	29. 38	994. 9	29. 88	1011. 9	30. 38	1028. 8	30. 88	1045. 7	31. 38	1062. 7
27. 89	944. 5	28. 39	961. 4	28. 89	978. 3	29. 39	995. 3	29. 89	1012. 2	30. 39	1029. 1	30. 89	1046. 1	31. 39	1063. 0
27. 90	944. 8	28. 40	961. 7	28. 90	978. 7	29. 40	995. 6	29. 90	1012. 5	30. 40	1029. 5	30. 90	1046. 4	31. 40	1063. 3
27. 91	945. 1	28. 41	962. 1	28. 91	979. 0	29. 41	995. 9	29. 91	1012. 9	30. 41	1029. 8	30. 91	1046. 7	31. 41	1063. 7
27. 92	945. 5	28. 42	962. 4	28. 92	979. 3	29. 42	996. 3	29. 92	1013. 2	30. 42	1030. 1	30. 92	1047. 1	31. 42	1064. 0
27. 93	945. 8	28. 43	962. 8	28. 93	979. 7	29. 43	996. 6	29. 93	1013. 5	30. 43	1030. 5	30. 93	1047. 4	31. 43	1064. 3
27. 94	946. 2	28. 44	963. 1	28. 94	980. 0	29. 44	997. 0	29. 94	1013. 9	30. 44	1030. 8	30. 94	1047. 8	31. 44	1064. 7
27. 95	946. 5	28. 45	963. 4	28. 95	980. 4	29. 45	997. 3	29. 95	1014. 2	30. 45	1031. 2	30. 95	1048. 1	31. 45	1065. 0
27. 96	946. 8	28. 46	963. 8	28. 96	980. 7	29. 46	997. 6	29. 96	1014. 6	30. 46	1031. 5	30. 96	1048. 4	31. 46	1065. 4
27. 97	947. 2	28. 47	964. 1	28. 97	981. 0	29. 47	998. 0	29. 97	1014. 9	30. 47	1031. 8	30. 97	1048. 8	31. 47	1065. 7
27. 98	947. 5	28. 48	964. 4	28. 98	981. 4	29. 48	998. 3	29. 98	1015. 2	30. 48	1032. 2	30. 98	1049. 1	31. 48	1066. 0
27. 99	947. 9	28. 49	964. 8	28. 99	981. 7	29. 49	998. 6	29. 99	1015. 6	30. 49	1032. 5	30. 99	1049. 5	31. 49	1066. 4

12329. $N_hC_LhC_MC_H$[1] (Col. 96). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) N_h - Total amount of clouds whose height is reported by h (see (c) below), coded in accordance with Table 29. When two or more cloud types are present below 8000 feet, select a code figure for N_h corresponding to the total amount of clouds reported by C_L (or C_M, if appropriate in accordance with (c) below).

(b) C_L - The predominant C_L cloud, coded in accordance with Table 35. When two or more types of C_L clouds cover equal amounts of sky, report the highest with respect to altitude.

(c) h - The height of C_L clouds, coded in accordance with Table 36, except that if no C_L clouds covering one tenth or more of the sky are present below 8000 feet, the height of C_M clouds below that elevation will be reported.

(d) C_M - The predominant C_M cloud, coded in accordance with Table 37. When two or more types of C_M clouds cover equal amounts of sky, report the highest with respect to altitude.

(e) C_H - The predominant C_H cloud, coded in accordance with Table 38. When two or more types of C_H clouds cover equal amounts of sky, report the highest with respect to altitude.

1/ This group will be sent even if no clouds are present.

TABLE 35
Symbol C_L - Clouds of types stratocumulus, stratus, cumulus, and cumulonimbus 1/

Code figures	Technical specifications
0	No clouds C_L
1	Cumulus humilis
2 2/	Cumulus congestus, with or without cumulus humilis or stratocumulus at the same level of base
3 3/	Cumulonimbus calvus, with or without cumulus, stratocumulus or stratus
4	Stratocumulus cumulogenitus or vesperalis
5	Stratocumulus other than cumulogenitus and vesperalis
6	Stratus and/or fractostratus, but not fractostratus of bad weather
7	Fractostratus and/or fractocumulus of bad weather ("scud") usually under altostratus and nimbostratus
8	Cumulus humilis or congestus and stratocumulus other than cumulogenitus and vesperalis with bases at different levels
9 3/	Cumulonimbus capillatus (often with anvil) with or without cumulus, stratocumulus, stratus or "scud"
/	Clouds of C_L type cannot be observed due to the sky being obscured by rain, snow, fog, duststorm, sandstorm, smoke, or other phenomena

1/ See Weather Bureau Circular S for nontechnical specifications and other explanatory remarks.

2/ Code figure 2 will be used to indicate the presence of any cumulus of considerable vertical development, even though cumulus-humilis predominated.

3/ Code figure 3 or 9 will be used to report the presence of any cumulonimbus even though other low clouds predominate.

TABLE 36
Symbol h - Height of base of cloud above sea 1/

Code figure	Height in feet	Approximate height in meters
[2]0	0 - 149	0 - 49
1	150 - 299	50 - 99
2	300 - 599	100 - 199
3	600 - 999	200 - 299
4	1000 - 1999	300 - 599
5	2000 - 3499	600 - 999
6	3500 - 4999	1000 - 1499
7	5000 - 6499	1500 - 1999
8	6500 - 7999	2000 - 2500
9	No clouds, or clouds at 8,000 or higher	No clouds, or clouds at 2,500 or higher.

1/ When the code figure for C_L describes two or more kinds of clouds - e.g., $C_L = 8$, code the height corresponding to the cloud covering the greater portion of the sky; if exactly equal amounts are covered, code the height corresponding to the highest layer. Similar procedures will be followed if two layers of the same cloud type are present - e.g., $C_L = 5$ at 2000 and 5000 feet.

2/ When the sky is completely hidden by obscuring phenomena and, in addition, no clouds below 8000 feet are visible, use code figure 0; otherwise, disregard the obscuring phenomena and code h as observed - e.g., use code figure 9 if no clouds are observable even though half the sky is hidden by fog.

TABLE 37
Symbol C_M - Clouds of types altocumulus, altostratus, and nimbostratus 1/

Code figures	Technical specifications
0	No clouds C_M
1	Altostratus translucidus
2	Altostratus opacus, or nimbostratus
3	Altocumulus translucidus more or less stable and at a single level
4	Altocumulus translucidus in patches (often lenticular) continually transforming and/or occurring at different levels.
5	Altocumulus translucidus in bands or in a layer systematically invading the sky and usually thickening as a whole, even partly into altocumulus opacus or duplicatus
6	Altocumulus cumulogenitus
7	Altocumulus duplicatus or opacus, not increasing; or altostratus and altocumulus
8 2/	Altocumulus cumiliformis (floccus or castellatus)
9 2/	Altocumulus of a chaotic sky; generally at different levels; cirrus densus in patches usually present
/	Clouds of C_M type cannot be observed due to (a) an intervening cover (usually more than 9/10) "C_L" type clouds, or (b) the sky is obscured by rain, snow, fog, duststorm sandstorm, or other phenomena

1/ See Weather Bureau Circular S for nontechnical specifications and other explanatory remarks.

2/ Use code figure 9 whenever clouds of a chaotic sky are observable irrespective of other C_M type clouds present. In the absence of clouds coded as 9, use code figure 8 whenever the corresponding clouds are observable even though they do not predominate.

TABLE 38
Symbol C_H - Clouds of types cirrus, cirrostratus, and cirrocumulus 1/

Code figure	Technical specifications
0	No clouds C_H
1	Cirrus filosus, scattered and not increasing
2	Cirrus densus in patches or twisted sheaves usually not increasing, sometimes presumably being the remains of the upper part of cumulonimbus
3	Cirrus nothus: either the remains of cumulonimbus or part of a distant cumulonimbus the rest of which is not visible
4	Cirrus (often cirrus uncinus) systematically invading the sky and usually thickening as a whole
5	Cirrus, often in polar bands, and/or cirrostratus systematically invading the sky and usually thickening as a whole, but the continuous layer not reaching 45° altitude
6	Cirrus, often in polar bands, and/or cirrostratus systematically invading the sky and usually thickening as a whole, and the continuous layer exceeding 45° altitude
7	Cirrostratus covering the whole sky
8	Cirrostratus not increasing and not covering the whole sky
9	Cirrocumulus the dominant cirriform cloud
/	Clouds of "C_H" type cannot be observed due to (a) an intervening cover (usually more than 9/10) of "C_L" or "C_M" types of clouds, or (b) the sky is obscured by rain, snow, fog, duststorm, sandstorm, smoke, or other phenomena

1/ See Weather Bureau Circular S for nontechnical specifications and other explanatory remarks.

12330. $D_S v_S$app (Col. 97). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) D_S - Ship's course, as recorded in column 1B and coded in accordance with Table 39.

(b) v_S - Ship's speed, as recorded in column 1C and coded in accordance with Table 40.

(c) a - Pressure tendency, determined in accordance with sec. 7600.

(d) pp - Pressure change, determined in accordance with sec. 7600 and coded in accordance with Table 41. When the change equals or exceeds 9.9 millibars, insert the group 99ppp immediately following group $D_S v_S$app. For ppp, enter the pressure change in tens, units, and tenths of millibars, and code pp as 99 in group $D_S v_S$app, (e.g., if the pressure change is 23.4, code the two groups as $D_S v_S$a99 99234). For record purposes, enter group 99ppp in column 90 with an asterisk in column 97 to indicate its relative position in the message.

TABLE 39

SYMBOL D_s.—*Ship's course—direction toward which ship is moving*

Code figures	True direction	Code figures	True direction
0	Ship hove to.	5	SW.
1	NE.	6	W.
2	E.	7	NW.
3	SE.	8	N.
4	S.	9	No information.

TABLE 40

SYMBOL v_s.—*Ship's speed*

Code figures	Speed	Code figures	Speed
0	Ship stopped.	5	13 to 15 knots.
1	1 to 3 knots.	6	16 to 18 knots.
2	4 to 6 knots.	7	19 to 21 knots.
3	7 to 9 knots.	8	22 to 24 knots.
4	10 to 12 knots.	9	More than 24 knots.

TABLE 41

Symbols "pp" and "ppp" —*Amount of barometric change in the last 3 hours*

Amount of rise or fall

pp						ppp					
Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars	Code figure	Inches of Mercury	Millibars
00	0.000	0.0				100	0.295	10.0			
02	0.005	0.2	52	0.155	5.2	102	.300	10.2			
03	0.010	0.3	54	0.160	5.4						
05	0.015	0.5	56	0.165	5.6	103	.305	10.3	154	0.455	15.4
07	0.020	0.7	58	0.170	5.8	105	.310	10.5	156	.460	15.6
08	0.025	0.8	59	0.175	5.9	107	.315	10.7	157	.465	15.7
						108	.320	10.8	159	.470	15.9
10	0.030	1.0	61	0.180	6.1	110	.325	11.0	161	.475	16.1
12	0.035	1.2	63	0.185	6.3						
14	0.040	1.4	64	0.190	6.4	112	.330	11.2	163	.480	16.3
15	0.045	1.5	66	0.195	6.6	113	.335	11.3	164	.485	16.4
17	0.050	1.7	68	0.200	6.8	115	.340	11.5	166	.490	16.6
						117	.345	11.7	168	.495	16.8
19	0.055	1.9	69	0.205	6.9	119	.350	11.9	169	.500	16.9
20	0.060	2.0	71	0.210	7.1						
22	0.065	2.2	73	0.215	7.3	120	.355	12.0	171	.505	17.1
24	0.070	2.4	75	0.220	7.5	122	.360	12.2	173	.510	17.3
25	0.075	2.5	76	0.225	7.6	124	.365	12.4	174	.515	17.4
						125	.370	12.5	176	.520	17.6
27	0.080	2.7	78	0.230	7.8	127	.375	12.7	178	.525	17.8
29	0.085	2.9	80	0.235	8.0						
30	0.090	3.0	81	0.240	8.1	129	.380	12.9	179	.530	17.9
32	0.095	3.2	83	0.245	8.3	130	.385	13.0	181	.535	18.1
34	0.100	3.4	85	0.250	8.5	132	.390	13.2	183	.540	18.3
						134	.395	13.4	185	.545	18.5
36	0.105	3.6	86	0.255	8.6	135	.400	13.5	186	.550	18.6
37	0.110	3.7	88	0.260	8.8						
39	0.115	3.9	90	0.265	9.0	137	.405	13.7	188	.555	18.8
41	0.120	4.1	91	0.270	9.1	139	.410	13.9	190	.560	19.0
42	0.125	4.2	93	0.275	9.3	141	.415	14.1	191	.565	19.1
						142	.420	14.2	193	.570	19.3
44	0.130	4.4	95	0.280	9.5	144	.425	14.4	195	.575	19.5
46	0.135	4.6	97	0.285	9.7						
47	0.140	4.7	98	0.290	9.8	146	.430	14.6	196	.580	19.6
49	0.145	4.9		0.295	10.0	147	.435	14.7	198	.585	19.8
51	0.150	5.1	[1]99	0.300	10.2	149	.440	14.9	200	.590	20.0
				etc.	etc.	151	.445	15.1	201	.595	20.1
						152	.450	15.2	203	.600	20.3

[1] When the amount of the barometric pressure change equals or exceeds 9.9 millibars, the group "99ppp" should be inserted in the message following the "D_sv_sapp" group. The "99" is the group identifier, and "ppp" is the total amount of the pressure change (in tens, units, and tenths of millibars) during the preceding 3 hours. When the group is inserted, "99" should be reported for "pp" in the "D_sv_sapp" group. *For example:* If the total amount of the pressure change is 13.4 millibars, the groups should be coded "D_sv_sa99 99134." If the amount is 9.9 millibars, the groups are coded "D_sv_sa99 99099." ("D_sv_sa" should be given appropriate values.)

12331. $8N_sCh_sh_s$ 1/ (Col. 98). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) N_s - Amount of significant cloud, selected in accordance with the following criteria and coded in accordance with Table 29:

(1) The lowest cloud layer below 20,000 feet covering more than 1/2 of the sky. 2/

(2) The lowest layer of cloud, if any, below the layer described in (1).

(3) If no layer below 20,000 feet covers more than 1/2 the sky, the significant cloud layer is the lowest layer below 20,000 feet. 2/

(4) If both the layers described in (1) and (2) are present, report two 8-groups in the above order. For record purposes, enter the second 8-group in column 90 with an asterisk in column 98 to indicate its proper position in the report.

(b) C - Type of significant cloud, coded in accordance with Table 42.

(c) h_sh_s - Height of significant cloud, coded in accordance with Table 43.

TABLE 42
Symbol "C" - Genus (type) of significant cloud

Code Figure	Type of Cloud	Code Figure	Type of Cloud
1	Cirrus (Ci)	7	Nimbostratus (Ns)
2	Cirrostratus (Cs)	8	Cumulus or Fracto-cumulus (Cu or Fc)
3	Cirrocumulus (Cc)		
4	Altocumulus (Ac)	9	Cumulonimbus (Cb)
5	Altostratus (As)	0	Stratus or Fracto-stratus (St or Fs)
6	Stratocumulus (Sc)	/	Whenever sky is obscured and significant cloud is not visible

1/ Omit this group if no significant clouds are present.
2/ Obtain the amount of cloud cover in each layer from the corresponding entries in cols. 22, 25, 29, and 33.

TABLE 43

(International Code 40)

SYMBOL "h_sh_s"—HEIGHT ABOVE STATION OF THE LAYER OF SIGNIFICANT CLOUD REPORTED BY "N_s" [1]

Code figure	Height in feet	Code figure	Height in feet
00	Lower than 100	78	7800
01	100	79	7900
02	200	80	8000
03	300	81	9000
04	400	(82)	Not specified
05	500	83	10,000; 11,000; 12,000
06	600	84	13,000; 14,000; 15,000
07	700	85	16,000; 17,000; 18,000; and 19,000
08	800		
09	900	86	20,000; 21,000; 22,000
10	1000	87	23,000; 24,000; 25,000
11	1100	88	26,000; 27,000; 28,000; and 29,000
etc.	etc.		
		89	30,000 or higher

1/ When the sky is obscured by rain, snow, etc., use the foregoing code figures to report vertical visibility.

12332. $9S_pS_ps_ps_p$ (Col. 99). Special phenomena groups will be sent only when the phenomenon is not reported elsewhere in the message and is important for forecast activities. If more than one group is sent, enter the additional groups in column 90 with an asterisk in column 99 to indicate its proper position in the message. In general, the following special phenomena groups are sent by ships.

(1) Direction and speed of maximum wind during the previous three hours, provided it exceeded 33 knots for a one-minute period.

(2) Pronounced variation in wind direction and speed, visibility, and pressure.

12332.1. Code symbols in this group are defined as follows:

(a) S_pS_p - General description of special phenomena, selected from Table 44.

(b) s_ps_p - Detailed description of special phenomena, selected from Table 45. (Symbols following individual elements in Table 44 indicate the corresponding portion of Table 45 to be used.)

TABLE 44

SYMBOL S_pS_p—SPECIAL PHENOMENA TABLE, "GENERAL" DESCRIPTION

Code figure	"General" description with "detailed" code used (Symbol of detailed code shown in parentheses)
	00 to 39: Direction of maximum wind and special wind data
*00	Maximum wind direction in tens of degrees (00–36). (dd, Table 30).
*01	Maximum wind velocity. (ff)
02	Maximum wind from the north-northeast. (ff)
04	Maximum wind from the northeast. (ff)
06	Maximum wind from the east-northeast. (ff)
08	Maximum wind from the east. (ff)
10	Maximum wind from the east-southeast. (ff)
12	Maximum wind from the southeast. (ff)
14	Maximum wind from the south-southeast. (ff)
16	Maximum wind from the south. (ff)
18	Maximum wind from the south-southwest. (ff)
20	Maximum wind from the southwest. (ff)
22	Maximum wind from the west-southwest. (ff)
24	Maximum wind from the west. (ff)
26	Maximum wind from the west-northwest. (ff)
28	Maximum wind from the northwest. (ff)
30	Maximum wind from the north-northwest. (ff)
32	Maximum wind from the north. (ff)
33	Direction of maximum wind unknown. (D_mD_m)
34	Velocity of maximum wind unknown. (ff)
35	Wind direction in past hour, or Wind direction one hour ago. (zz or D_mD_m)
36	Wind velocity in past hour. (zz)
37	Time of highest wind. (tt)
38	Pronounced shift in wind direction. (tt, zz)
39	Wind velocity at time of observation. (ff)
	40 to 49: Fog, smoke, haze, dust, sand, and blowing snow
40	Fog. (D_sD_s, zz)
41	Fog began. (tt, zz)
42	Fog ended. (tt, zz)
43	Fog bank in distance. (D_sD_s, zz)
44	Smoke. (D_sD_s, zz)
45	Haze. (D_sD_s, zz)
46	Blowing dust or sand. (D_sD_s, zz)
47	Storm of blowing dust or sand. (tt, zz)
48	Storm of drifting or blowing snow. (tt, zz)
	50 to 59: Clouds, ceiling, and cloud height
50	Direction of C_L *and* C_H clouds (each to 8 points in D_O code). (D_L & D_H)
51	Clouds, or Direction of clouds *from station*. (zz or D_sD_s)
52	Direction of C_L clouds (to 16 points), or C_L clouds. (D_mD_m or zz)
53	Direction of C_M clouds (to 16 points), or C_M clouds. (D_mD_m or zz)
54	Direction of C_H clouds (to 16 points), or C_H clouds. (D_mD_m or zz)
55	Ceiling. (zz)
56	Height of lowest clouds above ground (in "hundreds" of feet). (nn)
57	Height of highest clouds above ground (in "thousands" of feet). (nn)
58	Height of "ceiling," if under 950 feet (in "tens" of feet). (nn)
59	Tops of overcast (reported by pilot) in "thousands" of feet. (nn)
	60 to 69: Precipitation
60	Precipitation. (D_sD_s, zz)
61	Precipitation began. (tt, zz)
62	Precipitation ended. (tt, zz)
63	Rain, or Rain began. (zz or tt)
64	Snow, or Snow began. (zz or tt)
65	Freezing rain, or Freezing rain began. (zz or tt)
66	Sleet, or Sleet began. (zz or tt)
67	Wet snow, or Wet snow began. (zz or tt)
68	Hail, or Hail began. (zz or tt)
69	Rain and snow mixed, or Rain and snow mixed began. (zz or tt)
	70 to 79: Visibility, temperature, and pressure
70	Visibility. (zz)
71	Reduced visibility. (D_sD_s, zz)
72	Visibility in "whole miles". (nn)
73	Visibility in "tens" of feet. (nn)
74	Vertical visibility. (zz)
75	Water temperature in degrees Fahrenheit. (nn)
76	
77	Surface "station pressure" in "tenths" and "hundredths" of an inch. (nn)
78	Lowest sea level pressure in last 6 hours (in "tens" and "units" of mb). (nn)
79	Barometer, or Time of lowest pressure. (zz or tt)
	80 to 89: Miscellaneous
80	Supplementary "present weather" at time of observation. ("ww" code)
81	Frost. (tt, zz)
82	Glaze. (tt, zz)
83	State of Sea or Period of Sea Swell. (S_sS_s or K_pK_p)
84	
85	Depth of snow on ground (in whole inches). (nn)
86	Front passed station, or Front. (tt, zz)
87	Cold front passed station, or Cold front. (tt, zz)
88	Warm front passed station, or Warm front. (tt, zz)
89	Direction and Orientation of Cloud Shield. (D_{Cs} and D_o)
	90 to 99: Thunderstorms
90	Thunderstorm. (D_sD_s, zz)
91	Thunder first heard at station (with precipitation at station). (tt, zz)
92	Thunder last heard at station (with precipitation at station). (tt, zz)
93	Thunder first heard (but without precipitation at station). (tt, zz)
94	Thunder last heard (but without precipitation at station). (tt, zz)
95	Direction of movement of thunderstorm. (D_mD_m)
96	Distant lightning. (D_sD_s, zz)
97	Distant thunderstorm. (D_sD_s, zz)
98	Approaching thunderstorm. (D_sD_s, zz)
99	Tornado. (tt, zz)

*To conform to WMO resolutions, U. S. Weather Bureau stations will use code figures 00 and 01 to report maximum wind direction and velocity.

NOTE: The above Special Phenomena Code will be used until a revised Special Phenomena Code is adopted in Region IV of the WMO.

TABLE 45

Symbol "$s_p s_p$" - Special Phenomena Table, "Detailed" Description

Several individual code tables are required to report data for "$s_p s_p$". For ease of identification the individual "$s_p s_p$" code tables are considered to be parts of one general "$s_p s_p$" code table (No. 45) and have been designated by letter (e.g., 45a, 45b, etc.) The individual "$s_p s_p$" code tables are:

45a Wind Speed Table.....(ff)

45b Numerical Table.....(nn)

45c Time Table.....(tt)

45d Direction of Movement Table.....($D_m D_m$)

45d Direction from Station Table.....($D_s D_s$)

45e Variation Table.....(zz)

45f Direction of Cloud Movement Table.....(D_L and D_H)

45f Direction of Cloud Shield from Station.....(D_{Cs})

45g Orientation of Cloud Shield Table.....(D_o)

TABLE 45a

"WIND SPEED" TABLE

Symbol "ff"—Wind Speed in knots. (00 to 99)

Code Figure	Wind Speed	Code Figure	Wind Speed
00	Calm; or unknown	97	97 knots
01	1 knot	98	98 knots
02	2 knots	99	99 knots; or 100 knots
03	3 knots	01	101 knots*
04	4 knots	02	102 knots*
etc.	etc.	03	103 knots*
95	95 knots	04	104 knots*
96	96 knots	etc.	etc.

*When the wind speed is greater than 100 knots TWO Special Phenomena groups are included in the message and the same code figure is reported for "8_P8_P" in both groups. In the first group "99" is reported for "s_ps_p" and in the second group the speed in EXCESS of 100 knots is reported for "s_ps_p". For example: In reporting a maximum wind of 124 knots, the groups are coded "90199 90124."

TABLE 45b

"NUMERICAL" TABLE

Symbol "nn"—Units of specific value. (00 to 99)

Code figure	Value (depending on "general" code figure used)
00	Zero or less than 1 unit
01	"1"; "10"; "100"; or "1,000"
02	"2"; "20"; "200"; or "2000"
etc.	etc
12	"12"; "120"; "1,200"; or "12,000"
13	"13"; "130"; "1,300"; or "13,000"
etc.	etc
98	"98"; "980"; "9,800"; or "98,000"
*99	"99" or more; "990" or more; "9,900" or more; "99,000" or more

*When the value to be coded for symbol "nn" is "more than 99, etc." the appropriate number of 98_P8_{Pnn} groups will be used; i.e., in the first group (or groups) "99" will be reported for "nn" and the amount in excess of 100 (or 200, etc., as appropriate) will be reported for "nn" in the last group of the series. For example: 100 inches of snow on ground would be coded 98599 98500; 105 inches, 98599 98505; 210 inches, 98599 98599 98510, etc.

TABLE 45c

"TIME" TABLE

Symbol "tt" = "units" and "tenths" of hours *before* observation.* (00 to 75)

Code figure	Hours and minutes *before* observation*	Code figure	Hours and minutes *before* observation*
00	At observation.	42	4 hours 12 minutes.
01	0 hour 6 minutes.	43	4 hours 18 minutes.
02	0 hour 12 minutes.	44	4 hours 24 minutes.
03	0 hour 18 minutes.	45	4 hours 30 minutes.
04	0 hour 24 minutes.	46	4 hours 36 minutes.
05	0 hour 30 minutes.	47	4 hours 42 minutes.
06	0 hour 36 minutes.	48	4 hours 48 minutes.
07	0 hour 42 minutes.	49	4 hours 54 minutes.
08	0 hour 48 minutes.	50	5 hours 0 minutes.
09	0 hour 54 minutes.	51	5 hours 6 minutes.
10	1 hour 0 minutes.	52	5 hours 12 minutes.
11	1 hour 6 minutes.	53	5 hours 18 minutes.
12	1 hour 12 minutes.	54	5 hours 24 minutes.
13	1 hour 18 minutes.	55	5 hours 30 minutes.
14	1 hour 24 minutes.	56	5 hours 36 minutes.
15	1 hour 30 minutes.	57	5 hours 42 minutes.
16	1 hour 36 minutes.	58	5 hours 48 minutes.
17	1 hour 42 minutes.	59	5 hours 54 minutes.
18	1 hour 48 minutes.	60	6 hours 0 minutes.
19	1 hour 54 minutes.	61	6 to 7 hours.
20	2 hours 0 minutes.	62	7 to 8 hours.
21	2 hours 6 minutes.	63	8 to 9 hours.
22	2 hours 12 minutes.	64	9 to 10 hours.
23	2 hours 18 minutes.	65	10 to 11 hours.
24	2 hours 24 minutes.	66	11 to 12 hours.
25	2 hours 30 minutes.	67	12 to 18 hours.
26	2 hours 36 minutes.	68	More than 18 hours.
27	2 hours 42 minutes.	69	Time unknown.
28	2 hours 48 minutes.		
29	2 hours 54 minutes.	70	Began during observation.†
30	3 hours 0 minutes.		
31	3 hours 6 minutes.	71	Ended during observation.†
32	3 hours 12 minutes.		
33	3 hours 18 minutes.	72	Began and ended during observation.†
34	3 hours 24 minutes.		
35	3 hours 30 minutes.	73	Changed considerably during observation.†
36	3 hours 36 minutes.		
37	3 hours 42 minutes.		
38	3 hours 48 minutes.	74	Began after observation.†
39	3 hours 54 minutes.		
40	4 hours 0 minutes.	75	Ended after observation.†
41	4 hours 6 minutes.		

*"Before observation" in this code table means "before the reference time of observation" and is not necessarily the time "before the observation was actually taken."

†Code figures 70 to 75, refer to the PRECISE (or ACTUAL) time the element is observed.

TABLE 45d

"DIRECTION" TABLES

Symbol "D_mD_m" Direction *of movement.** (00 to 39)
Symbol "D_sD_s" = Direction *from station.*† (00 to 39)

Code figure	Direction	Code figure	Direction	Code figure	Direction
00	Calm.†	18	SSW.	33	Variable.
02	NNE.	20	SW.	34	Unknown.
04	NE.	22	WSW.	35	In several directions.
06	ENE.	24	W.	36	In several directions, but not at station.
08	E.	26	WNW.		
10	ESE.	28	NW.	37	Over nearby water area.
12	SE.	30	NNW.		
14	SSE.	32	N.	38	Over nearby valleys.
16	S.			39	Over nearby hills or mountains.

*Direction of movement is "direction *from which* item is moving"
†For symbol "D_sD_s" code figure 00 means "at station".

TABLE 45e

"VARIATION" TABLE

Symbol "zz" = Variation in phenomena. (70 to 99

Code figure	Description
70	Began while observation was being taken.†
71	Ended while observation was being taken.†
72	Began and ended while observation was being taken.†
73	Changed considerably while observation was being taken.†
74	Began *after* observation was taken.†
75	Ended *after* observation was taken.†
76	At station.
77	At station, but not in distance.
78	In all directions.
79	In all directions, but not at station.
80	Approaching station.
81	Receding from station.
82	Passing station in distance.
83	Seen in distance.
84	Reported in neighborhood, but not at station.
85	Aloft, but not near ground.
86	Near ground, but not aloft.
87	Occasional; occasionally.
88	Intermittent; intermittently.
89	Frequent; frequently; at frequent intervals.
90	Steady; steady in intensity; steadily; no appreciable change.
91	Increasing; increasing in intensity; has increased.
92	Decreasing; decreasing in intensity; has decreased.
93	Fluctuating; variable.
94	Continuous; continuously.
95	Very light; very weak; greatly below normal; very thin; very poor.
96	Light; weak; below normal; thin; poor.
97	Moderate; normal; average thickness; fair; gradually.
98	Heavy; severe; thick; above normal; good; suddenly.
99	Very heavy; killing; very severe; dense; greatly above normal; very thick; very good.

†Code figures 70 to 75 refer to the PRECISE (or ACTUAL) time the element is observed.

TABLE 45f

"DIRECTION OF CLOUD MOVEMENT" AND "DIRECTION OF CLOUD SHIELD FROM STATION" TABLE

Symbol "D_L"=Direction From Which C_L Type Clouds Are Moving. (0 to 9)
Symbol "D_H"=Direction From Which C_H Type Clouds Are Moving. (0 to 9)
Symbol "D_{Cs}"=Direction of Cloud Shield From Station. (0 to 9)

Code figure	Direction	Code Figure	Direction
0	No clouds, or calm.	5	Southwest.
1	Northeast.	6	West.
2	East.	7	Northwest.
3	Southeast.	8	North.
4	South.	9	Unknown or variable.

TABLE 45g

ORIENTATION OF CLOUD SHIELD TABLE

Symbol "D_o"=Orientation of Cloud Shield. (0 to 9)

Code Figures	Orientation
0	No observation
1	NNE–SSW or reverse
2	NE–SW or reverse
3	ENE–WSW or reverse
4	E–W or reverse
5	ESE–WNW or reverse
6	SE–NW or reverse
7	SSE–NNW or reverse
8	S–N or reverse
9	Uncertain

12333. $0T_sT_sT_dT_d$ (Col. 100). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) T_sT_s - Difference between sea and air temperature as recorded in columns 7 & 40A. When the air temperature is higher than the sea temperature, enter the actual difference; when the air temperature is lower than the sea temperature, add

50 to the difference before entering in column 100 - e.g., when the air temperature is 5° above the sea temperature, enter 05; when the air temperature is 5° below sea temperature, enter 55.

(b) T_dT_d - Dew point temperature, as recorded in column 8. Code values below zero in accordance with par. 12328(b).

12334. $1d_wd_wP_wH_w$ (Col. 101). Enter coded data as specified by the symbols shown in the column headings. These symbols have the following meaning:

(a) d_wd_w - Direction of waves in tens of degrees as recorded in column 40B, except that 50 will be added to this value when the height of waves exceeds 15 feet (see Table 47). When the direction of the waves is indeterminate, enter 49 if the height is 15 feet or less and 99 if the height is greater than 15 feet. Enter 00 when no waves are present.

(b) P_w - Period of waves, as entered in column 40B and coded in accordance with Table 46.

(c) H_w - Height of waves, as entered in column 40B and coded in accordance with Table 47.

12334.1. When more than one wave system is observed as indicated in par. 12322, two wave groups will be sent in the coded message. Enter coded data pertaining to the predominant wave system in column 101, and an asterisk to indicate the position in the coded message of the data for the second system. Enter an asterisk and the coded data for the less pronounced system in column 90.

TABLE 46

(International Code 69)

SYMBOL "P_w"—PERIOD OF THE WAVES

Code figure	Period
2	5 seconds or less
3	5 - 7 seconds
4	7 - 9 seconds
5	9 - 11 seconds
6	11 - 13 seconds
7	13 - 15 seconds
8	15 - 17 seconds
9	17 - 19 seconds
0	19 - 21 seconds
1	Over 21 seconds.
X	Calm or Period not determined.

NOTE: If the exact number of seconds for the period of the waves could be reported by two code figures, the lower code figure will be reported.

TABLE 47

Symbol "H_W" - Mean maximum height of the waves 1/

Code Figure	Height in feet	Code Figure	Height in feet (when 50 is added to $d_W d_W$)
0	Less than 1	0	16
1	1-1/2	1	17-1/2
2	3	2	19
3	5	3	21
4	6-1/2	4	22-1/2
5	8	5	24
6	9-1/2	6	25-1/2
7	11	7	27
8	13	8	29
9	14	9 2/	30-1/2
X	Height indeterminable		

1/ If the wave height is exactly midway between the heights corresponding to two code figures, the lower code figure is reported.

2/ For wave heights greater than 31 feet, add 50 to the coded direction $d_W d_W$; code H_W as 9. Immediately following this group add the word WAVES and their height in feet; e.g., with 37 foot waves from 80° having a period of more than 21 seconds, code the data for group $1d_W d_W P_W H_W$ as "15819 WAVES 37."

12335. c_2KD_1re [1] (Col. 102). Prefix the identifier "ICE" to this group, and enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) c_2 - Kind of ice, in accordance with Table 48.

(b) K - Effect of ice on navigation, in accordance with Table 49.

(c) D_1 - Bearing to the nearest edge of the ice, coded in accordance with Table 50. If an ice blink is reported for c_2, report the bearing of the blink. When more than one ice area is observed, report 9 unless one area is of outstanding importance to navigation, in which case the bearing of that area should be reported.

(d) r - Distance in nautical miles corresponding to the bearing reported for D_1 and coded in accordance with Table 51.

(e) e - Orientation of ice edge whose bearing and distance are reported for symbols D_1 and r, and coded in accordance with Table 52.

[1] Omit this group when no ice is observed.

TABLE 48
Symbol c_2. -- Description of kind of ice

Code figure	Description	Definition
0	None or "ice blink"	The white or yellowish-white glare on the sky produced by the reflection from considerable areas of sea ice.
1	Slush or young ice	An accumulation of ice crystals which are only slightly, if at all, frozen together to form a thin layer. The slush lends a leaden-tinted color to the sea surface, from which wind ripples are absent.
2	Fast-ice	A stretch of unbroken ice that is limited by the shore line on one side. Fast-ice is formed in bays, sounds, and shallow water, and remains fast in the position of growth. Fast-ice is sometimes called "Land-ice," "Shore-ice," "Bay-ice," or Coast-ice."
3	Drift-ice	Sea-ice which is not limited by the shore line.
4	Packed (compact) slush or strips of hummocked ice	
5	Open lead near shore	Open channels in the ice near the shore such as might be caused by wind, currents, ship movement, etc.
6	Heavy fast-ice	
7	Heavy drift-ice	
8	Hummocked ice	Ice characterized by ridges caused by ice pressure. If melting or weathering has occurred, hummocks assume a rounded shape.
9	Ice jamming	The action of unusual accumulations of hummocked ice that have been forced by wind against the shore or into small bays or inlets.

TABLE 49

SYMBOL K.—Effect of ice on navigation

Code figure	Description
0	Navigation unobstructed.
1	Navigation slightly obstructed.
2	Navigation difficult for low powered ships.
3	Navigation possible only for powerful ships.
4	Navigation possible only for ships constructed to withstand ice pressure.
5	Navigation possible with the assistance of ice-breakers.
6	Channel open in the solid ice.
7	Navigation temporarily closed.
8	Navigation closed.
9	Navigation conditions unknown (e. g., owing to bad weather).

TABLE 50

SYMBOL D_i.—*Bearing of ice limit*

Code figure	Description
0	Unknown.
1	Ice limit toward NE.
2	Ice limit toward E.
3	Ice limit toward SE.
4	Ice limit toward S.
5	Ice limit toward SW.
6	Ice limit toward W.
7	Ice limit toward NW.
8	Ice limit toward N.
9	Ice limit in several directions.

NOTE.—If more than one ice limit can be stated, the nearest or most important is reported.

TABLE 51

SYMBOL r.—*Distance to ice limit from reporting ship*

Code figure	Distance
0	0 to 1 mile.
1	1 to 2 miles.
2	2 to 4 miles.
3	4 to 6 miles.
4	6 to 8 miles.
5	8 to 12 miles.
6	12 to 16 miles.
7	16 to 20 miles.
8	More than 20 miles.
9	Unknown.

NOTE.—If the exact bounding distance for the ice limit corresponds to two code figures, the lower code figure is reported.

TABLE 52

SYMBOL e.—*Orientation of ice limit*

Code figure	Orientation of ice limit
0	Orientation of ice limit impossible to estimate—ship *outside* the ice.
1	Ice edge lying in a direction NE to SW with ice situated to the NW.
2	Ice edge lying in a direction E to W with ice situated to the northward.
3	Ice edge lying in a direction SE to NW with ice situated to the NE.
4	Ice edge lying in a direction S to N with ice situated to the eastward.
5	Ice edge lying in a direction SW to NE with ice situated to the SE.
6	Ice edge lying in a direction W to E with ice situated to the southward.
7	Ice edge lying in a direction NW to SE with ice situated to the SW.
8	Ice edge lying in a direction N to S with ice situated to the westward.
9	Orientation of ice limit impossible to estimate—ship *inside* the ice.

12336. Bergs. (Col. 103). Icebergs are large masses of ice that have broken away from the forward edge of a glacier and moved into the sea. When icebergs are observed, enter the number in column 103, and size and height above sea in column 90. In the transmitted message, report the number of icebergs in plain language at the end of the report; e.g., "1 berg," "2 bergs," etc.

12337. Times of beginning and ending of weather and obstructions to vision. (Cols. 105 - 111). Enter the times of beginnings and endings (GCT) of weather and obstructions to vision in accordance with pars. 3930 - 3932. Enter positions to the nearest whole degree latitude and longitude.

12338. Summary of the Day. (Cols. 112 - 128). Enter data for the period midnight to midnight GCT as follows:

(a) Maximum Wind - Enter the following data for the highest observed one-minute wind speed:

(1) Column 112 - Time to the nearest minute GCT.

(2) Column 113 - Direction and speed, using the same recording procedures as for columns 9 and 10.

(3) Columns 114 and 115 - Position to the nearest whole degree latitude and longitude.

(b) Lowest pressure - Enter the following data for the lowest observed pressure, as determined from the barogram after corrections have been applied:

(1) Column 116 - Time to the nearest minute GCT.

(2) Column 117 - Lowest pressure in millibars and tenths.

(3) Column 118 - Wind direction and speed at the time of lowest pressure, using the same recording procedures as for columns 9 and 10.

(4) Columns 119 and 120 - Position to the nearest whole degree latitude and longitude.

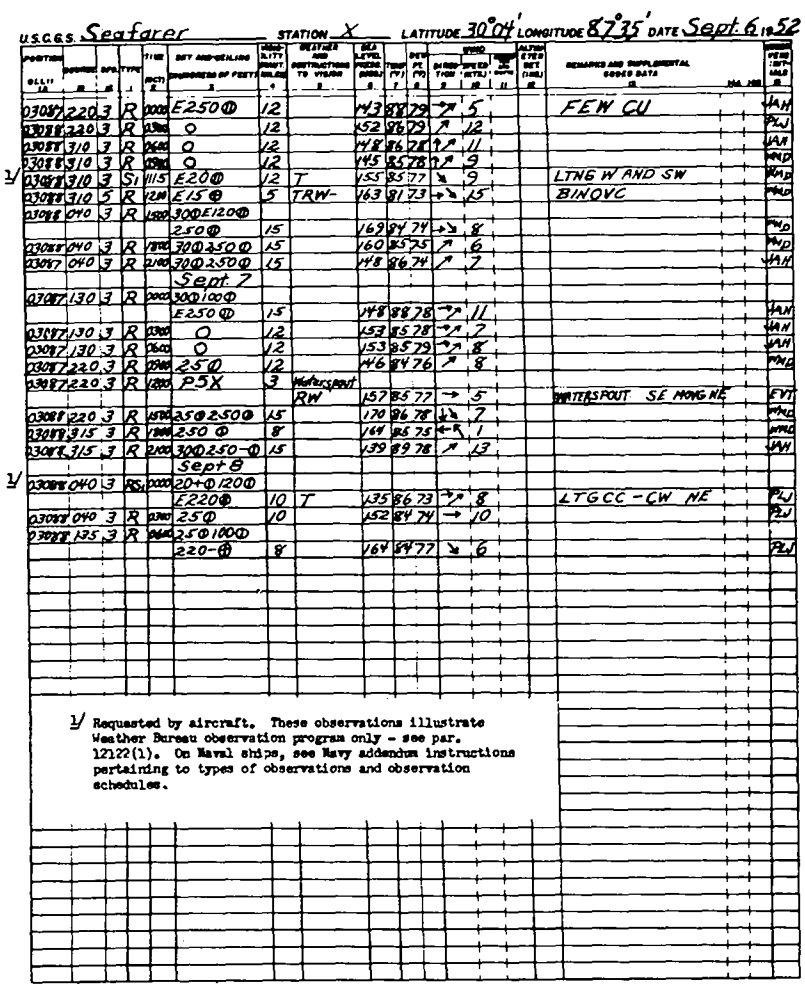
(c) Gales - Enter the following data whenever the wind speed averages force 8 or more (force 6 in tropical seas) for at least one hour during the day. If several such periods occur, enter data for additional periods in column 90.

(1) Column 121 - Time at which force 8 wind began, to the nearest minute GCT.

(2) Column 122 - Direction and speed of wind at the above time, recorded similarly to columns 9 and 10.

(3) Columns 123 and 124 - Position at above time to the nearest whole degree latitude and longitude.

(4) Columns 125 - 128 - Enter data pertaining to time at which force 8 wind ended, similarly to entries in columns 121 - 124.



W.B. FORM 1210A (Revised 1-52)

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
(OCEAN STATION VESSELS)

WBAN-11A

U.S.C.G.S. Seafarer STATION X LATITUDE 30°04' LONGITUDE 87°35' DATE Sept. 6, 1952

POSITION (GILLIS)	SOURCE	DPS	TYPE	TIME (GCT)	DET APPEARING (SOURCE OF DATA)	CEILING (HUNDREDS OF FEET)	WEATHER AND OBSTRUCTIONS TO VISION	SEA LEVEL PRESS (MB)	TEMP (°F)	DEW PT (°F)	WIND DIRECTION	WIND SPEED (KTS)	WIND GUSTS	ALTIMETER SET (INS)	REMARKS AND SUPPLEMENTAL CODED DATA	WEATHER AND OBSTRUCTIONS TO VISION
03088	220	3	R	0000	E250 ⓓ	12		143	88	79	→	5			FEW CU	HAH
03088	220	3	R	0300	O	12		152	86	79	↗	12				PLJ
03088	310	3	R	0600	O	12		148	86	78	↑↗	11				JAH
03088	310	3	R	0900	O	12		145	85	78	↑↗	9				WND
1/ 03088	310	3	S1	1115	E20 ⓓ	12	T	155	85	77	↘	9			LTNG W AND SW	WMD
03088	310	5	R	1200	E15 ⊕	5	TRW-	163	81	73	→↘	15			BINOVC	WND
03088	040	3	R	1500	300 E120 ⓓ											
					250 ⓓ	15		169	84	74	→↘	8				WND
03088	040	3	R	1800	300 250 ⓓ	15		160	85	75	↗	6				WND
03097	040	3	R	2100	300 250 ⓓ	15		148	86	74	↗	7				JAH
					Sept. 7											
03087	130	3	R	0000	300 100 ⓓ											
					E250 ⓓ	15		148	88	78	→↗	11				JAH
03087	130	3	R	0300	O	12		153	85	78	→↗	7				JAH
03097	130	3	R	0600	O	12		153	85	79	→↗	8				JAH
03087	220	3	R	0900	25 ⓓ	12		146	84	76	↗	8				WND
03087	220	3	R	1200	P5X	3	Waterspout									
							RW	157	85	77	→	5			WATERSPOUT SE MOVG NE	FVT
03088	220	3	R	1500	35 ⓓ 250 ⓓ	15		170	86	78	↓↘	7				WMD
03088	315	3	R	1800	250 ⓓ	8		164	86	75	←↖	1				WMD
03088	315	3	R	2100	300 250 ⓓ	15		139	89	78	↗	13				JAH
					Sept 8											
1/ 03088	040	3	RS	0000	20+ⓓ 120 ⓓ											
					E220 ⓓ	10	T	135	86	73	→↗	8			LTGCC-CW NE	PLJ
03088	040	3	R	0300	25 ⓓ	10		152	84	74	→	10				PLJ
03088	135	3	R	0600	250 100 ⓓ											
					220-ⓓ	8		164	84	77	↘	6				PLJ

1/ Requested by aircraft. These observations illustrate Weather Bureau observation program only - see par. 12122(1). On Naval ships, see Navy addendum instructions pertaining to types of observations and observation schedules.

W.B. FORM 1210B (Revised 1-52)

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
(OCEAN STATION VESSELS)

WBAN-11B

U.S.C.G.S. Seafarer STATION X LATITUDE 30°04' LONGITUDE 87°35' DATE Sept. 6, 1952

TIME (GCT)	STATION PRESSURE	DRY BULB (°F)	WET BULB (°F)	REL HUMIDITY (%)	CLOUDS AND OBSCURING PHENOMENA: AMT	LOWEST LAYER: TYPE	LOWEST LAYER: HEIGHT	SECOND LAYER: AMT	SECOND LAYER: TYPE	SECOND LAYER: HEIGHT	THIRD LAYER: AMT	THIRD LAYER: TYPE	THIRD LAYER: HEIGHT	FOURTH LAYER: AMT	FOURTH LAYER: TYPE	FOURTH LAYER: HEIGHT	VISIBILITY	39	40	SEA SURFACE TEMP (°F)	WAVES: PERIOD	WAVES: HEIGHT
00	29935	87.6	81.3	76	8	1-Cu	30	8	Ci	250	8	0		8	0		6			86	18	05 07
01																						
02																						
03	29960	85.9	80.7	80	0	0		0			0	0		0	0		0			87	18	05 07
04																						
05	29945	86.2	80.1	77	0	0		0			0	0		0	0		0			86	16	05 06
06																						
07	29935	85.3	79.8	79	0	0		0			0	0		0	0		0			86	16	05 08
08																						
09	29990	80.9	75.3	77	9+	9+	Cb	15	U			U			U		9+			86	04	50 6
10																						
11	30.010	84.0	76.7	72	9	2	Cu	30	6	Ac	120	8	2	Ci	250	9	0		8	86	04	50 6
12																						
13	29985	85.1	77.7	72	3	2	Cb	30	1	Ci	250	3	0			3	0		3	86	18	05 06
14																						
15	29945	85.6	77.2	69	3	1	Cb	30	2	Ci	250	3	0			3	0		2	86	18	04 06
16																						

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

Sea Sw: Direction 1127 Period 0006
LTNG began 0940, E to SW, 10 to 20 miles; MOVG W to SW 20 to 30 miles, ending 1240.
* 82830

WEATHER AND OBSTRUCTIONS TO VISION

TYPE	OBSAN TIME	OBSAN LAT	OBSAN LONG	SHIP TIME	SHIP LAT	SHIP LONG
T	1110	30	88	1225	30	88
RW	1146	30	88	1205	30	88

SYNOPTIC OBSERVATIONS 1/

00300	87480	62505	81022	14388	11508	51303	81830			00279	11829			
00299	87507	02312	81000	15285	00000	51108				05179	11829			
00298	87606	02011	81000	14886	00000	71905				00078	11625			
00299	87789	02009	81000	14585	00000	71605				05178	11625			
00300	87812	72915	76250	16581	79400	72917	87915			05573	49285			
00301	87715	72908	81019	16984	21562	11107	85983			05278	49285			
00302	87618	22906	81029	16085	29508	11908	82980			05125	11824			
00301	87528	22907	81021	14886	29508	11614	81930			00074	11824			

SUMMARY OF DAY (BEGINNING TO MIDNIGHT)

MAXIMUM WIND: TIME (GCT)	MAXIMUM WIND: DIRECTION & SPEED	MAXIMUM WIND: LAT	MAXIMUM WIND: LONG	LOWEST PRESSURE: TIME (GCT)	LOWEST PRESSURE: MILLIBARS	LOWEST PRESSURE: LAT	LOWEST PRESSURE: LONG	SEA SURFACE T OR HIGHEST - E IN TROPICAL SEAS: TIME (GCT)	SEA SURFACE T OR HIGHEST - E IN TROPICAL SEAS: DIRECTION & SPEED	SEA SURFACE T OR HIGHEST - E IN TROPICAL SEAS: LAT	SEA SURFACE T OR HIGHEST - E IN TROPICAL SEAS: LONG	HIGHEST WAVES: TIME (GCT)	HIGHEST WAVES: PERIOD & HEIGHT	HIGHEST WAVES: LAT	HIGHEST WAVES: LONG
1143	→22,30	88	00	0015	10142	-25	70	87							

1/ On Naval ships, see Navy addendum instructions for schedule of synoptic observations.

Fig. 8. Entries on WBAN-11A and B.

R-3.3-Library (2)

Change No. → 3

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON, D. C.

MANUAL OF SURFACE OBSERVATIONS

(WBAN)

CIRCULAR N

Sixth Edition

(Revised)

JULY 1952

Instructions pertaining to Change No. 3, Circular N, 6th Edition (Revised June 1, 1951):

(1) This change becomes effective 0000 GCT July 1, 1952, except that at Weather Bureau stations, changes pertaining to PIREPS (Chapter 10) may be made effective at an earlier date through separate instructions.

(2) The following changes should be made in ink:

(a) Page 26, ¶ 3231, 5th line, delete "30 miles per hour (26 knots)" and substitute "25 knots."

(b) Page 26, ¶ 3232, 5th line; and 3233, 4th line, delete "40 miles an hour" and the parentheses enclosing "35 knots."

(c) Page 26, ¶ 3310, 2nd line, delete "19 mph" and the parentheses enclosing "16 knots."

(d) Page 31, ¶ 3502, 3rd line, change "36°" to read "33°."

(e) Page 39, note preceding ¶ 3930, 2nd line, delete, "e.g., blowing spray."

(f) Page 52, ¶ 5150, line 7, change to read "....3-1/2 r.p.s. of the crank of the psychrometer....."

(g) Page 53, ¶ 5163, and page 54 ¶ 5173, 1st line of each paragraph, insert "is broken or the" between "thermometer" and "reading."

(h) Page 60, 4th line, insert "whole" between "to" and "degrees", and delete "and tenths Fahrenheit."

(i) Page 164, Index, under "Pilot reports", change to read "entry on WBAN-12.....10310-14". (This correction applies only to the WBAN Index; separate instructions will be issued for stations having a combined WBAN-Addendum Index.)

(3) This page may be discarded after the above changes have been entered.

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1/ This chapter is not distributed to Air Force stations.

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INTRODUCTION

Taking observations is the primary duty of the observer. Nothing except the most pressing demands upon the observer's attention should be given precedence to this fundamental duty. Since life, property, and the convenience of travelers, as well as accurate forecasts, may depend upon his observations, the observer should make every effort to take the observations as accurately and completely as possible, and to file them in sufficient time for scheduled transmission. Every observation must be accurate in all its parts, and it must convey a complete picture of the meteorological situation existing at the station.

When computations require the disposal of decimals, the following procedure will be observed:

(1) If the decimal to be disposed of is five or greater, the preceding digit will be increased by one.

*(2) If the decimal to be disposed of is less than five, the preceding digit will remain unchanged, e.g., 29.248 rounded to the nearest tenth is 29.2.

Algebraic signs will be disregarded - e.g., 1.5 = 2; -1.5 = -2.

*Revised
Eff. 7-1-52

CHAPTER 1. CLOUDS AND OBSCURING PHENOMENA

1000. GENERAL

*1010. Code numbers for cloud forms and states of the sky are described in detail in Weather Bureau Circular S. Instructions in this chapter are confined to those necessary for observing clouds and obscuring phenomena with respect to their amount, stratification, direction of movement, height of bases, and the effect of obscuring phenomena on vertical visibility. Observations of these elements will be taken from as many points as necessary to view the entire sky. Pilots' reports of sky cover will not be included in the surface observation, but will be sent as pireps only (see Chapter 10).

1100. DETERMINATION OF SKY COVER

*1110. DEFINITION OF SKY COVER. Sky cover is a term used to denote one of the following conditions:

(1) Amount of sky covered, but not necessarily hidden by clouds or obscuring phenomena aloft.

(2) Amount of sky concealed by obscuring phenomena on the ground.

(3) A combination of (1) and (2).

Sky cover may refer either to the amount of sky covered by a particular layer, or to the total amount covered by all layers. If the sky cover is opaque (i.e., conceals the sky), the tenths of sky cover plus the tenths of sky visible will always equal 1.0 (10/10). Sky cover is estimated with reference to the actual, rather than celestial, horizon. It is reported to the nearest tenth, with decimals disposed of in accordance with the Introduction (e.g., sky cover of .07 is regarded as one tenth, .95 as ten tenths). Sky-cover observations may be taken without the use of instruments. At night it will frequently be necessary to observe the clouds and obscuring phenomena passing through the beam from a ceiling light or ceilometer projector over a period of several minutes in order to obtain a more nearly representative picture of the amount and distribution. Determine the amount of sky cover in accordance with ¶ 1120 through 1121, and select corresponding sky-cover symbols from Table 1a.

*Table 1a. Sky-Cover Symbols

Symbol and Meaning	Explanation
X Obscuration.....	Ten tenths of sky hidden by precipitation or obstructions to vision (bases at surface).
-X Partial obscuration.....	0.1 to 0.9 sky hidden by precipitation or obstructions to vision (base at surface).
O Clear.....	0.0 total sky cover (This symbol is not used in combination.)
◐1/ Scattered.....	0.1 to 0.5 sky cover.
◑1/ Broken.....	0.6 to 0.9 sky cover.
⊕1/ Overcast.....	Ten tenths of sky cover. (This symbol will be used in combination with a lower overcast symbol only if the latter is classified thin.)

1/ Symbols for thin ("-") and dark ("+") will be prefixed to these symbols in accordance with ¶ 1511.

1120. WITH ADVANCING LAYER. To estimate the amount of an advancing (or receding) layer, determine the angular elevation above the horizon of the forward or rear edge of the layer as seen against the sky. This will be done with a theodolite or clinometer until experience is gained in estimating vertical angles. Convert the angle to tenths of sky cover by use of Table 1.

1120.1. When the layer does not extend to the horizon, determine the angular elevation of the forward and rear edges and the tenths of sky cover corresponding to each elevation. The difference will be the required sky cover. For example: Forward edge 78° = 0.4 sky cover; rear edge 53° = 0.2 sky cover. Total sky cover is the difference between the two, or 0.2 sky cover.

*Table 1. Sky cover with advancing or receding layers

Angles subtended by sky cover	Tenths of sky cover	Angles subtended by sky cover	Tenths of sky cover
Less than 26°.....	0.0	96° - 107°.....	0.6
26° - 45°.....	0.1	108° - 119°.....	0.7
46° - 59°.....	0.2	120° - 134°.....	0.8
60° - 72°.....	0.3	135° - 154°.....	0.9
73° - 84°.....	0.4	155° - 180°.....	1.0
85° - 95°.....	0.5		

1121. WITH CONTINUOUS LAYER SURROUNDING STATION. To estimate the amount when a continuous layer surrounds the station and extends to the horizon, determine the angular elevation of the edges, and convert to tenths of sky cover by use of Table 2.

*Table 2. Sky cover with layer surrounding station

Angular elevation	Tenths of sky cover	Angular elevation	Tenths of sky cover
Less than 3°.....	0.0	34° - 40°.....	0.6
3° - 8°.....	0.1	41° - 48°.....	0.7
9° - 14°.....	0.2	49° - 58°.....	0.8
15° - 20°.....	0.3	59° - 71°.....	0.9
21° - 26°.....	0.4	72° - 90°.....	1.0
27° - 33°.....	0.5		

1200. DETERMINATION OF STRATIFICATION

1210. DEFINITION OF LAYER. Clouds or obscuring phenomena whose bases are at approximately the same level are regarded as a layer. The layer may be continuous or composed of detached elements. The term layer does not imply that a clear space exists between the layers or that the clouds or obscuring phenomena composing them are of the same type (see ¶ 1230).

1220. EVALUATION OF MULTIPLE LAYERS. Frequent observation is necessary to evaluate stratification. A series of observations will often show the existence of upper layers above a lower layer. Through thin lower layers it may be possible to observe higher layers. Differences in the directions of cloud movements are often a valuable aid in observing and differentiating cloud stratification, particularly when haze, smoke, etc., render depth perception difficult.

1230. INTERCONNECTION OF LAYERS. Cumulo-type clouds developing below other clouds may reach or penetrate them. Also, by horizontal extension, swelling cumulus or cumulonimbus may form stratocumulus, altocumulus, or dense cirrus. When clouds that are formed in this manner are attached to a parent cloud, they will be regarded as a separate layer only if their bases appear horizontal and at a different level from the parent cloud. Otherwise, the entire cloud system will be regarded as a single layer at a height corresponding to that of the base of the cumulonimbus.

1300. DETERMINATION OF DIRECTION

1310. CLOUD DIRECTION. Cloud direction is the direction from which the cloud bases are moving. This direction will be determined visually by one of the methods indicated in ¶ 1310.1 - 1310.3.

1310.1. Observe the movement of clouds past a structure that forms a right angle in either a horizontal or a vertical plane. When the orientation of the structure is known, the direction is indicated by equal or unequal movement of clouds along both sides of the angle, or by movement of clouds parallel to either side.

1310.2. Sight a distinctive point of the cloud over a projection. Move about to keep this point in the same position with respect to the projection. The direction toward which the observer moves is the cloud direction; that is, the direction from which the cloud is moving.

1310.3. When clouds are moving slowly, their direction can be determined with reasonable accuracy by taking several observations a few minutes apart, and noting the relative positions of the clouds.

*1320. DIRECTION OF OBSCURING PHENOMENA. Determine direction of movement of obscuring phenomena aloft similarly to clouds. When the base of the obscuring phenomena is at the surface, and its direction cannot be observed, the direction of the surface wind will be attributed to the phenomena.

1400. DETERMINATION OF HEIGHTS

1410. CEILING DEFINITION. The ceiling is the height ascribed to the lowest layer of clouds or obscuring phenomena that is reported as broken, overcast, or obscuration (see Table 1a) and not classified "thin" or "partial." Note that, for obscurations, this height represents vertical visibility into the obscuring phenomena, rather than the height of the base. The ceiling is termed "unlimited" when the foregoing conditions are not satisfied. At all other times, the ceiling is expressed in feet above the surface. (See ¶ 1412.)

1411. VERTICAL VISIBILITY. Vertical visibility is a ceiling value used to express the distance that an observer in an obscuring medium can see vertically upward into the medium. The sky-cover symbols "X" and "-X" (see Table 1a) are always used when vertical visibility is reported. The ceiling ascribed to "X" must be classified "W", "P" or "A." Other sky-cover symbols are used with "X" and "-X" to report visible cloud layers (see ¶ 1511, example 5).

1412. SURFACE. "Surface" as used here is a horizontal plane, whose elevation above sea level equals the field elevation. At stations where the field elevation has not been established, "surface" will refer to the ground elevation at the point of observation.

1420. VARIABLE CEILING. The term "variable ceiling" describes a condition in which the ceiling rapidly increases and decreases by one or more reportable values during the period of observation. It will be reported only for ceilings less than 3000 feet. The average of all values secured will be used as the ceiling. Rapid fluctuation of the spot produced by a ceiling-light projector will indicate an irregular base whose height will be regarded as measured but variable. Distinguish this type of fluctuation from that which is due to multiple layers (see ¶ 1441.3).

1430. CEILING CLASSIFICATION. The ceiling is classified in accordance with Table 2a.

Table 2a. Ceiling-Classification Symbols

M	Measured	W	Indefinite
A	Aircraft	P	Precipitation
B	Balloon	E	Estimated

*1431. MEASURED CEILING. A ceiling is classified as measured whenever it pertains to clouds or obscuring phenomena aloft and is determined by means of:

(1) A ceiling light or ceilometer, provided penetration of the beam is not in excess of that normally experienced for the height and type of layer (see ¶ 1441.2).

(2) A raob or rawin balloon whose height is computed.

(3) The known heights of unobscured portions of objects, other than natural landmarks, within 1.5 nautical miles of any runway of the airport.

*1432. AIRCRAFT CEILING. A ceiling is classified as an aircraft ceiling when it is determined by a pilot while in flight over, or within 1.5 nautical miles of, any runway of the airport. Aircraft ceilings may refer to vertical visibility (see ¶ 1411), or clouds, or obscuring phenomena aloft.

1433. BALLOON CEILING. A ceiling is classified as a balloon ceiling whenever it pertains to clouds or obscuring phenomena aloft and is determined by means of ceiling or pilot balloons. (See par. 1442.)

1434. INDEFINITE CEILING. A ceiling is classified as indefinite whenever it pertains to hydrometeors, other than precipitation, or lithometeors whose bases are at the surface. All indefinite ceilings are estimations, but the height corresponding to the upper limit of a ceilometer reaction, the top of a ceiling-light projector beam, or the height at which a balloon completely disappears will be used as a guide.

1435. PRECIPITATION CEILING. A ceiling is classified as a precipitation ceiling when precipitation obscures the cloud base and prevents a determination of its height. All precipitation ceilings are estimations, but the guides indicated in par. 1434 should be used. These guides will usually indicate values that are lower than the actual vertical visibility.

*1436. ESTIMATED CEILING. A ceiling is classified as estimated:

(1) Whenever determined by means of the "Convective Cloud-Base-Height Diagram" (Fig. 1) under conditions appropriate to, and in accordance with instructions for, its use. (See par. 1447.)

(2) Whenever penetration of the ceilometer or ceiling-light beam is in excess of normal for the particular height and type of layer (see par. 1441.2).

(3) Whenever determined from the known heights of unobscured portions of natural landmarks, or of objects more than 1.5 nautical miles from any runway of the airport.

(4) Whenever determined on the basis of experience provided that the sky is not obscured by surface-based hydrometeors or lithometeors, and other guides are lacking, or considered unreliable.

*1440. METHODS OF DETERMINING CEILING AND CLOUD HEIGHTS. The methods indicated in pars. 1441 to 1447.2 will be used in determining heights. Heights of 5000 feet or less will be determined to the nearest 100 feet; heights of more than 5000 feet but less than 10,000 feet to the nearest 500 feet; and heights of 10,000 feet or more to the nearest 1000 feet. When the ceiling is halfway between two reportable values, select the lower value (e.g., 50 feet will be reported as "0"). Unless otherwise specified, all heights are with reference to the height of the base of cloud layers above the surface, not above sea level.

1441. CEILING LIGHT (OR CEILOMETER PROJECTOR). The ceiling light

*1444. PILOT OBSERVATIONS. Height of clouds and obscuring phenomena will ordinarily be expressed by the pilot in terms of feet above mean sea level, and will be converted to feet above field elevation if necessary. It must be determined, in any case, whether the report refers to field elevation or sea level, and to a location within 1.5 nautical miles of any runway of the airport. Pilots' reports in which the ceiling is indicated as estimated, rather than obtained by actual flight near the base, will not be used as "aircraft" ceilings.

*1444.1. When a pilot's report of ceiling meets the requirements for "aircraft" ceiling as specified in ¶ 1432 and 1444, but differs from the ceiling reported in the current observation, redetermine the ceiling immediately, provided a "measured" ceiling classification can be expected. Unless a "measured" ceiling can be obtained, the "aircraft" ceiling value will be considered current, and a special observation will be filed if required by ¶ 9132.1. If the redetermined ceiling value is classified as measured, the measured value will be considered as the current ceiling, but the pilot's report will nevertheless be distributed in accordance with ¶ 10210.

1445. BUILDINGS, ETC. Determination of heights may be based on the point at which layers are intercepted by objects (buildings, etc. other than natural landmarks) whose heights are known. Allow, so far as possible, for any appreciable slope in the layer from the point of observation to the point of interception of the object.

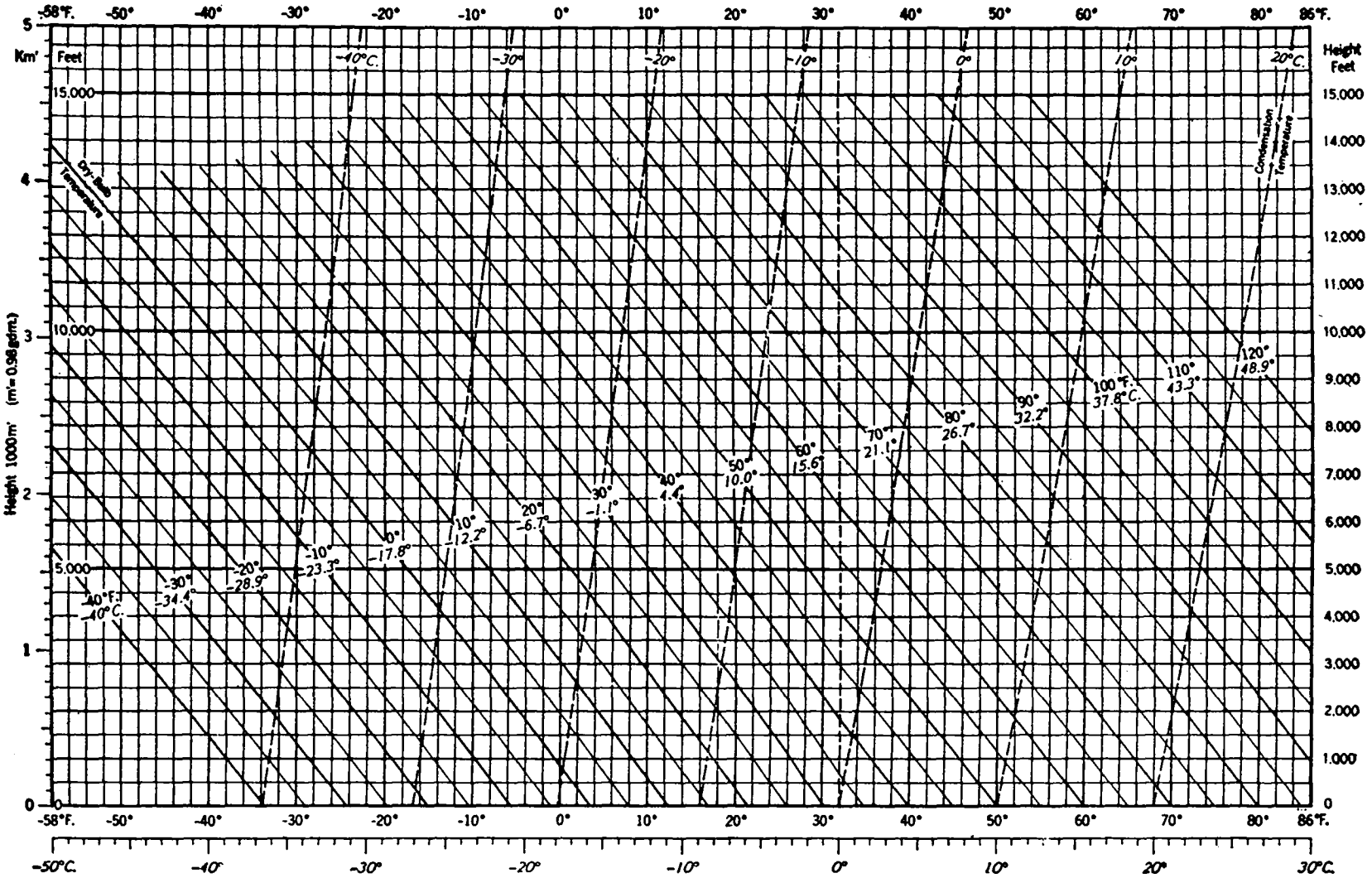
1446. NATURAL LANDMARKS. Heights based on the unobstructed portion of hills or mountains surrounding the station, when their height above the elevation of the station is known, will be classified as estimated. Orographic lifting may cause layers to differ in height from those immediately above the station. Estimates of height based on mountains more than 50 miles away will not be regarded as applicable to those overhead.

1447. CONVECTIVE CLOUD HEIGHT DIAGRAM. This diagram eliminates the computations necessary in determining height of convective-type clouds by use of a dew-point formula. It is not suitable for use at stations situated in mountainous or hilly terrain and will, therefore, not be used at these stations. Heights determined in this manner will be classified as estimated. (See Fig. 1.)

1447.1. The diagram will be used only when the clouds present are formed by active surface convection near the point of observation. The diagram is usually most accurate when used to compute the height of cloud bases at or below 5000 feet; but at land stations in coastal regions, sea breezes frequently render it inapplicable to clouds formed over land before the onset of the sea breeze.

1447.2. Obtain the estimated height of a cloud base above the point of observation as follows:

(1) Locate the point of intersection of the vertical line



Dew-Point Temperature

FIGURE 1. - Diagram for determining height of convective-type clouds.

(Convert sub-freezing dew-point temperatures from a water to ice basis by means of Table 9 before using this diagram)

(abscissa) corresponding to the observed dew-point temperature, and the curve (sloping upward to left) corresponding to the observed dry-bulb temperature.

(2) Find the height of the convective cloud base above the ground at the scale value (printed along the right side of the chart) corresponding to the point found in (1).

1450. FREQUENCY OF CEILING MEASUREMENTS. Whenever available, a ceiling light or ceilometer will be used as frequently as observations are taken, provided clouds are present at the observation and it appears likely that a height value can be secured. Stations not equipped with ceilometers will use balloons during daylight hours as specified in par. 1451-52. (See also par. 1442.1.)

*1451. At stations where hourly observations for scheduled transmission are taken, balloons will be used as follows to determine the ceiling value:

(1) At the discretion of the observer, when the ceiling is estimated as 2000 feet or more.

(2) At hourly intervals or more frequently, when the ceiling is between 1000 and 2000 feet, unless the highest instrument minimum 1/ for the airport is above 1000 feet, in which case (3) applies.

(3) At half-hour intervals or more frequently, when the ceiling is below 1000 feet, or at or below the highest instrument minimum 1/ for the airport.

1452. At stations not taking hourly aviation observations, ceiling balloons will be used whenever the ceiling is estimated to be less than 3000 feet.

1500. ENTRIES ON WBAN-10

*1510. CEILING AND SKY. (Col. 3) Enter in ascending order of height the appropriate sky-cover symbol for each layer, selected in accordance with the summation principles stated in par. 1511. Prefix the corresponding height in hundreds of feet (see par. 1440) to each sky-cover symbol, and an appropriate ceiling classification symbol to to the ceiling layer only. Heights ascribed to "X" will represent vertical visibility. A numerical value will not be ascribed to "-X" since unlimited vertical visibility is indicated. If the ceiling is variable (see par. 1420), enter the letter "V" following the ceiling value, e.g., M5V⓪.

1/ These minimums are with reference to instrument minimums exclusive of ILS, GCA, or alternate minimums.

*1511. SUMMATION. The sky-cover symbol for each layer represents the summation total of all sky cover (see par. 1110) at and below that level, including the amount of sky hidden by surface-based obscuring phenomena. In determining summation totals, disregard portions of surface-based obscuring phenomena that do not conceal the sky, and portions of upper-cloud layers that are visible only through transparencies in lower layers. If any portion of the sky cover is transparent, determine, in addition to the foregoing summation, the summation of opaque sky cover at each level (see examples 7 and 8 below). If, at any level aloft, the ratio of opaque to total sky cover (summation values) is 1/2 or less, prefix "-" (thin) to the corresponding sky-cover symbol. Omit this prefix if the ratio exceeds 1/2. Prefix "+" to layers that are unusually dark or threatening.

EXAMPLES

Opaque sky cover:

	Layers	Summation	Sky-Cover Symbol
(1)	0.4 sky hidden by fog	0.4	-X
	0.3 sky cover at 1000'	0.7	M10⊕
	0.2 sky cover at 5000'	0.9	50◐
(2)	Less than 0.1 sky cover at 500'	0.0	—
	Less than 0.1 sky cover at 2000' (Total sky cover 0.1)	0.1	20◐
(3)	0.6 sky cover at 1000'	0.6	M10⊕
	0.3 sky cover at 5000'	0.9	50◐
	0.1 sky cover at 10,000' (with breaks)	1.0	100⊕ ..(with remark: EINOVC)
(4)	0.1 sky cover at 1000' (Smoke aloft)	0.1	10◐ ..(with remark: KLYR 10◐)
	0.3 sky cover at 5000'	0.4	50◐
	0.1 sky cover at 10,000'	0.5	100◐
(5)	0.2 sky cover at 500'	0.2	5◐
	Sky hidden by snow, vertical visibility 1500'	1.0	F15X
(6)	0.8 sky hidden by snow	0.8	-X
	0.2 sky cover at 500'	1.0	M5⊕

Transparent or partially opaque sky cover:

	Layers	Summation Total	Summation Opaque Portions	Sky-Cover Symbol
(7)	0.8 sky cover at 500' (0.0 opaque)	0.8	0.0	*5-⊕
(8)	0.1 sky hidden by surface smoke	0.1	0.1	-X
	0.7 sky cover at 1000' (0.1 opaque)	0.8	0.2	*10-⊕
	0.2 sky cover at 5000' (all opaque)	1.0	0.4	*50-⊕

*Note that the ceiling classification letter is omitted because the layer is classified as "thin."

1520. REMARKS. (Col. 13) Enter data pertaining to clouds and obscuring phenomena in remarks as follows:

	Observed	Instructions for Entry
(1)	Breaks in overcast; one overcast layer only.	Enter "BINOVC," followed by direction of breaks where practicable.
(2)	Breaks in higher overcast; two or more overcast layers reported (lower one classified thin).	Enter "BRKHIC"
(3)	Higher clouds visible through breaks in overcast not classified thin.	Enter "HIR CLDS VSB"
(4)	Direction of breaks in broken layer with ceiling at or below highest instrument minimums. (Omit if breaks are in all quadrants)	Enter "BRKS," followed by direction, e.g.,"BRKS N"or "BRKS OVR MID MKR"
(5)	Obscuring phenomena (smoke, etc.) aloft	Enter "KLYR," "HLYR," etc., followed by height and corresponding sky-cover symbol, e.g., "KLYR 10⊕"
(6)	Special cloud types (see Circ. S for definitions)	
	a. Towering cumulus	Enter "TWRG CU," followed by direction from station.

Observed	Instructions for Entry
b. Cumulonimbus	Enter "CB," followed by direction from station and direction of movement, if known; also enter estimated distance from station in nautical miles if practicable, e.g., "CB 25 MI W MOVG NE."
c. Cumulomammatus	Enter "CM," followed by direction from station.
d. Altocumulus castellatus	Enter "ACC," followed by direction from station.
e. Virga	Enter "VIRGA," followed by direction from station.
(7) Variable sky condition	Enter ranges of variability, separated by letter "V"; e.g., "ΦVΦ" to indicate that a layer reported as broken in Col. 3 is occasionally scattered; "1 8ΦVΦ" to indicate that one of two or more broken layers is occasionally scattered; "-ΦVΦ" to indicate that a thin layer is occasionally opaque.
(8) Variable ceiling	Enter range of variability separated by letter "V," and prefix entire remark with abbreviation "CIG"; e.g., "CIG 15V20" (see ¶ 1420).
(9) Differing ceiling or sky condition at distance from station.	Enter appropriate remarks, such as "CIG LWR OVR CITY," "LWR CLDS W APCHG STN," etc.

*1530. TOTAL SKY COVER. (Col. 21) At each record hourly observation, enter tenths of total sky cover as defined in ¶ 1110.

*1540. CLOUDS AND OBSCURING PHENOMENA. (Cols. 22 - 35) Entries will be made in columns 22 - 35 for each hourly observation at Air Force, Navy, and first-order Weather Bureau stations. 1/ Data will be entered in ascending order of height. When clouds or obscuring phenomena are present at more than four levels, do not enter data for levels above the fourth in these columns, but enter additional information concerning these levels in column 90. The presence of these levels will also be indicated by the entry for total sky cover (column 21).

1/ At combined WB-CAA stations, entries will be made in these columns only when Weather Bureau personnel are on duty.

*1541. AMOUNT AND SUMMATION TOTAL. (Cols. 22, 25, 28, 29, 32, 33) Enter to the nearest tenth the sky cover (see ¶ 1110) observed at each level. Since a series of frequent observations or pilot reports often indicates the extent or existence of layers above a broken or overcast layer, amounts entered in columns 22, 25, 29, and 33 are not necessarily the amounts actually visible at the time of observation, and the sum of the number of tenths may exceed ten tenths. However, the entries in columns 28 and 32 will be a summation of the sky cover at and below the elevations reported in columns 27 and 31 respectively, and will not exceed 1.0. For example: If 0.4 clouds are visible at 1000 feet and a pilot reports 1.0 clouds at 3000 feet, the summation total entered in column 28 would nevertheless be only ten tenths.

1541.1. When higher layers cannot be identified because lower layers hide more than 0.9 of the sky, enter "U" in the amount columns and omit entries in the type, height, and summation columns pertaining to higher layers. When layers are not present at any level, or higher layers are not visible and 0.1 or more of the sky is visible, enter zeros in the appropriate amount columns and omit entry in type and height columns. When two or more types of clouds or obscuring phenomena occur at the same level, enter their combined amounts in the appropriate columns captioned "Amount". (See also par. 1542)

1542. TYPE, DIRECTION. (Cols. 23, 26,30, 34) Enter the appropriate abbreviation selected from Table 4a for clouds or obscuring phenomena. When two or more types of clouds or obscuring phenomena are observed at the same level, the predominating type with respect to amount will be recorded.1/ Enter the direction from which the layers are moving. When the direction is unknown, omit the entry. When motion is not discernible, enter "C" for calm; otherwise, enter an arrow denoting the motion to eight points of the compass immediately above the abbreviation. (See Table 4b.)

TABLE 4a. Cloud types and obscuring phenomena

Cloud type and obscuring phenomena	Abbreviations	Cloud type and obscuring phenomena	Abbreviations
CLOUDS		OBSCURING PHENOMENA—continued	
		Precipitation—Continued	
Altocumulus	Ac	Hail (any form and intensity including AP)	A
Altocumulus castellatus	Acc	Ice crystals	IC
Altostratus	As	Rain (any form and intensity including RW and ZR)	R
Cirrocumulus	Cc	Sleet any form and intensity including E. W.	E
Cirrostratus	Cs	Snow (any form and intensity including SW, SF, and SG)	S
Cirrus	Ci		
Cumulonimbus	Cb	*Hydrometeors other than precipitation*	
Cumulonimbus mammatus (Mammato-cumulus)	Cm	Blowing snow	BS
Cumulus	Cu	Fog (any form, including GF and IF)	F
Fractocumulus	Fc		
Fractostratus	Fs	*Lithometeors*	
Nimbostratus	Ns	Dust	D
Stratocumulus	Sc	Haze	H
Stratus	St	Sand	N
OBSCURING PHENOMENA		Smoke	K
Precipitation			
Drizzle (any form and intensity including ZL)	L		

1/If the amounts are equal, enter the type that, in the opinion of the observer, is most significant.

TABLE 4b. Cloud direction

↓	from north	↑	from south
↙	from northeast	↗	from southwest
←	from east	→	from west
↖	from southeast	↘	from northwest

1543. HEIGHT. (Cols. 24, 27, 31, 35) Enter height of clouds and obscuring phenomena aloft in columns captioned "Height." Enter the vertical visibility for obscuring phenomena with bases at the surface, using a dash to denote unlimited vertical visibility. Make all entries in hundreds of feet, using the intervals specified in par. 1440. Prefix an appropriate classification letter selected from Table 2a to the ceiling layer only.

*1544. TOTAL OPAQUE SKY COVER. (Col. 36) Enter the tenths of sky that are hidden by clouds or obscuring phenomena. (Note that this entry is similar to the entry of total sky cover in column 21, except that sky cover through which the sky is visible is disregarded when determining the entry in column 36.)

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

STATION _____ DATE _____

SKY and CEILING (Hundreds of Feet) 3	VISIBILITY (Miles) 4	WEATHER and OBSTRUCTIONS TO VISION 5	SEA LEVEL PRESS (mbs) 6	TEMP (°F) 7	DEW PT (°F) 8	WIND DIRECTION 9	WIND SPEED (MPH) 10	WIND CHARACTER AND SHIFTS 11	ALTIMETER SETTING (Ins) 12	REMARKS AND SUPPLEMENTAL CODED 13
Obscuring Phenomena Aloft:										
15-Ø	8		122	84	31	↑↖	8		010	KLYR 15-Ø
M8 Ø	8		200	53	38	↑	7		029	KLYR 8 Ø
Obscuring Phenomena AT Surface:										
P25X	2.0	TRWA	146	74	62	→	19		016	T W MOVG EWD FQT LTGCG HLSTO ½ INCH
W O X	0	L-F	176	57	37		C		020	
-X	2.0	F	157	62	61		C		018	
Clouds and Obscuring Phenomena:										
10Ø 100Ø	7		112	71	23	↗	6		009	KLYR 10Ø
40Ø60Ø E200Ø	8		135	90	52	↑↗	5		013	HLYR 60Ø
M5Ø25Ø	4	GF	186	58	56	↖	2		022	KLYR 5Ø
4Ø10ØE20Ø	7		166	52	29	←↖	10		020	KLYR 20Ø
15Ø 30-Ø	8		129	81	36	↘	6		013	KLYR 30-Ø
-X E15 Ø	5	H	081	76	61	↑	4		995	
M21Ø 50-Ø	7		105	70	29	↙	7		001	HLYR 50-Ø
Multiple Overcast Layers:										
5-Ø20-ØE50Ø	9		123	77	70	↘	5		012	HIR CLDS VSB

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

STATION _____ DATE _____

EL (MTY) 0	TOTAL SKY COVER 21	CLOUDS AND OBSCURING PHENOMENA: LOWEST LAYER AMT 22	LOWEST LAYER TYPE & DIR 23	LOWEST LAYER HEIGHT 24	SECOND LAYER AMT 25	SECOND LAYER TYPE & DIR 26	SECOND LAYER HEIGHT 27	SUMMATION TOTAL 28	THIRD LAYER AMT 29	THIRD LAYER TYPE & DIR 30	THIRD LAYER HEIGHT 31	SUMMATION TOTAL 32	FOURTH LAYER AMT 33	FOURTH LAYER TYPE & DIR 34	FOURTH LAYER HEIGHT 35	TOTAL OPAQUE SKY COVER 36
	4	4	K↗	15	0			4	0			4	0			1
	9	9	K	M8	0			9	0			9	0			7
	10	10	R→	P25	U				U				U			10
	10	10	F^c	WO	U				U				U			10
	8	8	F↑	—	0			8	0			8	0			8
	5	4	K↙	10	2	AC	100	5	0			5	0			4
	10	2	Cu→	40	3	H	60	5	5	Ci→	E200	10	U			10
	10	6	K	M5	6	Sc→	25	10	U				U			10
	10	2	St↑	4	1	Sc↘	10	3	7	K	E20	10	U			10
	8	2	Cu→	15	6	K	30	8	0			8	0			3
	8	6	H↑	—	3	Sc	E15	8	0			8	0			8
	10	6	Sc	M21	10	H	50	10	0			10	0			4
	10	10	St↘	5	2	Sc	20	10	6	A2→	E50	10	2	Ci→	250	8

Fig. 1a. Entries of clouds and obscuring phenomena - WBAN-10A and B.

*Revised
Eff. 7-1-52

CHAPTER 2. VISIBILITY

2000. GENERAL

*2010. Visibility is a term that denotes the greatest distance an object of specified characteristics can be seen and identified. This term may express the visibility in a single direction or the prevailing visibility based on all directions. Visibility observations will be taken from as many points as necessary to view all appropriate markers. Except as specified in par. 2011, observations should be with reference to a plane six feet above the ground or, if station facilities preclude an observation at this level, as close as practicable to it. Visibility will be observed and recorded in nautical miles in accordance with Table 4c. When the visibility is halfway between two reportable values, select the lower value.

*Table 4c. Reportable Visibility Values (Nautical Miles)

Decimal increments		1-mile increments when visibility is 3 to 15 miles, inclusive. 5-mile increments when visibility is more than 15.
0	1.1	
.1	1.2	
.2	1.3	
.3	1.4	
.4	1.5	
.5	1.6	
.6	1.7	
.7	1.8	
.8	1.9	
.9	2.0	
1.0	2.5	

2011. Unless otherwise authorized, all stations at which control towers are situated will take visibility observations at the control-tower level, as well as at the usual point of observation, whenever the visibility at the latter point is less than three miles. At civil stations, control-tower visibilities will be used for all aviation observations, including record, coding, and summary, but will not be used for synoptic observations; at military stations, control-tower visibilities will be used only as specified in par. 2420.

2100. GUIDES IN DETERMINING VISIBILITY

*2110. CHART OF VISIBILITY MARKERS. Each station will display charts of prominent objects and their distances from the observation point. These charts will include objects suitable for determining the visibility at night as well as by day. At least two charts will be available; one

including all markers throughout the entire range of visible objects, and the other an expanded scale chart including only those markers within 1.5 miles of the observation point.

2120. VISIBILITY MARKERS AT NIGHT. The most suitable objects for determining visibility at night are unfocused lights of moderate intensity at known distances, and the silhouettes of mountains or hills, etc., against the sky. The brilliance of stars near the horizon may also be a useful indication. Because of their intensity, airway beacons may not be used as visibility markers, but their degree of brilliance may be used as an aid to indicate whether visibility is greater or less than the distance of the beacon. "Course lights" (red or green) of beacons may be used as definite visibility markers. These and all other lights normally used as visibility markers should be used with caution after storms, for their intensity may be reduced by snow or freezing precipitation.

2130. VISIBILITY MARKERS DURING DAYLIGHT. For accurate determinations during daylight hours, confine the choice of markers to black, or nearly black, objects against the horizon sky rather than to light-colored markers and those appearing against terrestrial backgrounds.

2140. SIZE OF VISIBILITY MARKERS. In order that visibility values may be representative, they must apply to objects of specified minimum size or larger. An object that subtends an angle of less than 0.5 degree at the eye becomes invisible at a shorter distance than larger objects under the same conditions. Therefore, objects whose angular size is 0.5 degree or greater should be selected as visibility markers whenever possible. A hole 0.3 inch (or 5/16") in diameter punched in a card that is held at arm's length subtends an angle of approximately 0.5° at the eye. If the portion of any object above the horizon completely fills the hole when the card is held as explained above, the object is of suitable size for a marker.

2150. DAY AND NIGHT VISIBILITY. Transparency of the atmosphere in the open country (except in polar regions) removed from sources of atmospheric pollutants changes but very little from daylight to darkness and vice versa. However, in areas subject to pollution (as smoke from domestic heating or cooking, and industrial exhausts) there may be systematic variations during the transition period about sunrise or sunset. In such areas a decrease in visibility often occurs near dawn particularly when a steep inversion exists near the surface. Before taking a visibility observation at night, the observer should spend two to six minutes in the dark (depending upon the contrast between office and outside illumination) to adapt his eyes to nighttime conditions.

2160. ESTIMATIONS OF VISIBILITY. When the visibility is greater than the distance to the farthest object, note the sharpness with which

the object stands out. Sharp outlines in relief, with little or no blurring of color, indicate that the visibility is much greater than the distance of the reference object. On the other hand, blurred or indistinct objects indicate the presence of haze or other phenomena that has reduced the visibility to not less than the distance of the objects.

2200. VISIBILITY IN A DEFINITE DIRECTION

2210. Visibility in a definite direction is the greatest horizontal distance in that direction at which the outlines of visibility markers can be distinguished against the horizon sky under the conditions existing at the time of observation.

2300. PREVAILING VISIBILITY

2310. DEFINITION. Prevailing visibility is the maximum visibility common to sectors comprising 1/2 or more of the horizon circle. Under nonuniform conditions the sectors may be distributed in any order. Under uniform conditions the prevailing visibility is the same as the visibility in any direction. If the visibility is variable, i.e., the prevailing visibility rapidly increases and decreases by one or more reportable values during the period of the observation, use the average of all observed values as the prevailing visibility. Report the visibility as variable only if the prevailing visibility is less than three miles.

*2320. DETERMINATION. To determine prevailing visibility under nonuniform conditions, regard the horizon circle as divided into several sectors of equal size in each of which the visibility is substantially uniform. Select the highest value that is equal to or less than the visibility of sectors that cover at least one-half of the horizon circle. For example, if the horizon circle were divided into four sectors and the respective visibility values were .2, .8, .6, and 1.0 mile, the prevailing visibility would be .8 mile. This is evident from the fact that .8 mile is the highest value equal to or less than the visibility values of one-half or more of the horizon circle. This is illustrated in Fig. 2.

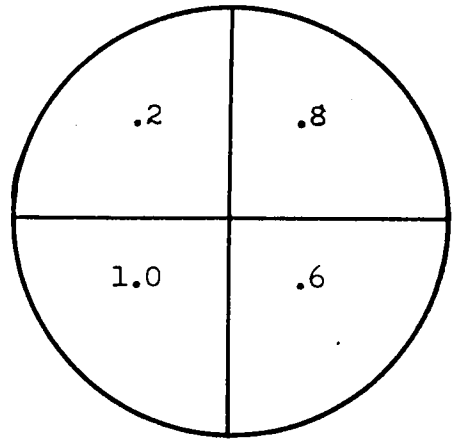


Fig. 2. Visibility in sectors of horizon circle.

2400. ENTRIES ON WBAN-10

*2410. VISIBILITY. (Col. 4) Enter the prevailing visibility in the increments listed in Table 4c. If the visibility is variable, enter "V" following the visibility (see ¶ 2310). Enter "15+" when the visibility is more than 15 miles but suitable distant markers for more precise determination are lacking. At civil stations taking control-tower visibility observations, enter the visibility at the control-tower level in this column when the visibility at the usual point of observation is less than three miles.

*2420. REMARKS. (Col. 13) Enter visibility data in this column as follows:

(1) 1/ Visibility by quadrants: Enter visibility for quadrants in which it differs from the prevailing visibility, provided the visibility in one or more quadrants is less than three miles. Prefix each value with the corresponding quadrant designator; e.g., "VSBY N1.0".

(2) Visibility at differing levels (see ¶ 2011 and 2410):

(a) At civil stations, when the visibility at the control-tower level (as entered in Col. 4) differs from the visibility at the usual point of observation, enter the latter value in Col. 13, followed by the height of the restricting phenomena if determinable; e.g., "SFC VSBY 2.0 GFDEP 50".

(b) At military stations and joint-use airports 2/, when the visibility at the control-tower level differs from the visibility at the usual point of observation, enter the former value in Col. 13, followed by the height of the restricting phenomena if determinable; e.g., "TWR VSBY 2.0 GFDEP 50".

(3) 1/ Variable visibility when prevailing visibility is less than three miles (see ¶ 2310): Enter range of variability separated by "V"; e.g., "VSBY 1.0V2.0".

1/ These remarks will relate to the same observation point as the value entered in Col. 4, i.e., if tower visibility is recorded in Col. 4, remarks pertaining to visibility by quadrants or variable visibility will also represent control-tower values.

2/ A joint-use airport is one at which the control tower is operated by military personnel, but weather observations are taken by Weather Bureau personnel.

3434. When drizzle occurs in combination with other hydrometeors and lithometeors, estimate the rate of accumulation and select the corresponding intensity from Table 7.

TABLE 7. Intensity of drizzle on rate-of-fall basis

Very Light	Scattered drops that do not completely wet an exposed surface, regardless of duration.
Light (Slight)	Trace to 0.01 inch per hour.
Moderate	More than 0.01 inch to 0.02 inch per hour.
Heavy	More than 0.02 inch per hour.

Note. - When precipitation equals or exceeds 0.04 inch per hour, there is a strong presumption that the precipitation is rain.

3435. When drizzle or snow (including snow pellets and snow grains) occurs alone, determine the intensity in accordance with Table 8.

*TABLE 8. Intensity of drizzle and snow with visibility as criteria

Very Light	Scattered flakes or droplets that do not completely cover or wet an exposed surface, regardless of duration.
Light (Slight)	Visibility 1100 yards or more (.5 nautical mile).
Moderate	Visibility less than 1100 yards but not less than 550 yards.
Heavy	Visibility less than 550 yards (.3 nautical mile).

3440. TYPES OF PRECIPITATION. For purposes of these instructions, precipitation is divided into liquid, freezing, and frozen types. These types are discussed in pars. 3441 to 3443.7. A combination of types or of forms of one type will be individually observed and reported regardless of existing meteorological conditions that might appear to be inconsistent with them.

3441. LIQUID PRECIPITATION. Liquid precipitation is classified as rain or drizzle in accordance with the criteria below.

3441.1. RAIN. Drops of water (in the liquid state) falling from clouds; most drops are larger - or if not larger, sparser - than the drops in drizzle. Rain, as used in this manual, excludes drizzle and freezing rain.

*3441.2. DRIZZLE. Very small and uniformly dispersed droplets that may appear to float while following air currents. Unlike fog droplets, drizzle falls to the ground. It usually falls from low stratus clouds and is frequently accompanied by low visibility and fog.

3442. FREEZING PRECIPITATION. Freezing precipitation is classified as freezing rain or freezing drizzle, in accordance with criteria below.

3442.1. FREEZING RAIN. Rain that falls in liquid form but freezes to the exposed surface of the ground, or to unheated objects on the ground. If the fall is so rapid that run-off occurs, the formation of ice will usually appear as glaze.

3442.2. FREEZING DRIZZLE. Drizzle that freezes similarly to rain (see par. 3442.1) is classified as freezing drizzle.

3443. FROZEN PRECIPITATION. Solid precipitation is classified in accordance with the criteria in pars. 3443.1 to 3443.7.

3443.1. SLEET (ICE PELLETS). Transparent, more or less globular, hard grains of ice about the size of raindrops, that rebound when striking hard surfaces. Its fall may be continuous, intermittent, or showery.

3443.2. HAIL. Ice balls or stones, ranging in diameter from that of medium-size raindrops to an inch or more. They may fall detached or frozen together into irregular, lumpy masses. They are composed either of clear ice or of alternating clear and opaque snowflake layers. Hail often accompanies thunderstorm activity. Surface temperatures are usually above freezing when hail occurs. Determination of size will be based on the diameter, in inches, of normally shaped hailstones.

3443.3. SMALL HAIL. Semitransparent, round or conical, grains of frozen water. Each grain generally consists of a smaller grain of soft hail as a nucleus, surrounded by a very thin ice layer, which gives it a glazed appearance. The grains are wet when they fall at temperatures above freezing. They are not crisp or easily compressible, and do not generally rebound or burst even when they strike hard ground.

3443.4. SNOW. White or translucent ice crystals chiefly in complex branched hexagonal form (six-pointed "stars"), often mixed with simple crystals. It occurs under meteorological conditions similar, with the exception of the accompanying temperatures, to those with which corresponding forms of rain are associated.

3443.5. SNOW PELLETS (SOFT HAIL). White, opaque, round or occasionally conical, kernels of snow-like consistency, 1/16 to 1/4 inch in diameter. They are crisp and easily compressible, and may rebound or burst when striking hard surfaces. They occur almost exclusively in showers.

3443.6. SNOW GRAINS (GRANULAR SNOW). The solid equivalent of drizzle. They take the form of minute, branched, star-like snowflakes,

indicators, at stations equipped with them, is required in determining whether or not rain or drizzle is freezing at the time of observation.

*3512. BLOWING SPRAY. Spray lifted from the sea surface by the wind and blown about in such quantities that the horizontal visibility is restricted.

3600. LITHOMETEORS

3610. GENERAL. Lithometeors comprise a class of atmospheric phenomena, among which dry haze and smoke are the most common examples. In contrast to a hydrometeor, which consists largely of water, a lithometeor is composed of solid dust or sand particles, or the ashy products of combustion.

3620. HAZE. Dust or salt particles so small that they cannot be felt, or individually seen by the unaided eye; however, they reduce visibility and lend a characteristic opalescent appearance to the air. Haze resembles a uniform veil over the landscape that subdues its colors. This veil has a bluish tinge when viewed against a dark background, such as a mountain; but it has a dirty yellow or orange tinge against a bright background, such as the sun, clouds at the horizon, or snow-capped mountain peaks. When the sun is well up, its light may have a peculiar silvery tinge owing to haze. These color effects distinguish haze from light fog, whose thickness it may sometimes attain. Note:- Irregular differences in air temperature may cause a shimmering veil over the landscape; this is called "optical haze."

3630. SMOKE. An ashy product of combustion consisting of fine particles suspended in the atmosphere. When smoke is present the disk of the sun at sunrise and sunset appears very red and during the daytime has a reddish tinge. Smoke at a distance, such as from forest fires, usually has a light grayish or bluish color and is evenly distributed in the upper air.

3640. DUST. Finely divided earthy matter, uniformly distributed in the air. It imparts a tannish or grayish hue to distant objects. The sun's disk is pale and colorless or has a yellow tinge at all periods of the day.

3650. DUST DEVIL. Small, vigorous whirlwind, usually of short duration, made visible by dust picked up from the surface.

3660. BLOWING DUST. Dust picked up locally from the surface by the wind and blown about in clouds or sheets. Blowing dust may completely obscure the sky.

3670. DUSTSTORM 1/. Blowing dust that reduces the visibility to less than 1100 yards, but not less than 550 yards.

1/ These phenomena are reported separately only in synoptic observations. In aviation observations, "duststorm" and "heavy duststorm" are reported as "blowing dust", and "sandstorm" and "heavy sandstorm" as "blowing sand".

3671. HEAVY (SEVERE) DUSTSTORM[1]. Blowing dust that reduces the visibility to less than 550 yards.

3680. BLOWING SAND. Sand picked up from the surface by the wind and blown about in clouds or sheets.

3690. SANDSTORM[1]. Sand blown through the air by a very strong wind or gale. Visibility is reduced to less than 1100 yards but not less than 550 yards. The sand particles are not carried to appreciable distances from their source.

3691. HEAVY (SEVERE) SANDSTORM[1]. Blowing sand that reduces visibility to less than 550 yards.

3700. IGNEOUS METEORS

3710. LIGHTNING. A visible electrical discharge occurring in the atmosphere. Lightning is the only common igneous meteor of importance in meteorology. It occurs as a discharge within a cloud; from cloud to cloud; or from cloud to ground. Distant lightning is any lightning that occurs so far from the observer that the resulting thunder cannot be heard. It may be observed as streaks or sheets.

3800. LUMINOUS METEORS

3810. GENERAL. Optical phenomena, with the exception of aurora, are caused by reflection, refraction, or diffraction of the light from the sun or moon as it passes through clouds or other hydrometeors.

3820. HALO, SOLAR OR LUNAR. A luminous ring, commonly of 22° radius around the sun or moon. It usually appears whitish, but it may show the spectral colors with the red on the inside. The sky is darker inside the ring than outside. Halos are formed by refraction of the light as it passes through ice crystals. Note:- This description applies only to the 22° halo. Other phenomena are the 46° ring, parhelia, tangent arc, etc.

3830. CORONA, SOLAR OR LUNAR. A luminous ring surrounding the sun or moon and formed by diffraction of light by water droplets. It may vary greatly in size, but is usually smaller than a halo. All the spectral colors may be visible, with the red on the outside, but frequently the inner colors are not visible. Sometimes the spectral colors or portions of them are repeated several times and are somewhat irregularly distributed; this is called iridescence.

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[1]These phenomena are reported separately only in synoptic observations. In aviation observations, "duststorm" and "heavy duststorm" are reported as "blowing dust", and "sandstorm" and "heavy sandstorm" as "blowing sand".

3840. RAINBOW. A semicircular arc seen opposite the sun, usually exhibiting all the primary colors, with red on the outside. It is caused by diffraction, refraction and reflection of light within raindrops, which often produces a secondary bow outside the primary one. In this case the colors are reversed.

3850. FOG BOW. A whitish, semicircular arc, seen opposite the sun in fog. Its outer margin has a reddish and its inner a bluish tinge. The middle of the band is white. An additional bow, with the colors reversed, sometimes appears inside the first.

3860. AURORA. A luminescence, frequently called Northern Lights. It is usually seen in the northern skies in lower latitudes, and overhead, or even to the southward of the zenith, in higher latitudes. It may appear in such forms as arcs, rays, curtains, coronas, etc. It is usually of a whitish color but may have various other colors. The lower edges of the arcs and curtains of the aurora are usually fairly well defined, while the upper edges are ill-defined.

3900. ENTRIES ON WBAN-10

*3910. WEATHER AND OBSTRUCTIONS TO VISION. (Col. 5) Enter precipitation and obstructions to vision in accordance with the symbols in Tables 8a and 8b. Use + after precipitation symbols to indicate heavy intensity, - to indicate light, and - - to indicate very light; the absence of a sign indicates moderate intensity. Precipitation will be entered in this column only if actually occurring at the time of the observation. (See par. 3920 for entry of remarks concerning intermittent precipitation.) Two or more entries for a single observation will be made in the following order:

(1) Tornado (or waterspout)

(2) Thunderstorm

(3) Liquid precipitation, in order of decreasing intensity

(4) Freezing precipitation, in order of decreasing intensity

(5) Frozen precipitation, in order of decreasing intensity

(6) Obstructions to vision, in order of decreasing predominance if discernible.

*3911. Omit entry of obstructions to vision in Col. 5 whenever the visibility recorded in Col. 4 is seven miles or more. If the visibility is less than seven miles, weather or obstructions to vision must be reported either in Col. 5 or Col. 13 (see par. 3920). If the visibility is reduced by phenomena not occurring at the station, enter an explanatory note in remarks, e.g., "GF BANK N".

TABLE 8a. Symbols for weather

TORNADO or WATERSPOUT (always written out in full) followed by direction from station.

T+	Heavy Thunderstorm	EW	Sleet Showers
T	Thunderstorm	S	Snow
R	Rain	SW	Snow Showers
RW	Rain Showers	SP	Snow Pellets
L	Drizzle	SG	Snow Grains
ZR	Freezing Rain	IC	Ice Crystals
ZL	Freezing Drizzle	A	Hail
E	Sleet	AP	Small Hail

*TABLE 8b. Symbols for obstructions to vision

F	Fog	IF	Ice Fog
GF	Ground Fog	H	Haze
BS	Blowing Snow	K	Smoke
BN	Blowing Sand	D	Dust
BD	Blowing Dust	BY	Blowing spray

*3920. REMARKS (Col. 13). Enter data pertaining to weather and obstructions to vision as follows:

Observed	Instructions for Entry
(1) Tornado and waterspout	
(a) Observed from station	Enter direction toward which it is moving, e.g., MOVG NEWD
(b) Reported by public	Enter (1) location with respect to weather-reporting station or a city or town, (2) direction toward which it is moving, (3) time tornado was observed, e.g., UNCONFIRMED TORNADO 15 MI W DCA MOVG N 1600E
(c) Began following the most recent record observation, but not occurring during current observation. (Enter this remark for all observations up to and including the next record observation, even though the phenomenon was previously reported in a special observation. See par. 9180.)	Enter the time of occurrence (or time of beginning and ending), peak speed of gusts, and direction of movement, e.g., TORNADO 1155E G120 MOVD NE.
(2) Thunderstorm	
(a) In progress at station	Enter direction, if observable: (1) with respect to station (2) direction toward which storm is moving, e.g., T OVHD MOVG EWD or T SW MOVMT VRBL (omit remark concerning movement if movement unknown)

4221. UNDRIFTED SNOW. Thrust the measuring stick vertically into the snow so that the end rests on the ground surface. Read the depth to the nearest 0.1 inch. Repeat at several spots and take the average of the readings as the snow depth. If the ground is covered with ice, cut through the ice with some suitable implement, and measure the thickness. Add the thickness of the ice to the depth of snow above the ice.

4222. DRIFTED SNOW. When the snow is drifted, a reasonably accurate depth measurement may be made by taking the average of several measurements over representative areas. These should include the greatest and least depths. For example, if spots with no snow are visible, one of the values should be zero.

4230. SNOWFALL WITHIN SPECIFIED PERIODS. These measurements are most conveniently made on a surface that has been cleared of previous snowfall. If such a spot is not available, measure the total depth of snow and subtract the depth previously measured. If the previous snowfall has crusted, the new fall may be measured by permitting the end of the measuring stick to rest on the crust. If different falls of snow are mixed by drifting, measure the total depth of snow and subtract the previously measured depth. The remainder is the approximate depth of the new fall, which will be adjusted if necessary to correct for melting, evaporation, and run-off. If several snow showers occur between observations and each melts before the following one occurs, the total snowfall for the period will be the sum of the maximum depths (measured or estimated) for each occurrence.

4300. ENTRIES ON WBAN-10

4310. PRECIPITATION. (Col. 44) Enter in the 6-hourly spaces the total precipitation (water equivalent), in inches and hundredths, occurring during the six hours ending with the observation. On the line captioned "Mid" enter the amount measured at midnight; i.e., the amount that has occurred between midnight and the preceding 6-hourly observation. 1/ On the line captioned "Mid to" enter the amount that has occurred between midnight and the following 6-hourly observation. (Note that the entry for the first 6-hourly observation after midnight is the sum of the entries opposite "Mid" (for the preceding day) and "Mid to". Enter "T" for trace (see par. 4020) and "0" if no precipitation has fallen.

4311. If no precipitation has fallen during the six hours preceding the time of measurement of precipitation for the 6-hourly observation, but begins shortly thereafter and before the coded synoptic observation (or additive data group) is filed, enter "T" in Col. 44. This procedure will be followed even though a measurable amount may have fallen.

1/For purposes of entries on WBAN-10B, the midnight observation will be considered as the last observation of the day; e.g., a midnight observation taken at 0000 LST on the 15th will be entered on WBAN-10B for the 14th.

4320. SNOWFALL. (Col. 45) Enter in the 6-hourly spaces the maximum (unmelted) depth (inches and tenths) of frozen precipitation (see par. 3443) that has fallen during the six hours ending with the observation, obtained in accordance with Sec. 4200. On the line captioned "Mid", enter the amount occurring between midnight and the preceding 6-hourly observation.1/ On the line captioned "Mid to", enter the amount that has occurred between midnight and the following 6-hourly observation. (Note that the entry for the first 6-hourly observation after midnight is the sum of the entries opposite "Mid" (for the preceding day) and "Mid to". Entries for hail will be followed by an asterisk, and "*Hail" will be recorded in Col. 90. Enter "T" for trace (see par. 4020) and "0" if no frozen precipitation has fallen. When frozen precipitation melted as it fell, i.e., there is no visible accumulation on the ground, enter "T" with a note " Melted as it fell" in Col. 90. If there is a visible accumulation of snow but some melting has occurred within the past six hours, enter an estimated amount in Col. 45 and a note "Estimated due to partial melting" in Col. 90.

4330. SNOW DEPTH. (Col. 46) Enter in the 6-hourly spaces the depth of frozen precipitation (see par. 3443) and ice on the ground at each 6-hourly observation, to the nearest inch. On the line captioned "Mid", enter the amount on the ground at midnight.1/ Entries for hail will be followed by an asterisk and "*Hail" will be recorded in Col. 90. Enter "T" for amounts of less than 0.5 inch, and "0" when none is on the ground in exposed areas, even though snow is still present in surrounding forested or otherwise protected areas. If snow melts as it falls, and there is no visible accumulation on the ground (see par. 4320), enter "0". When snow that occurs between observations melts partially before the following observation, enter in Col. 90 the maximum depth (measured or estimated) between observations.

*4340. TWENTY-FOUR HOUR PRECIPITATION. (Col. 68) Enter the total precipitation (water equivalent in inches and hundredths) for the 24 hours ending at midnight. Enter "T" for trace (see ¶ 4020), and "0" if none has fallen. The sum of any number of "T" observations will be regarded as a trace unless recording gages indicate the total is .005 inch or more. (Note that the entry in this column is the sum of the entries in column 44, exclusive of the first 6-hourly observation of the day, provided a midnight observation is taken and, where a recording gage is used, no traces have been recorded.)

*4350. TWENTY-FOUR HOUR SNOWFALL. (Col. 69) Enter to inches and tenths the total amount (unmelted) of frozen precipitation that has fallen during the twenty-four hours ending at midnight. (Note that the entry in this column is the sum of the entries in Col. 45, exclusive of

1/For purposes of entries on WBAN-10B, the midnight observation will be considered as the last observation of the day; e.g., a midnight observation taken at 0000 LST on the 15th will be entered on WBAN-10B for the 14th.

the entry for the first 6-hourly observation of the day, provided a midnight observation is taken.) Entries for hail will be followed by an asterisk and "*Hail" entered in column 90. Enter "T" for trace, and "0" if none has fallen. When precipitation melts as it falls, enter "T" with a note "Melted as it fell" in column 90.

*4360. SNOW DEPTH. (Col. 70) Transcribe the value recorded in column 46 for the 1230 1/ GCT observation.

*4370. WATER EQUIVALENT OF FROZEN PRECIPITATION (Col. 80) At Air Force, Navy, and first-order Weather Bureau stations, whenever snow depth as entered in column 70 is two inches or more, enter in column 80 the water equivalent as measured at approximately 1200 GCT daily 1/. Enter the data in inches and hundredths, determined in accordance with ¶ 4053. If an appropriate column heading is not printed in this column, write or stamp "WATER EQUIV." in the heading.

1/ In areas other than continental United States and Alaska, the time of the observations referred to in ¶ 4360 and 4370 may be modified as necessary to meet regional needs.

CHAPTER 6. HUMIDITY MEASUREMENT

6000. DEFINITIONS

6010. GENERAL. These instructions are concerned with the expression of humidity in terms of relative humidity and dew point. These data are calculated with psychrometric tables or calculators based on atmospheric pressures of 23, 25, 27,28, 29, and 30 inches of mercury. If a psychrometric calculator is available, it will be used in preference to the tables unless the dry- and wet-bulb temperatures exceed the range of the calculator.

6010.1. Relative humidity and dew point data can be expressed with respect to ice or water. For record purposes, it is required that these data be expressed at all temperatures with respect to water. The psychrometric calculator satisfies this requirement. Psychrometric tables numbered WB 235 express values of relative humidity with respect to ice when the dry-bulb is less than 32°, and of dew points with respect to ice when the dew point is less than 32°. These values must be converted to their water equivalent, and Tables 9 and 10 are provided for this purpose.

6020. DEW POINT. The dew point is the temperature to which a sample of air must be cooled, while the mixing ratio[1] and barometric pressure remain constant, in order to attain saturation[2] with respect to water. The dew point is expressed to the nearest whole degree Fahrenheit.

6030. RELATIVE HUMIDITY. Relative humidity is the percentage of (a) the mixing ratio of a sample of air to (b) the mixing ratio of air saturated with respect to water at the same temperature and pressure as those of the sample.

6100. PSYCHROMETRIC COMPUTATIONS

6110. DEPRESSION OF THE WET-BULB. The depression of the wet-bulb is the algebraic difference between the dry- and wet-bulb temperatures. It is used with the psychrometric tables and calculators to make dew point and relative humidity computations.

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[1]MIXING RATIO. The mixing ratio of moist air is the ratio of the mass of water vapor to the mass of dry air with which the water vapor is associated.

[2]SATURATION. Saturation as used here denotes a state in which the mixing ratio of a sample of air is equal to that of air immediately over a flat surface of pure water, where equality exists between the rates of evaporation from and condensation of water vapor on the surface, provided that the temperature and barometric pressure of the sample are the same as those of the surface and the superjacent air.

EXAMPLES:

(1) Dry-bulb temperature.....40.6
Wet-bulb temperature.....32.1

Depression.....8.5

(2) Dry-bulb temperature.....1.2
Wet-bulb temperature.....-0.7

Depression.....1.9

(3) Dry-bulb temperature.....-3.4
Wet-bulb temperature.....-4.7

Depression.....1.3

*6110.1. When the wet-bulb is covered with water and a depression cannot be obtained, the relative humidity will be regarded as 100%, and the temperature of the dew point as the same as that of the wet-bulb. If the wet-bulb is covered with ice and a depression cannot be obtained, the relative humidity will be regarded as 100% with respect to ice and the relative humidity and the dew point will be converted to their water equivalents (see ¶ 6131.1 - 6131.2), unless liquid fog is present at the station. In this latter instance, the relative humidity will be regarded as 100% with respect to water.

6120. PSYCHROMETRIC CALCULATOR. At civil stations, use the calculator based on the barometric pressure nearest the normal station pressure (see par. 6010). Air Force stations will use the nearest existing station pressure. Instructions for use of the calculator are printed on it. Note that different scales of the calculator will be used according as the wet-bulb is covered with ice or water at the time of the observation (see par. 5151.3).

6130. PSYCHROMETRIC TABLES. At civil and Navy stations, use the tables based on the barometric pressure nearest the normal station pressure (see par. 6010). At Air Force stations use the table nearest the existing pressure. The arguments are (a) the dry-bulb temperature as given in the vertical column at the left of the table, and (b) the depression of the wet-bulb printed across the top of the table. Dew point and relative humidity data are given as tabular values on correspondingly captioned pages.

6131. The dew point and relative humidity are found from the tables as follows:

(1) When the temperature of the dry-bulb and the depression of the wet-bulb coincide with those given in the tables, the dew point or relative humidity is the tabular value at the intersection of the vertical column corresponding to the wet-bulb depression and the horizontal row corresponding to the air temperature.

(2) When either the air temperature or the depression of the

TABLE 10B—*Relative humidity conversion table*

Tabular values are relative humidities with respect to water (RH_w) corresponding to relative humidities with respect to ice (RH_i) given at heads of the columns]

Dry-bulb temp. (°F)	Relative humidity with respect to ice (RH_i)										Dry bulb temp. (° F)	Relative humidity ratio RH_w/RH_i
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		
	%	%	%	%	%	%	%	%	%	%		
−60	6.1	12.3	18.4	24.5	30.7	36.8	42.9	49.0	55.2	61.3	−60	0.6130
−59	6.2	12.3	18.5	24.6	30.8	37.0	43.1	49.3	55.4	61.6	−59	.6160
−58	6.2	12.4	18.6	24.8	31.0	37.1	43.3	49.5	55.7	61.9	−58	.6191
−57	6.2	12.4	18.7	24.9	31.1	37.3	43.5	49.8	56.0	62.2	−57	.6220
−56	6.3	12.5	18.8	25.0	31.3	37.5	43.8	50.0	56.3	62.5	−56	.6252
−55	6.3	12.6	18.9	25.1	31.4	37.7	44.0	50.3	56.6	62.8	−55	.6284
−54	6.3	12.6	18.9	25.3	31.6	37.9	44.2	50.5	56.8	63.1	−54	.6315
−53	6.3	12.7	19.0	25.4	31.7	38.1	44.4	50.8	57.1	63.5	−53	.6347
−52	6.4	12.8	19.1	25.5	31.9	38.3	44.7	51.0	57.4	63.8	−52	.6379
−51	6.4	12.8	19.2	25.6	32.1	38.5	44.9	51.3	57.7	64.1	−51	.6412
−50	6.4	12.9	19.3	25.8	32.2	38.7	45.1	51.5	58.0	64.4	−50	.6444
−49	6.5	13.0	19.4	25.9	32.4	38.9	45.4	51.8	58.3	64.8	−49	.6479
−48	6.5	13.0	19.5	26.0	32.5	39.0	45.6	52.1	58.6	65.1	−48	.6507
−47	6.5	13.1	19.6	26.2	32.7	39.2	45.8	52.3	58.9	65.4	−47	.6541
−46	6.6	13.2	19.7	26.3	32.9	39.5	46.0	52.6	59.2	65.8	−46	.6576
−45	6.6	13.2	19.8	26.4	33.1	39.7	46.3	52.9	59.5	66.1	−45	.6611
−44	6.6	13.3	19.9	26.6	33.2	39.9	46.5	53.2	59.8	66.5	−44	.6646
−43	6.7	13.4	20.0	26.7	33.4	40.1	46.7	53.4	60.1	66.8	−43	.6677
−42	6.7	13.4	20.1	26.9	33.6	40.3	47.0	53.7	60.4	67.2	−42	.6716
−41	6.8	13.5	20.3	27.0	33.8	40.5	47.3	54.0	60.8	67.5	−41	.6751
−40	6.8	13.6	20.4	27.1	33.9	40.7	47.5	54.3	61.1	67.8	−40	.6785
−39	6.8	13.6	20.5	27.3	34.1	40.9	47.7	54.6	61.4	68.2	−39	.6820
−38	6.9	13.7	20.6	27.4	34.3	41.1	48.0	54.8	61.7	68.6	−38	.6855
−37	6.9	13.8	20.7	27.6	34.5	41.4	48.3	55.2	62.1	69.0	−37	.6895
−36	6.9	13.9	20.8	27.7	34.6	41.6	48.5	55.4	62.3	69.3	−36	.6928
−35	7.0	13.9	20.9	27.9	34.8	41.8	48.8	55.7	62.7	69.6	−35	.6965
−34	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	63.0	70.0	−34	.7002
−33	7.0	14.1	21.1	28.2	35.2	42.2	49.3	56.3	63.4	70.4	−33	.7039
−32	7.1	14.2	21.2	28.3	35.4	42.5	49.5	56.6	63.7	70 8	−32	.7077
−31	7.1	14.2	21.3	28.5	35.6	42.7	49.8	56.9	64.0	71.1	−31	.7114
−30	7.2	14.3	21.5	28.6	35.8	42.9	50.1	57.2	64.4	71.5	−30	.7152
−29	7.2	14.4	21.6	28.8	36.0	43.2	50.3	57.5	64.7	71.9	−29	.7192
−28	7.2	14.5	21.7	28.9	36.1	43.4	50.6	57.8	65.1	72.3	−28	.7229
−27	7.3	14.5	21.8	29.1	36.3	43.6	50.9	58.1	65.4	72.7	−27	.7267
−26	7.3	14.6	21.9	29.2	36.5	43.8	51.2	58.5	65.8	73.1	−26	.7308
−25	7.3	14.7	22.0	29.4	36.7	44.1	51.4	58.8	66.1	73.4	−25	.7344
−24	7.4	14.8	22.2	29.5	36.9	44.3	51.7	59.1	66.5	73.9	−24	.7386
−23	7.4	14.8	22.3	29.7	37.1	44.5	52.0	59.4	66.8	74.2	−23	.7425
−22	7.5	14.9	22.4	29.9	37.3	44.8	52.3	59.7	67.2	74.6	−22	.7465
−21	7.5	15.0	22.5	30.0	37.5	45 0	52.5	60.0	67.5	75.0	−21	.7504
−20	7.5	15.1	22.6	30.2	37.7	45.3	52.8	60.4	67.9	75.5	−20	.7546
−19	7.6	15.2	22.8	30.3	37.9	45.5	53.1	60.7	68.3	75.9	−19	.7586
−18	7.6	15.3	22.9	30.5	38.1	45.8	53.4	61.0	68.6	76.3	−18	.7627
−17	7.7	15.3	23.0	30.7	38.3	46.0	53.7	61.3	69.0	76.7	−17	.7668
−16	7.7	15.4	23.1	30.8	38.5	46.3	54.0	61.7	69.4	77.1	−16	.7709
−15	7.8	15.5	23.3	31.0	38.8	46.5	54.3	62.0	69.8	77.5	−15	.7751
−14	7.8	15.6	23.4	31.2	39.0	46.8	54.6	62.4	70.1	77.9	−14	.7794
−13	7.8	15.7	23.5	31.3	39.2	47.0	54.8	62.7	70.5	78.4	−13	.7835
−12	7.9	15.8	23.6	31.5	39.4	47.3	55.1	63.0	70.9	78.8	−12	.7878
−11	7.9	15.8	23.8	31.7	39.6	47.5	55.5	63.4	71.3	79.2	−11	.7922

NOTE: Saturation vapor pressures over ice and water, used in computing this table, are based on formulas by J. A. Goff and S. Gratch, *Trans. Amer. Soc. Heat. and Vent. Eng.*, vol. 52, p. 95 (1946). Formula for saturation vapor pressure over water assumed to apply from −60° F. to 140°F.

6200. HYGROGRAPH

6210. GENERAL. The hygrograph provides a continuous record of relative humidity. To read the relative humidity from the hygrograph, follow the same procedure as that for the thermograph, described in par. 5211. The scale is based on relative humidity values from 0 to 100 percent. When the hygrograph is adjusted to correspond with a psychrometric reading made at dry-bulb temperatures below freezing, the psychrometric value of relative humidity with respect to water will be used. Hygrograms will be evaluated according to local needs and the records disposed of locally. Hygrograph data will not be entered on observational records unless specifically authorized.

6300. HYGROTHERMOGRAPH (WEATHER BUREAU STATIONS ONLY)

6310. The hygrothermograph is a combination of the hygrograph and thermograph. The actuating elements - - a Bourdon tube for temperature and a bundle of hairs for humidity - - are placed side by side, each with its separate linkage and pen arm. Temperature and humidity are recorded simultaneously on separate portions of the chart. Instructions in Sec. 5200 will be followed with respect to the temperature portion of the record, and instructions in Sec. 6200 with respect to the humidity portion.

6400. ENTRIES ON WBAN-10

*6410. DEW POINT. (Col. 8) Enter the dew-point temperature to the nearest whole degree. Prefix a minus sign to dew-point temperatures below zero. Whenever the air temperature is below -35°F., the wet-bulb temperature will be regarded as the same as the dry-bulb temperature. Determine the corresponding dew point, with respect to water (see ¶ 6010.1), and enter this value in column 8 in parentheses. (See ¶ 11020.)

*6420. RELATIVE HUMIDITY. (Col. 20) At Air Force, Navy, and first-order Weather Bureau stations, enter relative humidity for each record observation unless the air temperature is below -35°F. (See ¶ 11010.)

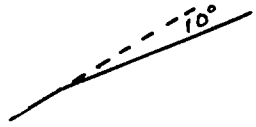
6421. At Weather Bureau stations equipped with telepsychrometers, whenever the wet-bulb is 33°F. or less and the dry-bulb is above 20°F., enter in column 20 the relative humidity as computed on the psychrometric calculator, using 1) the dry-bulb temperature obtained from the telepsychrometer, and 2) the dew-point temperature obtained from the mercurial thermometers.

*6430. TWENTY-FOUR HOUR MAXIMUM RELATIVE HUMIDITY. (Col. 78) At stations computing hourly relative humidity, enter the maximum relative humidity as obtained from column 20. Omit entry if twenty-four record observations are not taken daily.

*6440. TWENTY-FOUR HOUR MINIMUM RELATIVE HUMIDITY. (Col. 79) At stations computing hourly relative humidity, enter the minimum relative humidity as obtained from column 20. Omit entry if twenty-four record observations are not taken daily.

7621. Classify barometric tendencies as "3" or "8" only if the trace contains no points of discontinuity. A point of discontinuity is defined as a point at which the extension of the earlier part of the trace makes an angle with the subsequent trace of 15° or more (estimated). Classify tendencies as "2" or "7" only if there are at least two crests or two troughs of .02 inch or more. If neither of the foregoing criteria applies, classify the tendency as "0", "1", "4", "5", "6", or "9", according to the general criteria in Table 10d and the additional instructions in par. 7622.

Examples

A. 

This tendency should be classified as 3 because discontinuity is less than 15°.

B.

This tendency should be classified as 1 because discontinuity is 15°.

C.

This tendency should be classified as 7 because there are two crests of .02 inch.

7622. When two or more characteristics apply, select the tendency that is representative of the latter portion of the trace (see examples A and B below), unless this tendency is not compatible with the net amount of change in the past three hours. In this latter case, select the tendency that is most descriptive of the entire 3-hour period and is also compatible with the net 3-hour change. (See examples C and D below.)

A. should be classified as 4.

B. should be classified as 5.

C. should be classified as 0.

(Although numeral 6 of the tendency code is more representative of the latter portion of the period, it is not compatible with the positive sign of the net 3-hour change.)

D. should be classified as 0.

(Although numeral 7 of the tendency code is more representative of the latter portion of the period, it is not compatible with the positive sign of the net 3-hour change.)

7630. To find the amount of change, determine to the nearest 0.005 inch the net change over the interval. (See par. 7760.)

7640. When the barogram indicates a rapid fall in pressure followed by an abrupt rise, with both rise and fall at the rate of 0.06 inch per hour or more, the lowest pressure in the "V" will be noted and converted to sea-level pressure for reporting in accordance with par. 7730. The mean temperature used in the reduction will be determined in accordance with the following:

(1) When a thermograph is available, select the temperatures corresponding to the time of the lowest pressure and to the time 12 hours previously.

(2) When a thermograph is not available, select the temperatures at the preceding observation and at a time 12 hours previously.

7700. ENTRIES ON WBAN-10

*7710. SEA-LEVEL PRESSURE. (Col. 6) Omit the initial "9" or "10" of the sea-level pressure and enter it as three figures (without a decimal point) representing tens, units, and tenths of millibars; e.g., enter 1013.2 as "132".

*7720. ALTIMETER SETTING. (Col. 12) Omit the initial "2" or "3" of the altimeter setting and enter it as three figures (without a decimal point) representing units, tenths, and hundredths of inches; e.g., enter 29.94 as "994". At stations not equipped with mercurial barometers but requiring altimeter settings for operational purposes, prefix an "E" to the entry.

*7730. REMARKS. (Col. 13) Enter pressure data in column 14 as follows:

Observed	Entry
(1) Pressure rising or falling at rate of .06 inch per hour or more.	PRESRR or PRESFR

Observed	Entry
(2) Barogram "V" (see par. 7640)	Enter in the next record observation the lowest sea-level pressure in tens, units, and tenths of millibars, and time of occurrence LST; e.g., "LOWEST PRES 631 1745C".
(3) Pressure unsteady, as shown on the barogram by sharp troughs or crests that depart at least .03 inch from the mean trend.	PRES UNSTDY

*7740. STATION PRESSURE. (Col. 17) Enter station pressure to the nearest .005 inch determined from the instrument appearing highest in the priority list in ¶ 7011. Omit entry if a mercurial barometer is not used for periodic comparisons with other pressure-measuring instruments. (Entries in this column will be used in determining sea-level pressure and altimeter setting, after being rounded to the nearest .01 inch.)

*7750. PRESSURE TENDENCY. (Col. 37) Make this entry for 3- and 6-hourly synoptic observations at stations equipped with a barograph or microbarograph. Enter a single code figure, taken from Table 10d for pressure tendency during the 3-hour period ending at the time of observation. (See Sec. 7600.)

*7760. NET THREE-HOUR PRESSURE-CHANGE. (Col. 38) Make entries in this column at stations where pressure tendencies are entered in accordance with ¶ 7750. Determine the net change in station pressure for the preceding three hours to the nearest 0.005 inch by subtracting corresponding entries in column 17. If an observation was not taken three hours earlier, determine the changes from the barogram.

7770. HEIGHT OF 850-MILLIBAR SURFACE. (Col. 49) At stations whose elevations are between 2500 and 9500 feet, enter the height of the 850-millibar surface above sea level in feet to the nearest ten gpft.

7780. STATION PRESSURE COMPUTATIONS. (Lines 59-65) Enter station pressure computations for the 6-hourly synoptic observations as specified below:

7781. TIME. (Line 59) Enter the time of reading the barometer. (Note that this time will usually differ from that ascribed to the observation in columns 2 and 16.)

7782. ATTACHED THERMOMETER. (Line 60) Enter the temperature of the thermometer attached to the mercurial barometer to the nearest 0.5° Fahrenheit or centigrade. Omit entries when the pressure readings are taken from precision aneroid barometers or altimeter-setting indicators.

7783. OBSERVED BAROMETER. (Line 61) Enter the uncorrected observed reading of the mercurial barometer to the nearest .001 inch or .05 mb.; or of the precision aneroid barometer to the nearest .005 inch or .1 mb. Omit entry if an altimeter-setting indicator is being used to determine station pressure (see par. 7011).

7784. TOTAL CORRECTION. (Line 62) Enter the sum of all corrections required to reduce the observed reading to station pressure. Omit entry if an altimeter-setting indicator is being used to determine station pressure.

7785. STATION PRESSURE. (Line 63) Enter to the nearest .001 inch or .05 mb. for mercurial barometer reading; to the nearest .005 inch or .1 mb. for precision aneroid or altimeter-setting indicator readings.

7786. BAROGRAPH READING. (Line 64) Enter to the nearest .005 inch or .2 mb. according as the barogram is graduated in millibars or inches. When the barogram is changed at the time of the 6-hourly observation, take the barograph reading from the new barogram.

7787. BAROGRAPH CORRECTION. (Line 65) Enter to the nearest .005 inch or .1 mb. with proper sign, the difference between the entries in lines 63 and 64, that is, line 63 minus line 64. If for any reason the barogram is changed after the time of the 6-hourly observation, enter the new barograph correction in column 90 and an asterisk in column 65 preceding the correction established at the time of the 6-hourly observation.

8232. Condenser-discharge indicators give an uncorrected average value at the highest point reached on the scale during a single pulse or oscillation. Observe the face of the indicator over a period of one minute and take the average of the corrected highest points reached by the meter needle during successive pulses or oscillations. Apply the correction indicated in Table 15.

TABLE 15. Corrections to indicated wind speeds
(Condenser-discharge type anemometers)

A. Type "S" anemometer		B. Type "SA" anemometer	
Uncorrected speed (m.p.h.)	Correction (whole m.p.h.)	Uncorrected speed (m.p.h.)	Correction (whole m.p.h.)
0-59	0	0-87	0
60-69	-1	88-94	+1
70-79	-2	95-100	+2
80-100	-3		

8233. Direct-reading indicators and recorders usually indicate almost instantaneous values. (Note that the condenser-discharge indicator is not considered direct-reading since an instantaneous wind speed cannot be taken directly from the indicator.) Observe the indicator or recorder trace for a 1-minute period and determine an average value. Apply to the average value the correction furnished for the particular instrument.

8234. If it is impossible to obtain a wind speed from any indicator described above, the wind speed may be taken from a single or multiple register record. Determine the average speed over the 5-minute interval immediately preceding the observation and apply the appropriate correction from Table 14.

8235. Assume zero correction for anemometers for which no correction tables have been furnished.

8236. Estimate the wind speed when it is less than the starting speed of the anemometer.

8300. CHARACTER OF WIND

*8310. GUSTINESS. Gustiness is characterized by sudden, intermittent increases in speed, with at least nine knots variation (corrected) between peaks and lulls. The peak speed must reach at least sixteen knots, and the average time interval between peaks and lulls should usually not exceed twenty seconds. (See ¶ 3310.)

8311. Gustiness will be estimated from 1/60 mile (buzzer or light) indicators by noting the variations in the time interval between buzzes or flashes, and will be determined from direct-reading indicators by observing the pointer. The peak gust is the highest speed momentarily indicated, without regard to the duration of the gust. Gustiness cannot be determined directly with the condenser-discharge type indicator, but an estimate can be made after successive fluctuations of the pointer have been noted.

*8312. At stations equipped with gust recorders, the character of the wind will be taken from recorders. During the passage of hurricanes or other periods of high gusty winds, recorders designed for two-speed operation will be operated at the higher speed.

8330. WIND SHIFTS. Wind shifts, as defined and used in this manual, are usually associated with the following phenomena, characteristic of a cold-front passage. These phenomena are:

(1) Gusty winds shifting in a clockwise manner in the Northern Hemisphere, i.e., south shifting to west, or southwest shifting to northwest (shifting counterclockwise in the Southern Hemisphere).

(2) Rapid drop in the dew point.

(3) Rapid drop in temperature.

(4) Rapid rise in pressure.

(5) In summer; lightning, thunder, heavy rain, and possibly hail.

(6) In winter; frequent rain or snow squalls with cloud heights changing rapidly - either to higher or lower heights than existed prior to the wind shift.

8332. In the Northern Hemisphere, whenever the wind shifts suddenly to a westerly or northerly quadrant, be alert for the characteristic changes accompanying a shift. If some of the changes accompanying a shift are noted before the wind changes direction or speed, watch for a clockwise shift of wind direction, an increase in speed, or a change in direction of low clouds.

8333. In flat regions, wind shifts without precipitation, but accompanied by strong winds, sometimes occur. The visibility may be greatly restricted by blowing dust over extensive areas.

8400. ENTRIES ON WBAN-10

*8410. WIND DIRECTION. (Col. 9) Enter the wind direction to sixteen points of the compass by means of one or two short arrows, as shown in Table 16. When the wind is calm, make no entry in this column.

TABLE 16. Wind direction symbols

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

*8420. WIND SPEED. (Col. 10) Enter the wind speed in knots. If the wind speed is estimated, enter the letter E immediately following the speed. Enter C for calm.

*8430. GUSTINESS. (Col. 11) Report gusts by the symbol "+" immediately after the one-minute wind speed. Enter the peak speed of gusts observed during the past 15 minutes immediately after this symbol. (See Fig. 6.) These data will be reported when they occur regardless of the type of wind equipment used. If estimated, enter E in accordance with ¶ 8420.

*8440. SHIFTS. (Col. 11) Enter the direction of the wind before the shift to sixteen points of the compass with short arrows followed by the local standard time of the shift (24-hour clock) and a letter denoting the local standard time zone. Since the space provided in column 11 is not sufficient for wind-shift data, distribute all wind data evenly among columns 9, 10, and 11; e.g., "↘ 25+40 ↖1614C" in these columns would indicate a wind shift from southeast to northwest at 1614 CST.

*8450. SQUALLS. (Col. 11) Report squalls by the symbol "Q" immediately following the one-minute wind speed and preceding the peak speed of gusts observed during the past 15 minutes (see Fig. 6 and Sec. 3300).

*8460. PEAK GUST. (Cols. 71 - 73) Enter this datum only at stations supplied with recording equipment other than single or multiple register. The peak gust is the highest speed recorded during the 24 hours ending at midnight. Enter (1) the direction to 16 points if suitable recording

equipment is available, otherwise to eight points; (2) the speed to the nearest knot; and (3) the time to the nearest minute.

CHAPTER 9. TYPES OF 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 terms "aviation observation" and "synoptic observation" connote the assemblage of specified observational elements in a manner designed to satisfy meteorological and operational requirements. All scheduled observations will be started just sufficiently in advance of the time of transmission to permit accurate evaluation of all the elements. The observation of elements will be taken in the order given below, unless the sites of instrumental equipment require deviation:

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

9100. AVIATION OBSERVATIONS

9110. GENERAL. Aviation observations are primarily intended to provide (a) immediate weather information for aviation interests, and (b) data for climatological investigations. 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 par. 9142. The weather will be observed and the various elements evaluated between observations as often as is consistent with the condition of the weather. Changing weather situations that might require a special or local extra observation will be watched most closely to insure that an observation will be filed promptly after the change occurs. All elements reported in an aviation observation will have been observed within 15 minutes preceding the time of entry on WBAN-10.

9120. RECORD OBSERVATIONS. A record observation is taken at scheduled hourly intervals and will be prepared for teletype transmission at least two minutes and not more than five 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.

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*In aviation observations, these items should be reviewed if practicable before filing the message to ensure that current data are being transmitted.

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

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

*9130. SPECIAL OBSERVATIONS. Special observations are taken to provide information on significant developments in meteorological conditions occurring at other than scheduled times. Unless otherwise authorized, they are taken by all first-order Weather Bureau, CAA, Air Force, Navy and SAWR observing stations. Other stations will take special observations only as specified in separate administrative instructions. Special observations are taken even though there are no impending aircraft operations.

9131. 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) Wind shift or an increase in wind speed

When a change in any other element satisfies the criteria for a special observation, the observation will include:

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

In all cases remarks will be added when appropriate.

9132. 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. At Air Force stations additional criteria will be specified in separate instructions. Stations taking less than 24 hourly observations will take special observations as required following the first record observation for the day.

*9132.1. CEILING.

(1) The ceiling decreases to less than 1500 feet, or increases to 1500 feet or more.

(2) The ceiling decreases to less than 1000 feet, or increases to 1000 feet or more.

(3) The ceiling decreases to less than 500 feet, or increases to 500 feet or more.

(4) A ceiling of less than 500 feet changes by 100 feet or more. 1/

(5) The ceiling decreases to less than the highest instrument minimum 2/ for the airport. 1/

(6) The ceiling increases to or above the highest instrument minimum 2/ for the airport. 1/

*9132.2. SKY CONDITION. Clouds are observed below:

(a) 1000 feet, and no clouds were previously reported below this altitude.

(b) the highest instrument minimum 2/ for the airport, and no clouds were previously reported below this altitude. 1/

*9132.3. VISIBILITY.

(1) The visibility decreases to less than:
(a) 3 miles
(b) .9 mile
(c) .7 mile
(d) .4 mile
(e) .2 mile
} 1/

(2) The visibility increases to equal or exceed:
(a) 3 miles
(b) .9 mile
(c) .7 mile
(d) .4 mile
(e) .2 mile
} 1/

9132.4. TORNADO.

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

1/ Effective only at stations having scheduled air-carrier operations, and at all Air Force stations.

2/ These minimums are with reference to instrument minimums exclusive of ILS, GCA, or alternate minimums.

9132.5. THUNDERSTORM.

(1) Begins (A special observation is not required to report the beginning of a new thunderstorm if one is currently reported as in progress at the station.)

(2) Increases in intensity

(3) Ends (Special observation 15 minutes after thunder is last heard at station.)

9132.6. PRECIPITATION.

(1) Hail begins, ends, or changes in intensity.

(2) Freezing precipitation other than very light begins, ends, or changes in intensity.

(3) Sleet begins, ends, or changes in intensity.

*9132.7. WIND AND WIND SHIFTS.

(1) Doubling of speed (over a one-minute interval) to more than 25 knots.

(2) Wind shift.

9132.8. 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.

9140. LOCAL EXTRA OBSERVATIONS. Local extra observations are taken, at all stations, for local distribution only, under the circumstances specified in par. 9141-43. 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. Local extra observations will be taken at intervals not exceeding 15 minutes, beginning whenever there are impending aircraft operations 1/ and

(1) the ceiling decreases to 500 feet or less, or
(2) the visibility decreases to .9 mile or less.

1/ These observations will be taken at Air Force stations irrespective of impending aircraft operations.

identifier and time. If the observation to be corrected is a special, record-special, or local extra report, the correcting report will also include type of report. If an error in a record, or record-special observation is discovered within the hour after the observation has been transmitted on the teletype, a correction will be filed immediately, regardless of special observations that might have been transmitted in the meantime. If an error is discovered in a special or local extra observation before the next succeeding observation is given teletype or local distribution, a correction will be filed. If an error is discovered in a check observation, a correction will be given to the broadcaster. When more than an hour has elapsed before an error in a transmitted observation has been discovered at the originating station, a corrected report will not be transmitted.

9163.1. A correction message may consist of a complete, corrected observation, or of a single element properly identified (e.g., COR 1328E ALSTG 969), whichever procedure is the shorter.

9170. CODING. Instructions in Chapters 1-8 will be observed in coding individual elements of observations for teletype and radio distribution. Instructions for the coding of station identification, type of report, and time are given in pars. 9171-9173.

9171. STATION IDENTIFICATION. The station identification is a three letter symbol assigned to the station for use in teletype transmissions. These symbols are listed in the Civil Aeronautics Administration publication "Location Identifiers."

9172. TYPE. Record observations are not identified by any symbol in teletype transmission. Special and record-special reports are identified by the letter "S" followed by a serial number (see par. 11101). Local extra reports transmitted on local teletype circuits are identified by the contraction "LCL."

9173. TIME. The time of record and record-special observations is not included in the report, since the time of the sequence in which the reports are included appears at the heading of the sequence collection. However, a corrected report of a record observation will include the sequence time of the record observation immediately following the station identification. In special and local extra reports, when coded for teletype transmission, the time, in four figures, is followed by the correct time zone indicator selected from Table 17, except that Air Force stations and other designated stations will use Greenwich mean time and the indicator "Z."

9174. DELAYED OBSERVATIONS. When an observation is not available for transmission at the scheduled time but will be available later, file the abbreviation "DLAD" at the time of the scheduled observation.

*9180. DISSEMINATION. Record and special aviation observations will

be transmitted by teletype or radio where suitable facilities are available. These transmissions will be made in accordance with communication manuals specified by the individual services. When transmission is delayed until time for the next record or special observation, transmit only the latest observation and enter "FIBI" in column 13 of the observation not transmitted. When the observation not transmitted pertains to the phenomena listed in pars. 9132.4 to 9132.7, enter in remarks of the next succeeding transmitted observation: (a) the time of the observation not transmitted, (b) weather, obstructions to vision, and wind reported in that observation. (This remark may be omitted or abridged insofar as it duplicates data pertaining to tornadoes, waterspouts, or heavy thunderstorms, entered in accordance with Item 1(c) and 2(b) of par. 3920.)

Examples

S5 1437E M15⌀1.7RW+ ↘25Q55↑1432E (FIBI)

S6 1448E M20⌀6RW- ↘15/1437E RW+ ↘25Q55↑1432E.

9181. LOCAL DISTRIBUTION. All observations will be distributed by a common airport communications system, when available, to local operational offices desiring them. If a single airport communications system is not available, observations will always be furnished to the tower, GCA units, and air-ground positions if desired by these units, and to other local operations if time and station workload permits.

*9200. SYNOPTIC OBSERVATIONS

9210. Data to be included in synoptic observations are those specified in current synoptic codes. The required data will be observed and evaluated in accordance with instructions in this manual. Synoptic observations are coded directly from the corresponding hourly aviation observation, and are not separately recorded on WBAN-10A. In the event that rapidly changing conditions require that the synoptic observation differ from the corresponding aviation observation, enter a brief explanatory note in column 90.

9300. MIDNIGHT OBSERVATION

9310. At midnight, local standard time, an observation of maximum and minimum temperatures and of precipitation will be taken at all stations having personnel in duty status at that time, except that this observation may be omitted at stations in time zones where a synoptic observation is begun within ten minutes of local midnight. If no midnight observation is taken, omit all entries from WBAN-10B on the lines captioned "Mid" and "Mid to".

*Revised
Eff. 7-1-52

CHAPTER 10. PILOTS' REPORTS

10000. GENERAL

*10010. Pilots' reports of meteorological phenomena encountered in flight are termed PIREPS. These reports of weather are an extremely valuable source of information that often is not otherwise available. Observers will cooperate to the fullest extent possible with pilots and with ground personnel to secure all available pilots' reports promptly.

10100. CODING

*10110. GENERAL. All reference to heights of phenomena encountered in flight will be expressed in hundreds of feet to the nearest hundred above mean sea level 1/. Authorized weather symbols, international cloud abbreviations, and word and phrase contractions will be used; or if they are lacking, complete words. All phenomena having an authorized symbol (see Tables 8a and 8b) will be reported in symbol form followed, if required, by the appropriate intensity indicator. "U" will be used for "intensity unknown." If the phenomenon has been reported in general terms by the pilot ("precipitation" without indication of rain or snow, etc.) the phenomenon and its intensity will be reported in an authorized phrase contraction or, lacking that, in one or more complete words.

*10120. ARRANGEMENT OF ELEMENTS. Pireps will be coded in accordance with ¶ 10121 - 10127. In general, the order of coding will be:

(1) Station identification.

(2) Time of entering pilot's report on WBAN-12

(3) The term PIREP.

(4) Location or extent of phenomena with respect to an observing station or other well-known point. (If the original report by the pilot is with respect to a fan-marker or intersection point, it will be converted to the foregoing basis by the ground observer.)

(5) Time of pilot's observation, whenever known.

(6) Phenomena reported.

1/ Note.- Pilot reports of cloud heights used as a ceiling in aviation observations will be converted to feet above the surface by the observer and coded in accordance with ¶ 1440.

(7) Altitude of phenomena.

(8) Type of aircraft, in reports of turbulence and icing only.

*10121. ICING. Use the contraction "ICG" with indication of intensity and type, if known. For example:

TRACE ICG = Trace of ice.
LGT RIME ICG = Light rime icing condition.
MDT ICG = Moderate icing condition.
HVY ICG = Heavy icing condition.

EXAMPLES:

The pilot of a Stinson, flying between Seattle and Oakland, reports to Medford that at 0700 PST he encountered light icing conditions 5 to 20 miles north of Eugene, Ore., at 2000 feet MSL.

MFR 0715P PIREP 5-20 N EUG 0700P LGT ICG 20 STSN

The pilot of an F-51 flying between Oakland and Burbank reports that he encountered heavy icing conditions at 0925 PST over mountains north of Burbank, with the top of the icing at 11,500 MSL, base 10,000 (note that Air Force stations use GCT.):

SRF 1731Z PIREP MTNS N BUR 1725Z HVY ICG 100-115 F-51

*10122. ELECTRICAL DISCHARGE OR LIGHTNING STROKE. Use the word "DISCHARGE."

EXAMPLES:

A pilot flying a PBY between Richmond, Va., and Washington, D.C., reports to Washington that at 1620 EST his aircraft experienced an electrical discharge 20 miles south of Washington at an altitude of 5000 feet MSL:

DCA 1629E PIREP 20 S DCA 1620E DISCHARGE 50

The pilot of a liaison aircraft enroute from St. Louis, Mo. to

Chicago, Ill., reports to Chicago that at 1515 CST his plane experienced an electrical discharge over the Kankakee River at an altitude of 2500 feet MSL:

CHI 1535C PIREP 15 S JOT 1515C DISCHARGE 25

*10123. TURBULENCE. Use the contraction "TURBC" preceded by an indication of intensity as illustrated in the following list:

LGT TURBC = Light turbulence.
MDT TURBC = Moderate turbulence.
HVY TURBC = Heavy turbulence.

EXAMPLES:

A pilot reports to Kansas City, Missouri, that his C-54 encountered heavy turbulence at 2330 CST, 10 miles northeast of Knoxville, Tenn., at 6000 feet MSL:

MKC 2335C PIREP 10 NE TYS 2330C HVY TURBC 60 C54

The pilot of a DC-3 flying at 10,000 feet MSL through Donner Summit Pass, Calif., reports to Reno, Nev., that light turbulence is being experienced 1050 PST.

RNO 1055P PIREP OVR DONNER SUMMIT 1050P LGT TURBC 100 DC3

*10124. HAIL. Use the authorized teletypewriter symbol for hail and indicate the intensity in the same manner as in weather reports of hail. Use the symbol "U" to indicate unknown intensity.

NOTE: It is quite possible that a pilot report of hail will be added to a report of turbulence and electrical discharge. All these phenomena may be included in the same pirep.

EXAMPLES:

The pilot of a DC-4 reports to Omaha, Nebr., at 1617 CST that he is flying through moderate hail 10 miles south at an altitude of 3500 feet MSL:

OMA 1619C PIREP 10 S OMA 1617C A 35

At 1628 CST the same pilot reports that he is flying in light hail and heavy rain, with heavy turbulence at 3000 feet MSL, 15 miles southwest of Omaha, and that at 5000 feet MSL his plane had experienced a discharge:

OMA 1635C PIREP 15 SW OMA 1628C HVY TURBC R+A- 30 DISCHARGE 50 DC4.

*10125. WINDS ALOFT.

(1) Use the contraction "WND".

(2) Code true direction from which the wind is blowing in three figures representing the degrees of the compass, to the nearest 10 degrees.

(3) Use figures to code the wind speed in knots.

EXAMPLES:

At 0845 CST the pilot of a C-54 reports to Bismarck, N. Dak., that he is encountering an 82-knot wind west of Bismarck at 6000 feet MSL, wind direction 80 degrees:

BIS 0850C PIREP W BIS 0845C WND 080 82 KT 60

At 1215 CST the pilot of a PBY reports to Madison, Wis., that he is encountering a 72-knot wind from 240 degrees, 20 miles southeast of the station, at 8500 feet MSL:

MSN 1225C PIREP 20 SE MSN 1215C WND 240 72 KT 85

*10126. BASES AND TOPS OF CLOUDS. Select appropriate sky-cover symbol from Table 1a. Enter heights of bases preceding the symbol, and heights of tops 1/ following the symbol, in hundreds of feet MSL. (Note - Intervals specified in ¶ 1440 for reporting cloud heights are not applicable to pilots' reports.)

EXAMPLES:

The pilot of a B-29 flying over Navasota, Texas, at 0613 CST reports to Houston that the top of the overcast is at 8500 feet MSL:

HOU 0618C PIREP OVR AVS 0613C ⊕85

If the plane had been 15 miles southeast of Navasota when the pilot determined the height of the top of the overcast, the coded report would read:

HOU 0618C PIREP 15 SE AVS 0613C ⊕85

The pilot of a DC-3 flying over Washington, D. C. reports at 1110 EST to Washington that the ceiling is 1500 feet MSL, and top of overcast 4500 feet MSL:

DCA 1118E PIREP OVR DCA 1110E 15⊕45

1/ For traffic control purposes, pilots sometimes furnish reports such as "500 on top at 8000". Such reports merely indicate that the pilot is maintaining an altitude of at least 500 feet above all clouds, in accordance with his traffic clearance. It should not be inferred from this report that the top of the clouds is 7500 feet.

A pilot flying between Casper and Sheridan, Wyo., reports to Sheridan that the cloud base over Kaycee is 14,000 feet MSL. The type of aircraft was not reported, nor the time of the observation.

SHR 1850M PIREP 65 S SHR 140⊕

10127. In addition to the elements indicated in ¶ 10121-10126, any other elements of meteorological or operational significance will be coded in the general form outlined in ¶ 10120.

10200. DISSEMINATION

*10210. All pireps, including those pertaining to ceilings within 1.5 miles of any runway of the airport, will be disseminated in the same manner as special observations. (See ¶ 1444.1 for conditions under which pilots' reports of ceiling will also be incorporated into the current aviation observation.) Stations will enter pireps on Service A or, if Service A is not available, transmit them to the station designated to receive its scheduled observations. If a pirep and a record or special observation are available for transmission at the same time, the pirep will be added as a remark to the record or special observation. Similarly, two or more pireps may be combined to avoid repetition of the station identifier or other identical items. When two or more pireps that contain substantially the same information are available for transmission at the same time, only the most recent one will be sent. Air Force stations will disseminate pireps in accordance with instructions issued by wing or group commanders.

10300. ENTRY ON WBAN-12

*10310. Pireps will be entered on WBAN-12. A new WBAN-12 will be started the first of each month, LST, and pireps for as many days as possible entered on each page. The period covered by each page will be indicated in the space provided for the date. Pireps for consecutive days will be separated by a line space and the date pertaining to the succeeding entries will be entered in this space near the center of the form. Dates will not be entered for days on which pireps are not received. Duplicate entries of pireps on WBAN-10A are not required even though a pirep is appended to a record or special observation in accordance with ¶ 10210; however, such entries are optional if convenient for coding purposes. Column entries will be made on WBAN-12 in accordance with ¶ 10311 to 10314.

*10311. TIME OF ENTRY. (Col. 1). Enter time in accordance with ¶ 11102.

*10312. LOCATION OR EXTENT OF PHENOMENA, TIME OF OBSERVATION, PHENOMENA REPORTED, ALTITUDE OF PHENOMENA, TYPE OF AIRCRAFT. (Col. 2 - 6). Enter coded data in accordance with ¶ 10120 - 10127 (see Fig. 5). Omit entries in columns for which data are missing.

*10313. DISSEMINATION. (Col. 7). At Air Force and Navy stations, enter "T" when the report has been disseminated by teletypewriter and "I" when it has been disseminated by interphone or other means to local operational interests; enter the GCT time in four figures (24-hour clock) following each entry of "I" or "T". Omit entry in this column at civil stations.

*10314. OBSERVER'S INITIALS. (Col. 8). Enter initials of observer entering the observation on WBAN-12.

WB FORM 1130 E
(7-1-52)

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

WBAN 12

PILOT REPORTS

STATION WBAS, Los Angeles, Calif. DATES July 8 TO 11, 1952

TIME OF ENTRY (1)	LOCATION OR EXTENT OF PHENOMENA (2)	TIME OF OBSN. (3)	PHENOMENA REPORTED (4)	ALTITUDE OF PHENOMENA (5)	TYPE AIR-CRAFT (6)	DISSEM-INATION (7)	OBSR. INITIALS (8)
			July 8				
0316	40-60 S BFL	0305 P	LGT ICG	115-130	DC6		ABC
0612	50 W EED		WND 270 80 KT	100			ABC
1350	45 NW ELC	1345P	LGT TURBC	90	DC 4		DEF
			July 9				
0725	50 NW BLH	0714P	DISCHARGE	80			
			LGT TURBC	55	BCFT		GHI
1115	75 S LAX	1101 P	⊕50-65 95⊕				DEF
1820	85 E STH	1810P	LGT ICE	140	B29		JKL
			July 11				
0400	SAN-40 NW	0340P	ST BANK ALG CST				DEF
0910	OVR BFL	0900P	28⊕40 No BalDups				
			HIR -⊙				DEF
1026	10S LAX	1010P	HAZE TOP 18 CLR ABV				mno
1438	15 SW BUR		TMP 51F	80			mno
1742	50 N AND S IDE	1720	CB LTGIC				JKL

Fig. 5. Entries of pilot reports on WBAN-12.

*Revised Eff. 7-1-52

*Revised
Eff. 7-1-52

CHAPTER 11. ENTRIES ON FORM WBAN-10

11000. GENERAL

*11001. Form WBAN-10 consisting of parts A, B, and D, will constitute the basic original record of surface observations at all stations taking aviation observations. A new WBAN-10A and B will be started for recording each day's observations, unless otherwise specified, beginning with the first observation at or following 0000 local standard time. One page of WBAN-10B and as many pages of WBAN-10A as are needed will be used for each day. WBAN-10D will be prepared in accordance with instructions on the form or in the addendum.[1/]

11002. Instructions in this chapter relate primarily to entry of nonmeteorological data. Instructions relating to meteorological elements will be found in the chapters pertaining to these elements.

*11003. Enter observations as legibly as possible in chronological order, restricting data, so far as possible, to the columns appropriate to them as indicated by the column headings. Ditto marks will not be used. Use a black-lead drawing pencil (Venus 2H or 3H or equivalent), employing sufficient pressure to ensure legible copies and ample contrast for photographic reproduction. At stations where the form is used by the communications operator directly, slants to separate data in the aviation code may be used as specified in Chapter 9.

11004. The name of the station and date will be entered in the spaces provided. If stamps are used, use black ink.

*11010. MISSING DATA. The symbol "M" will be entered only for missing data normally recorded. Appropriate notes explaining the missing data will be entered in column 90, or column 13 at SAWR stations.

11020. STATISTICAL DATA. Data entered in parentheses are for statistical purposes only, and are not to be transmitted as an element of an aviation observation.

11030. CORRECTION OF ENTRIES. When incorrect data have been entered, corrections will be made as follows:

11031. If the error is discovered before the report is transmitted, the erroneous entry will be neatly erased from all copies and correct entry made.

11032. If an error is discovered in an observation after the report is transmitted, a red line will be drawn through the erroneous entry only

1/ WBAN-10D is not prepared at Air Force stations.

and the correction entered in red immediately above it. If a correction is transmitted, enter the phrase "COR (Time)" in red in column 13 of the erroneous observation. Carbon copies, if prepared will also be corrected in red.

11100. WBAN-10A

11101. TYPE. (Col. 1) The type of report will be indicated by one of the following designations:

(1) R Record observation.

(2) S (followed by serial number) Special observation. Serial numbers are assigned consecutively for each day. Number 1 is the first special (or record-special) filed for transmission on or after 0000 LST, of a given day.

(3) RS (followed by serial number) Record-special observation.

(4) L Local extra observation.

(5) ✓ Check observation. (If a check observation requires local extra procedure, enter "L.")

11102. TIME ENTRIES. (Col. 2) The time ascribed to an observation is that of the last entry on WBAN-10. Entries will be in local standard time to the nearest minute in terms of the 24-hour clock, unless use of GCT is specifically authorized. The first two figures will indicate the hour, and the last two, the minutes. For example, 0000 indicates the beginning of the day; 0235 indicates 2:35 a.m.; 1346 indicates 1:46 p.m.; 2359 indicates the end of the day. The time based upon any of the standard time meridians can be converted to GCT by adding one hour for each 15° of longitude west of Greenwich. (See Table 17.)

TABLE 17. Meridians of standard time zones and conversion to GCT

Standard Time Zone	Letter Designator	Meridian	To Convert To GCT, add -
Atlantic Standard Time	- -	60°	4 hours.
Eastern Standard Time	E	75°	5 hours.
Central Standard Time	C	90°	6 hours.
Mountain Standard Time	M	105°	7 hours.
Pacific Standard Time	P	120°	8 hours.
Yukon Standard Time	Y	135°	9 hours.
Alaskan Standard Time	A	150°	10 hours.
Bering Standard Time	B	165°	11 hours.

*11103. REMARKS. (Col. 13) Enter remarks in symbols or abbreviations specified in the CAA publication "Contractions" whenever possible; otherwise, use plain English. If necessary, use additional lines; it is not intended that the physical dimensions of the column shall limit in any way the information to be reported. Enter also additive data groups and raob data. Contractions pertaining to non-meteorological data, such as notices to airmen concerning broadcast facilities, may also be entered in the column if desired.

*11103.1. Enter additive data pertaining to pressure, precipitation, clouds, and temperature in accordance with Table 18. (See ¶ 11103.11 for supplementary requirements pertaining to elements not generally observed at all stations.) Consult the 1949 Synoptic Code (or the abridgement provided stations that transmit additive data only) for coding instructions on individual elements.

*TABLE 18. Additive Data Requirements

(Note: The following specifications do not apply to SAWRS, nor to other second-order civil stations that have been individually authorized to omit certain elements listed below.)

Type of Station	Additive data at 6-hourly periods (0030Z, 0630Z, etc.)	Additive data at 3-hourly periods (0330Z, 0930Z, etc.)
(1) All Air Force and Navy stations; all civil stations in Alaska and overseas; and all first-order Weather Bureau stations that do not file either 3- or 6-hourly synoptic observations on Service C.	Pressure tendency and change; precipitation; clouds; and maximum and minimum temperatures. ($appRR$[1]$C_LC_MC_HD_C$ $T_{n/x}T_{n/x}$)	Pressure tendency and change; clouds (app[1]$C_LC_MC_HD_C$)
(2) First-order Weather Bureau stations filing both 3- and 6-hourly synoptic observations on Service C.	None	None
(3) First-order Weather Bureau stations filing 6-hourly but not 3-hourly synoptic observations on Service C.	None	Pressure tendency and change; clouds (app[1]$C_LC_MC_HD_C$)
(4)[2] All second order civil stations designated to transmit additive data.	Pressure tendency and change; precipitation; maximum and minimum temperatures ($appRR$[1]$T_{n/x}T_{n/x}$)	Pressure tendency and change (app)

1/ Plain language precipitation data and group 99ppp will be used to supplement these groups in accordance with synoptic coding instructions.

2/ At combined Weather Bureau-CAA stations, when observations are taken by CAA personnel, additive data will be transmitted in accordance with (4), except that if CAA personnel file synoptic observations on Service C all additive data on Service A for the corresponding time will be omitted; when observations are taken by Weather Bureau personnel at this type of station, additive data will be filed in accordance with (1)-(3).

*11103.11. In addition to the above basic groups, snow depth ($9S_pS_ps_ps_p$) and 850-mb. data ($2h_{85}h_{85}h_{85}a_3$) will be sent by all stations when necessary in accordance with synoptic coding instructions 1/. These additional groups will be transmitted in the following order:

6-hourly symbolic form:

appRR (99ppp and plain language precipitation data)

$C_LC_MC_HD_C$ $9S_pS_ps_ps_p$ $T_n/_xT_n/_x$ $2h_{85}h_{85}h_{85}a_3$ $3R_{24}R_{24}R_{24}R_{24}$ $4T_xT_xT_nT_n$

3-hourly symbolic form:

app (99ppp) $C_LC_MC_HD_C$ $2h_{85}h_{85}h_{85}a_3$

11103.2. At specified international aerodromes, cloud group $8N_sCh_sh_s$ will be sent with record and special observations. This group will be transmitted as the final item in the report, following remarks, 3- and 6-hourly additive data, or field conditions. Use slants to separate group $8N_sCh_sh_s$ from altimeter setting or remarks, but not from 3- and 6-hourly additive data or field conditions.

11104. OBSERVER'S INITIALS. (Col. 15) Enter initials of observer taking the observation in this column.

11200. WBAN-10B

11201. TIME. (Col. 16) Entries in this column will be in chronological order, to the nearest minute. The times will be the same as times of corresponding record observations. (See par. 11102.) Note that the first two figures of the time group are printed on the form.

11202. TIME. (Cols. 41 and 42) Entries in column 41 will be omitted unless otherwise instructed. In column 42 in the block captioned "Mid to....," enter the time of the beginning of the first 6-hourly observation after 0000 LST. In the next four blocks below, enter the time of the beginning of the 6-hourly synoptic observation. The entries will be to the nearest minute in terms of the 24-hour clock.

11203. STATE OF GROUND. (Col. 50) At first-order Weather Bureau and Air Force stations, enter state of ground in accordance with Table 19. Omit this entry at stations having only concrete, macadam, or similar artificial surfaces in the vicinity of the station.

1/ Designated Weather Bureau stations that take observations on a part-time basis will also send supplementary temperature and precipitation data ($3R_{24}R_{24}R_{24}R_{24}$ and $4T_xT_xT_nT_n$) when specifically authorized to do so. These latter groups may also be sent at other than 6-hourly times in accordance with the Additive Data Coding Manual.

TABLE 19. State of ground

Code figures	Description
0....	Surface of ground dry (no appreciable amount of dust or loose sand).
1....	Surface of ground moist.
2....	Surface of ground wet (standing water in small or large pools on surface).
3....	Surface of ground bare and frozen.
4....	Glaze on ground but no ice, slush, or snow.
5....	Ice, slush, or snow covering less than one-half of ground.
6....	Ice, slush, or firm or settled snow covering more than one-half of ground (but not completely).
7....	Ice, slush, or firm or settled snow covering ground completely.
*8...	Loose dry snow covering more than one-half of surface (but not completely).
*9...	Loose dry snow covering surface completely.

*Figures 8 and 9 may be used to indicate dust or loose sand on the surface of the ground in the proportions indicated. Under these conditions, when the temperature is below 32°F., enter the words "State of ground - dust" or "State of ground - loose sand" in column 90.

NOTE. - Numbers 0 to 4 apply to representative bare ground and numbers 5 to 9 to an open representative area.

11204. SEA, STATE AND DIRECTION[1]. (Col. 51) State and direction of the sea refer only to the condition of the sea surface resulting from the action of winds prevailing in the immediate local area. It should be noted that it is possible for a "flat, oily" sea to co-exist with a "light," "moderate," or even "heavy" swell.

11204.1. The state of the sea will be recorded as a code figure in accordance with Table 20.

[1]Entries in columns 51-54 are made at designated Weather Bureau and Navy stations only.

Enter fifth figure of group in accordance with Table 23.

TABLE 23. Surf (D_S)

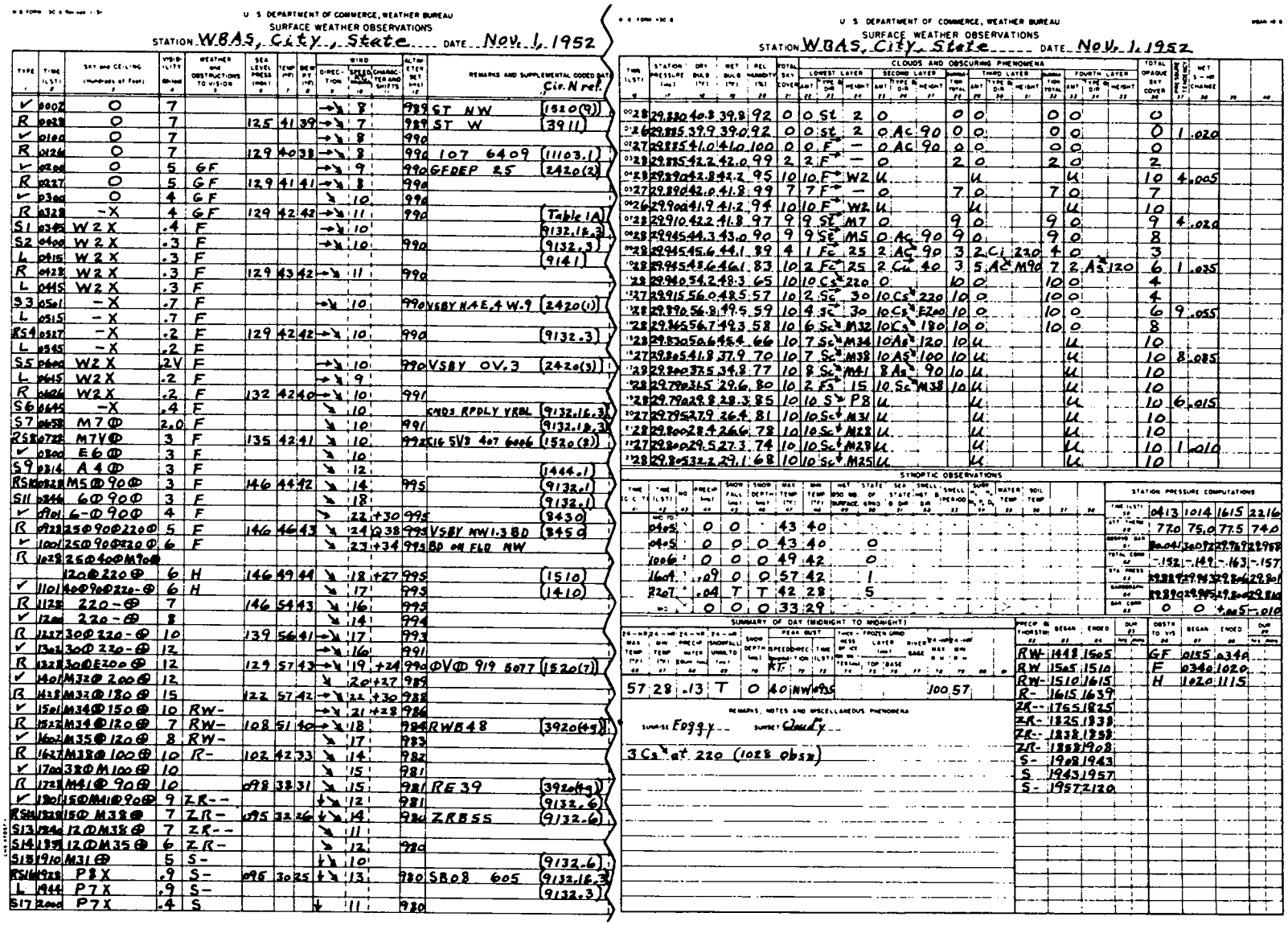
Code No.	Angle of breakers with the beach	Code No.	Angle of breakers with the beach
0	Calm.	5	0° up to 10° } from the right.
1	0° up to 10° } from the left.	6	10° up to 20° }
2	10° up to 20° }	7	More than 20° }
3	More than 20° }	8	Confused, but predominantly from the right.
4	Confused, but predominantly from the left.	9	Not known.

11208. THICKNESS OF ICE ON WATER. (Col. 74) At designated Weather Bureau and Navy stations, enter this datum to the nearest 0.1 inch.

11209. FROZEN GROUND LAYER. (Cols. 75-76) At designated Weather Bureau and Navy stations, enter this datum to the nearest whole inch.

11210. RIVER GAGE. (Col. 77) At Weather Bureau stations where a river gage is read, enter the river gage reading to the nearest 0.1 foot.

*11211. (Cols. 80-81) Except in accordance with ¶ 4370, any data needed locally may be entered in columns 80 and 81, provided the nature of the data is properly identified in the column headings.



U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
STATION WBAS, City, State DATE Nov. 1, 1952

TYPE	TIME (LST)	SKY and CEILING (Hundreds of Feet)	VISIBILITY (Miles)	WEATHER and OBSTRUCTIONS TO VISION	SEA LEVEL PRESS (mbs)	TEMP (°F)	DEW PT (°F)	WIND DIRECTION	WIND SPEED (MPH)	WIND CHARACTER AND SHIFTS	ALTIMETER SET (mbs)	REMARKS AND SUPPLEMENTAL CODED DATA	Cir. N ref.
✓	0002	O	7					→	8		989	ST NW	(1520(9))
R	0028	O	7		125	41	39	→	7		989	ST W	(3911)
✓	0100	O	7					→	8		990		
R	0126	O	7		129	40	38	→	8		990	107 6409	(11103.1)
✓	0200	O	5	GF				→	9		990	GFDEP 2.5	(2420(2))
R	0227	O	5	GF	129	41	41	→	8		990		
✓	0300	O	4	GF				↘	10		990		
R	0328	-X	4	GF	129	42	42	→	11		990		(Table 1A)
S1	0345	W 2 X	.4	F				→	10				(9132.18.3)
S2	0400	W 2 X	.3	F				→	10		990		(9132.3)
L	0415	W 2 X	.3	F									(9141)
R	0428	W 2 X	.3	F	129	43	42	→	11		990		
L	0445	W 2 X	.3	F									
S3	0501	-X	.7	F				→	10		990	VSBY N4E,4 W.9	(2420(1))
L	0515	-X	.7	F									
RS4	0527	-X	.2	F	129	42	42	→	10		990		(9132.3)
L	0545	-X	.2	F									
S5	0600	W2 X	.2V	F				→	10		990	VSBY OV.3	(2420(3))
L	0615	W2X	.2	F				→	9				
R	0626	W2X	.2	F	132	42	40	→	10		991		
S6	0645	-X	.4	F				↘	10			CIGS RPDLY VRBL	(9132.16.3)
S7	0658	M7 ⊕	2.0	F				↘	10		991		(9132.18.3)
RS8	0728	M7V ⊕	3	F	135	42	41	↘	10		992	K16 SV3 407 6006	(1520(8))
✓	0800	E6 ⊕	3	F				↘	10				
S9	0814	A4 ⊕	3	F				↘	12				(1444.1)
RS10	0828	M5 ⊕ 90 ⊕	3	F	146	44	42	↘	14		995		(9132.1)
S11	0846	6 ⊕ 90 ⊕	3	F				↘	18				(9132.1)
✓	0901	6-⊕ 90 ⊕	4	F				↘	22	+30	995		(9430)
R	0928	25 ⊕ 90 ⊕ 220 ⊕	5	F	146	46	43	↘	24	Q 38	995	VSBY NW 1.3 BD	(3450)
✓	1001	25 ⊕ 90 ⊕ 220 ⊕	6	F				↘	27	+34	995	BD ON FLD NW	
R	1028	26 ⊕ 40 ⊕ M70 ⊕											
		120 ⊕ 220 ⊕	6	H	146	49	44	↘	18	+27	995		(1510)
✓	1101	40 ⊕ 90 ⊕ 220 - ⊕	6	H				↘	17		995		(1410)
R	1128	220 - ⊕	7		146	54	43	↘	16		995		
✓	1200	220 - ⊕	8					↘	14		994		
R	1227	30 ⊕ 220 - ⊕	10		139	56	41	→	17		993		
✓	1301	30 ⊕ 220 - ⊕	12					→	16		991		
R	1328	30 ⊕ E200 ⊕	12		129	57	43	→	19	+24	990	⊕V ⊕ 919 6077	(1520(7))
✓	1401	M32 ⊕ 200 ⊕	12					↘	20	+27	989		
R	1428	M32 ⊕ 180 ⊕	15		122	57	42	→	22	+30	988		
✓	1501	M34 ⊕ 150 ⊕	10	RW-				→	21	+28	986		
R	1527	M34 ⊕ 120 ⊕	7	RW-	108	51	40	→	18		986	RWB48	(3920(49))
✓	1602	M35 ⊕ 120 ⊕	8	RW-				↘	17		983		
R	1627	M38 ⊕ 100 ⊕	10	R-	102	42	33	↘	14		982		
✓	1700	38 ⊕ M100 ⊕	10					↘	15		981		
R	1728	M41 ⊕ 90 ⊕	10		098	38	31	↘	15		981	RE39	(3920(49))
✓	1801	150 ⊕ M41 ⊕ 90 ⊕	9	ZR--				↓	12		981		(9132.6)
RS12	1828	150 ⊕ M38 ⊕	7	ZR-	095	32	26	↓	14		984	ZRB55	(9132.6)
S13	1846	120 ⊕ M38 ⊕	7	ZR--				↘	11				
S14	1859	120 ⊕ M35 ⊕	6	ZR-				↘	12		980		
S15	1910	M31 ⊕	5	S-				↓	10				(9132.6)
RS16	1928	P8X	.9	S-	096	30	25	↓	13		980	SB08 605	(9132.16.3)
L	1944	P7X	.9	S-									(9132.3)
S17	2000	P7X	.4	S				↓	11		980		

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
STATION WBAS, City, State DATE Nov. 1, 1952

TIME (LST)	STATION PRESSURE (ins)	DRY BULB (°F)	WET BULB (°F)	REL. HUMIDITY (%)	TOTAL SKY COVER	CLOUDS AND OBSCURING PHENOMENA: LOWEST LAYER AMT	TYPE & DIR	HEIGHT	SECOND LAYER AMT	TYPE & DIR	HEIGHT	THIRD LAYER TOP TOTAL	AMT	TYPE & DIR	HEIGHT	FOURTH LAYER TOP TOTAL	AMT	TYPE & DIR	HEIGHT	TOTAL OPAQUE SKY COVER	CEILING (Hundreds of Feet)	NET 3-HR CHANGE
0028	29.830	40.8	39.8	92	0	0	St	2	0			0	0			0	0			0		
0226	29.815	39.9	39.0	92	0	0	St	2	0	Ac	90	0	0			0	0			0	1	.020
0327	29.815	41.0	41.0	100	0	0	F	—	0	Ac	90	0	0			0	0			0		
0328	29.815	42.2	42.0	99	2	2	F	—	0			2	0			2	0			2		
0428	29.830	42.8	42.2	95	10	10	F	W2	U				U				U			10	4	.005
0527	29.890	42.0	41.8	99	7	7	F	—	0			7	0			7	0			7		
0626	29.900	41.9	41.2	96	10	10	F	W2	U				U				U			10		
0728	29.910	42.2	41.8	97	9	9	St	M7	0			9	0			9	0			9	4	.020
0828	29.945	44.3	43.0	90	9	9	St	M5	0	Ac	90	9	0			9	0			8		
0928	29.945	45.6	44.1	89	4	1	Fc	25	2	Ac	90	3	2	Ci	220	4	0			3		
1028	29.945	48.6	46.1	83	10	2	Fc	25	2	Cu	40	3	5	Ac	M90	7	2	As	120	6	1	.035
1128	29.940	54.2	48.3	65	10	10	Cs	220	0			10	0			10	0			4		
1227	29.915	56.0	48.5	57	10	2	Sc	30	10	Cs	220	10	0			10	0			4		
1328	29.890	56.8	49.5	59	10	4	Sc	30	10	Cs	F200	10	0			10	0			6	9	.055
1428	29.865	56.7	49.3	58	10	6	Sc	M32	10	Cs	180	10	0			10	0			8		
1528	29.830	56.6	48.4	66	10	7	Sc	M34	10	As	120	10	U				U			10		
1627	29.800	54.1	48.8	70	10	7	Sc	M38	10	As	100	10	U				U			10	8	.085
1728	29.800	37.5	34.8	77	10	8	Sc	M41	8	As	90	10	U				U			10		
1828	29.770	36.5	29.6	80	10	2	Fs	15	10	Sc	M38	10	U				U			10		
1928	29.790	29.8	28.3	85	10	10	S	P8	U				U				U			10	6	.015
2027	29.795	27.9	26.4	81	10	10	Sc	M31	U				U				U			10		
2128	29.800	28.4	26.6	78	10	10	Sc	M28	U				U				U			10		
2227	29.800	29.5	27.3	74	10	10	Sc	M28	U				U				U			10	1	.010
2328	29.840	32.2	29.1	68	10	10	Sc	M25	U				U				U			10		

SYNOPTIC OBSERVATIONS

TIME (GCT)	TIME (LST)	NO.	PRECIP (Inches)	SNOW FALL (Inches)	SNOW DEPTH (Inches)	MAX. TEMP (°F)	MIN. TEMP (°F)	WET BULB TEMP (°F)	STATE OF WEATHER	SEA SURFACE TEMP	SWELL DIR.	SWELL PERIOD	SURF HEIGHT	WATER TEMP	SOIL TEMP
	0405		0	0		43	40								
	0405		0	0	0	43	40		0						
	1006		0	0	0	49	42		0						
	1601		.09	0	0	57	42		1						
	2201		.04	T	T	42	28		5						
			0	0	0	33	29								

STATION PRESSURE COMPUTATIONS

TIME (LST)	04	10	16	22
STA. PRESS	29.13	29.14	29.15	29.16
GRDPD BAR	30.04	30.02	29.99	29.98
TOTAL CORR	-.152	-.149	-.163	-.157
STA. PRESS	29.888	29.891	29.837	29.903
BAROGRAPH	29.89	29.89	29.84	29.90
BAR CORR	0	0	+.005	-.010

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

MAX. TEMP (°F)	MIN. TEMP (°F)	PRECIP (Inches)	SNOWFALL (Inches)	SNOW DEPTH (Inches)	PEAK GUST SPEED (MPH)	PEAK GUST DIR.	PEAK GUST TIME (LST)	THICK. OF FROZEN GRND (Inches)	PRECIP & THUNDER BEGAN	PRECIP & THUNDER ENDED	DUR. (hr. min.)	OBSTR. TO VIS BEGAN	OBSTR. TO VIS ENDED	DUR. (hr. min.)
57	28	.13	T	0	40	NW	935		RW- 1448	1505		GF	0155	0344
									RW 1505	1510		F	0344	1020
									RW- 1510	1615		H	1020	1115
									R- 1615	1639				
									ZR-- 1765	1825				
									ZR- 1825	1838				
									ZR-- 1838	1858				
									ZR- 1858	1908				
									S- 1908	1943				
									S 1943	1957				
									S- 1957	2120				

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

Sunrise Foggy Sunset Cloudy

3 Cs at 220 (1028 obsn)

Fig. 6. Entries on WBAN-10A and B.

CHAPTER 12. MARINE OBSERVATIONS

12000. GENERAL

12010. These instructions apply to all observations taken by Naval aerological personnel on Naval vessels and by Weather Bureau personnel on ocean station vessels. Instructions in Chapters 1 - 11 will be followed in taking marine observations except as specifically noted in this chapter.

12011. Greenwich Civil Time will be used on all observational records including autographic records.

12100. OBSERVATIONAL PROGRAM

12110. NAVY. The observational program on Naval vessels is outlined in the Navy addendum.

12120. WEATHER BUREAU. The surface observational program conducted by Weather Bureau personnel on ocean station vessels consists of:

(a) Scheduled observations (combined record and synoptic observations) filed with the ship's communicator at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 GCT.

(b) Special observations as required by par. 12122. (Aviation observations referred to in pars. 9132 - 9150 will not be taken.)

12121. SCHEDULED OBSERVATIONS. Scheduled observations will be taken and transmitted in accordance with par. 12120 as soon as the vessel departs from base port, and continued until return to base port, except when the vessel is temporarily in another port where surface observations are taken by a land station.

12122. SPECIAL OBSERVATIONS. Special surface observations will be taken and filed promptly with the communicator whenever requested by aircraft, by ships engaged in search and rescue operations, or by a Weather Bureau forecast office. Special surface observations will be transmitted:

(1) To aircraft (except those contemplating ditching, see next paragraph) and to surface vessels, in plain language, the elements following the same order in which they are coded in scheduled synoptic observations; or, when specifically requested, in the AERO code form: (Ocean station Identifier) Nddff VVwwW $8N_sCh_sh_s$. 1/

1/ Group $OTTT_dT_d$, Q signals, and plain language remarks are optional.

(2) To aircraft contemplating ditching, in plain language or, when language difficulties are anticipated, in "Q" code. The report will consist of the following elements in the order given:

(a) Surface wind direction in degrees.

(b) Surface wind speed in knots.

(c) Swell - length, height, and speed of swell waves and direction from which they are moving.

(d) State of sea - length, height, and speed of sea waves and direction from which they are moving.

(e) Visibility.

(f) Present weather.

(g) Amount, and height of base of low cloud (both the predominant layer and any scattered clouds below).

(h) Sea-level pressure.

(i) Remarks.

(3) To Weather Bureau forecast offices, in the same code used for scheduled synoptic observations.

12200. WBAN-11A and B, and WBAN-10D

12210. WBAN-11. WBAN-11A and B constitute the basic observational record for all marine observations taken in accordance with sections 12000, and 12100.

*12211. PREPARATION. Only one copy of WBAN-11 need be prepared unless otherwise specified. Pencil will be used in accordance with ¶ 11003. In the heading, enter name of ship and date (GCT). When a ship is assigned to an ocean station, enter station designator, and latitude and longitude of the station to degrees and minutes.

12211.1. A new WBAN-11A will be started on the first day of each month (GCT). A new WBAN-11B will be started with the first observation of each day (GCT).

12211.11. On Naval ships with major aerological units aboard, a new WBAN-11A will be started on the first observation of the day (GCT). As many pages will be used daily as necessary.

apparent size of the ship (or other object), and the portion visible. Use Table 25 as a guide in determining distances (e.g., in accordance with line 7 of Table 25, the horizon when viewed from a bridge 40 feet above sea level is 7.6 nautical miles away).

TABLE 25. Distance to objects on the horizon at sea (nautical miles)

Height of observer's eyes above sea level (feet)	Height of object above sea level (feet)														
	0[1]	10	20	30	40	60	80	100	150	200	300	400	600	800	1,000
10	3.8	7.2	8.7	9.9	10.8	12.5	13.9	15.1	17.7	19.8	23.5	26.5	31.6	36.0	39.8
15	4.6	8.0	9.5	10.7	11.6	13.3	14.7	15.9	18.5	20.6	24.3	27.3	32.4	36.8	40.6
20	5.4	8.7	10.2	11.4	12.3	14.0	15.4	16.6	19.2	21.3	25.0	28.0	33.1	37.5	41.3
25	6.0	9.3	10.8	12.0	12.9	14.6	16.0	17.2	19.8	21.9	25.6	28.6	33.7	38.1	41.9
30	6.6	9.9	11.4	12.6	13.5	15.2	16.6	17.8	20.4	22.5	26.2	29.2	34.3	38.7	42.5
35	7.1	10.4	11.9	13.1	14.0	15.7	17.1	18.3	20.9	23.0	26.7	29.7	34.8	39.2	43.0
40	7.6	10.8	12.3	13.5	14.4	16.1	17.5	18.7	21.3	23.4	27.1	30.1	35.2	39.6	43.4
45	8.0	11.3	12.8	14.0	14.9	16.6	18.0	19.2	21.8	23.9	27.6	30.6	35.7	40.1	43.9
50	8.5	11.7	13.2	14.4	15.3	17.0	18.4	19.6	22.2	24.3	28.0	31.0	36.1	40.5	44.3
60	9.3	12.5	14.0	15.2	16.1	17.8	19.2	20.4	23.0	25.1	28.8	31.8	36.9	41.3	45.1
70	10.0	13.2	14.7	15.9	16.8	18.5	19.9	21.1	23.7	25.8	29.5	32.5	37.6	42.0	45.8
80	10.7	13.9	15.4	16.6	17.5	19.2	20.6	21.8	24.4	26.5	30.2	33.2	38.3	42.7	46.5
90	11.4	14.5	16.0	17.2	18.1	19.8	21.2	22.4	25.0	27.1	30.8	33.8	38.9	43.3	47.1
100	12.0	15.1	16.6	17.8	18.7	20.4	21.8	23.0	25.6	27.7	31.4	34.4	39.5	43.9	47.7

[1] Horizon.

*12308. WEATHER AND OBSTRUCTIONS TO VISION (Col. 5). Enter weather and obstructions to vision in accordance with ¶ 3910 and 3911. Remarks referred to in ¶ 3920 are not required in marine observations, but may be entered on an optional basis when appropriate (see Fig. 8). Precipitation measurements referred to in Chapter 4 will not be made unless specifically authorized.

12309. SEA-LEVEL PRESSURE (Col. 6). Enter sea-level pressure in accordance with par. 7710, as determined from an aneroid barometer which has been compared with a mercurial barometer as specified in the addendum.

12310. TEMPERATURE AND DEW POINT (Cols. 7 and 8). Enter dry-bulb and dew-point temperature in accordance with pars. 5510 and 6410.

12311. WIND (Cols. 9 - 11). Enter true wind direction, speed (in knots), wind shifts, and gustiness in accordance with section 8400. Compute true wind from apparent wind in accordance with par. 12311.1. Obtain apparent wind from instrumental equipment whenever available and adequately exposed; otherwise, estimate the apparent wind direction to the nearest ten degrees off the bow, and the apparent wind speed to the nearest five knots in accordance with Table 26. Use the values in Table 27 as a check on computed true wind speeds.

TABLE 26. , Apparent wind speed

Speed (knots)	Indication
Less than 1	Calm; smoke rises vertically.
1–3	Smoke drifts from funnel.
4–6	Wind felt on face.
7–10	Wind extends light flag.
11–16	Wind raises dust, cinders, loose paper.
17–21	Wind waves and snaps flag briskly.
22–27	Whistling in rigging.
28–33	Inconvenience felt walking against wind.
34–40	Generally impedes progress.

TABLE 27. Determination of wind speed by sea condition

Speed in knots	Descriptive terms	Sea conditions	Wind force (Beaufort)
Less than 1	Calm	Sea smooth and mirror-like	0
1–3	Light air	Scale-like ripples without foam crests	1
4–6	Light breeze	Small, short wavelets; crests have a glassy appearance and do not break.	2
7–10	Gentle breeze	Large wavelets; some crests begin to break; foam of glassy appearance. Occasional white foam crests.	3
11–16	Moderate breeze	Small waves, becoming longer; fairly frequent white foam crests.	4
17–21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white foam crests; there may be some spray.	5
22–27	Strong breeze	Large waves begin to form; white foam crests are more extensive everywhere; there may be some spray.	6
28–33	Moderate gale	Sea heaps up and white foam from breaking waves begin to be blown in streaks along the direction of the wind; spindrift begins.	7
34–40	Fresh gale	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind.	8
41–47	Strong gale	High waves; dense streaks of foam along the direction of the wind; sea begins to roll; spray may reduce visibility.	9
48–55	Whole gale	Very high waves with long overhanging crests. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole, the surface of the sea is white in appearance. The rolling of the sea becomes heavy and shocklike. Visibility is reduced.	10
56–63	Storm	Exceptionally high waves that may obscure small and medium-sized ships. The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility reduced.	11
64 and above	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very much reduced.	12

EXAMPLE:

Given: Wave direction 40°, period 9 seconds, height 21 feet.

Entry in Column 40B: 040921.

12322.1. Instructions in pars. 11204 - 11207.5 are not applicable to observations recorded on WBAN-11B. Specifically, no distinction should be made between "sea" and "swell" except for the special aviation observations required by par. 12122(2). Waves referred to in par. 12322 are the combined results of "sea" and "swell". Only one wave system will be reported unless the height, direction, and period of a second system are clearly defined, in which case data for the second system will be recorded in column 90 in accordance with par. 12334.1. All wave data will be with respect to large, well-formed waves; disregard the lower, poorly-formed waves.

12323. REMARKS, NOTES, AND MISCELLANEOUS PHENOMENA (Col. 90). Enter data in this column in accordance with pars. 3934 - 3934.7, except that time of sunrise and sunset, rather than character, will be entered.

12324. $YQL_aL_aL_a$ (Col. 91). Enter coded data in accordance with column heading, where the symbols have the following meaning:

(a) Y - Day of week (GCT) in accordance with Table 28.

(b) Q - Octant of the globe in accordance with Table 24.

(c) $L_aL_aL_a$ - Latitude to the nearest tenth of degree. Convert minutes to tenths by dividing by 6 and rounding in accordance with the Introduction - e.g., Code 9°28' as 095.

TABLE 28

SYMBOL Y.—*Day of the week*

Day	Code figure
Sunday	1
Monday	2
Tuesday	3
Wednesday	4
Thursday	5
Friday	6
Saturday	7

12325. $L_oL_oL_oGG$ (Col. 92). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meading:

(a) $L_oL_oL_o$ - Longitude to the nearest tenth of degree. Omit hundreds digit, and convert minutes to tenths in accordance with par. 12324(c) - e.g., Code 125°42' as 267.

(b) GG - The corresponding time entered in column 2 to the nearest whole hour, GCT.

*12326. Nddff (Col. 93). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) N - Total amount of clouds, as recorded in column 21 and coded in accordance with Table 29.

(b) dd - Wind direction, as recorded in column 9 and coded in accordance with Table 30.

(c) ff - Wind speed in knots, as recorded in column 10, except that whenever the wind speed is from 100 to 199 knots, inclusive, add 50 to the coded direction and omit the hundreds digit for wind speed - e.g., code wind direction of 270°, speed 105 knots, as 7705.

TABLE 29

SYMBOL "N"—TOTAL AMOUNT OF CLOUD
SYMBOL "N_h"—AMOUNT OF CLOUD WHOSE HEIGHT IS REPORTED BY "h"
SYMBOL "N_s"—AMOUNT OF THE SIGNIFICANT CLOUD LAYER

Code figure	Amount of Sky Covered (in tenths)	Code figure	Amount of Sky Covered (in tenths)
0	0	5	6
1	1	6	7 and 8
2	2 and 3	7	9
3	4	8	10
4	5	[1]9	Sky obscured

[1] Code Figure 9 will be used when the sky is completely hidden with obscuring phenomena. If the sky is only partially hidden, disregard the obscuring phenomena and code cloud data as observed - e.g., "0" if no clouds are present, even though half the sky is hidden.

TABLE 30
Symbol dd - Direction from which wind is blowing. 1/

Code Figure	Direction	Code Figure	Direction
00	Calm	18	S
02	NNE	20	SSW
05	NE	23	SW
07	ENE	25	WSW
09	E	27	W
11	ESE	29	WNW
14	SE	32	NW
16	SSE	34	NNW
		36	N

1/ Wind speeds from 100 to 199 knots, inclusive, are reported by adding 50 to the code figure for "dd" and coding the observed speed minus 100 for "ff". See par. 12326(c).

*12327. VVwwW (Col. 94). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) VV - Prevailing visibility, as recorded in column 4 and coded in accordance with Table 31.

(b) ww - Present weather (occurring at the actual time of observation or within one hour of it), coded in accordance with Table 32. Use entries in column 5 as a guide in selecting the proper code figure. If more than one code figure is applicable, use the largest numerical figure.

(c) W - Past weather (occurring at the station the past 3 or 6 hours), coded in accordance with Table 33. At 0000, 0600 1200 and 1800 GCT, W refers to the preceding six hours, while at intermediate times (0300, 0900, etc.) W refers to the preceding three hours. Use the largest applicable numerical code figure, except that W and ww should be selected so that the combined code figures describe present and past weather as completely as possible. For example, when the weather occurring at the time of observation (rather than for the previous hour) is coded as ww, the weather during the past six (or three) hours will be coded as W; while if the weather that occurred during the preceding hour is coded as ww, the weather during the five (or two) hours ending one hour before should be coded as W.

TABLE 31

SYMBOL "VV"—HORIZONTAL VISIBILITY

Code figure	Visibility in Nautical Miles and Tenths	Code figure	Visibility in Nautical Miles and Tenths
00	Less than 0.1	19	1.9
01	0.1	20	2.0
02	0.2	25	2.5
03	0.3	30	3.0
04	0.4	37	4
05	0.5	46	5
06	0.6	55	6
07	0.7	64	7
08	0.8	74	8
09	0.9	80	9 and 10
10	1.0	81	11 to 20, inclusive
11	1.1	82	25 and 30
12	1.2	83	35 and 40
13	1.3	84	45 and 50
14	1.4	85	55 to 80, inclusive
15	1.5	86	85 to 105, inclusive
16	1.6	87	110 to 160, inclusive
17	1.7	88	165 to 265, inclusive
18	1.8	89	270 or more

*TABLE 32

SYMBOL WW—*Present weather*

00–49 NO PRECIPITATION AT THE SHIP AT THE TIME OF OBSERVATION

00–19: NO PRECIPITATION, FOG, DUSTSTORM, SANDSTORM OR DRIFTING SNOW AT THE SHIP AT THE TIME OF OBSERVATION OR DURING THE PRECEDING HOUR, EXCEPT FOR 09–12.

No hydrometeors except clouds.

- 00 No clouds or cloud development not observed
- 01 Clouds generally dissolving or becoming less developed
- 02 State of sky on the whole unchanged
- 03 Clouds generally forming or developing

} Characteristic change of the state of sky during the past hour.

Haze, dust, sand or smoke.

- 04 Visibility reduced by smoke, e. g., veldt or forest fires, industrial smoke, or volcanic ashes.
- 05 Dry haze.
- 06 Widespread dust in suspension in the air, not raised by wind at or near the ship at the time of observation.
- 07 Dust or sand raised by wind at or near the ship at the time of observation, but no well developed dust devil(s) and no duststorm or sandstorm seen.
- 08 Well developed dust devil(s) seen at or near the ship within last hour, but no duststorm or sandstorm.
- 09 Duststorm or sandstorm within sight of ship or at ship during the last hour.

- 10 Light fog, visibility 1,000 meters (1,100 yards) or more.
- 11 Patches of
- 12 More or less continous

} Shallow fog at the ship not deeper than about 10 meters (33 feet).

- 13 Lightning visible, no thunder heard.
- 14 Precipitation within sight, but not reaching sea at the ship.
- 15 Precipitation within sight, reaching sea, but distant [i. e., estimated to be more than 5 kilometers (3 miles) from ship].
- 16 Precipitation within sight, reaching sea, near to but not at the ship.
- 17 Thunder heard, but no precipitation at the ship.
- 18 Squall(s)
- 19 Funnel cloud(s) (tornado or waterspout)

} within sight during the past hour.

20–29: PRECIPITATION, FOG OR THUNDERSTORM AT THE SHIP DURING THE PRECEDING HOUR BUT *NOT* AT THE TIME OF OBSERVATION.

- 20 Drizzle (not freezing)
- 21 Rain (not freezing)
- 22 Snow
- 23 Rain and snow
- 24 Freezing drizzle or freezing rain

} not falling as showers.

- 25 Shower(s) of rain.
- 26 Shower(s) of snow, or of rain and snow.
- 27 Shower(s) of hail, or of hail and rain.
- 28 Fog.
- 29 Thunderstorm (with or without precipitation).

30–39: DUSTSTORM, SANDSTORM, OR DRIFTING SNOW.

- 30 Slight or moderate duststorm or sandstorm— has decreased during the preceding hour.
- 31 Slight or moderate duststorm or sandstorm— no appreciable change during the preceding hour.
- 32 Slight or moderate duststorm or sandstorm— has increased during the preceding hour.
- 33 Severe duststorm or sandstorm— has decreased during the preceding hour.
- 34 Severe duststorm or sandstorm— no appreciable change during preceding hour.
- 35 Severe duststorm or sandstorm— has increased during the preceding hour.
- 36 Slight or moderate drifting snow
- 37 Heavy drifting snow

} generally low.

- 38 Slight or moderate drifting snow
- 39 Heavy drifting snow

} generally high.

40–49: FOG AT THE TIME OF OBSERVATION.

- 40 Fog at a distance at the time of observation, but not at the ship during the last hour, the fog extending to a level above that of the observer.
- 41 Fog in patches.

See rule 1.

- 42 Fog, sky discernible
- 43 Fog, sky not discernible

} has become thinner during the preceding hour.

- 44 Fog, sky discernible
- 45 Fog, sky not discernible

} no appreciable change during the preceding hour.

- 46 Fog, sky discernible
- 47 Fog, sky not discernible

} has begun or has become thicker during the preceding hour.

- 48 Fog, depositing rime, sky discernible.
- 49 Fog, depositing rime, sky not discernible.

[1]Visibility less than 0.5 nautical mile.

TABLE 32 (continued)

50–99 PRECIPITATION AT THE SHIP AT THE TIME OF OBSERVATION

50–59: DRIZZLE AT TIME OF OBSERVATION.

50	Drizzle, not freezing, intermittent	slight at time of observation.
51	Drizzle, not freezing, continuous	
52	Drizzle, not freezing, intermittent	moderate at time of observation.
53	Drizzle, not freezing, continuous	
54	Drizzle, not freezing, intermittent	thick at time of observation.
55	Drizzle, not freezing, continuous	
56	Drizzle, freezing, slight.	
57	Drizzle, freezing, moderate or thick.	
58	Drizzle and rain, slight.	
59	Drizzle and rain, moderate or heavy.	

60–69: RAIN AT TIME OF OBSERVATION.

60	Rain, not freezing, intermittent	slight at time of observation.
61	Rain, not freezing, continuous	
62	Rain, not freezing, intermittent	moderate at time of observation.
63	Rain, not freezing, continuous	
64	Rain, not freezing, intermittent	heavy at time of observation.
65	Rain, not freezing, continuous	
66	Rain, freezing, slight.	
67	Rain, freezing, moderate or heavy.	
68	Rain or drizzle and snow, slight.	
69	Rain or drizzle and snow, moderate or heavy.	

70–79: SOLID PRECIPITATION NOT IN SHOWERS AT TIME OF OBSERVATION.

70	Intermittent fall of snowflakes	slight at time of observation.
71	Continuous fall of snowflakes	
72	Intermittent fall of snowflakes	moderate at time of observation.
73	Continuous fall of snowflakes	
74	Intermittent fall of snowflakes	heavy at time of observation.
75	Continuous fall of snowflakes	
76	Ice needles (with or without fog).	
77	Granular snow (with or without fog).	
78	Isolated starlike snow crystals (with or without fog).	
79	Ice pellets.	

80–99: SHOWERY PRECIPITATION, OR PRECIPITATION WITH CURRENT OR RECENT THUNDERSTORM.

80	Rain shower(s), slight.	
81	Rain shower(s), moderate or heavy.	
82	Rain shower(s), violent.	
83	Shower(s) of rain and snow mixed, slight.	
84	Shower(s) of rain and snow mixed, moderate or heavy.	
85	Snow shower(s), slight.	
86	Snow shower(s), moderate or heavy.	
87	Shower(s) of soft or small hail, with or without rain, or rain and snow mixed— slight.	
88	Shower(s) of soft or small hail, with or without rain, or rain and snow mixed— moderate or heavy.	
89	Shower(s) of hail, with or without rain, or rain and snow mixed, not associated with thunder— slight.	
90	Shower(s) of hail, with or without rain, or rain and snow mixed, not associated with thunder— moderate or heavy.	
91	Slight rain at time of observation	thunderstorm during the preceding hour but not at time of observation.
92	Moderate or heavy rain at time of observation	
93	Slight snow or rain and snow mixed or hail* at time of observation	
94	Moderate or heavy snow, or rain and snow mixed or hail* at time of observation	
95	Thunderstorm, slight or moderate, without hail* but with rain and/or snow* at time of observation	thunderstorm at time of observation.
96	Thunderstorm, slight or moderate, with hail* at time of observation	
97	Thunderstorm, heavy, without hail* but with rain and/or snow at time of observation	
98	Thunderstorm combined with duststorm or sandstorm—at time of observation	
99	Thunderstorm, heavy, with hail* at time of observation	

* Hail, small hail, soft hail.

*TABLE 33
Symbol W - Past Weather
(During 3 or 6 hours preceding the ACTUAL time of observation)

Code Figure	Past Weather
0	0.0 clouds
1	0.1 to 0.5 clouds
2	More than 0.5 clouds
3	Sandstorm, or duststorm, or drifting or blowing snow
4	Fog, or smoke, or thick dust haze
5	Drizzle
6	Rain
7	Snow, or rain and snow mixed, or sleet
8	Shower(s)
9	Thunderstorm, with or without precipitation

NOTE: When precipitation or thunderstorms have occurred and have not been reported by ww, code figures 5 to 9 will be used as appropriate even though they do not represent the generally prevailing weather.

12328. PPPTT (Col. 95). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) PPP - Sea-level pressure in tens, units, and tenths of millibars. Omit hundreds and thousands digits. Convert inches to millibars in accordance with Table 34.

(b) TT - Temperature to the nearest whole degree Fahrenheit. Omit the hundreds digit for temperatures above 99°; when the temperature is below zero, subtract the actual temperature from 100 and code the remainder - e.g., code 105° as 05; -2° as 98.

*TABLE 34

SYMBOL PPP.—*Corrected barometer reading*

[Code in "tens," "units," and "tenths" of millibars, omit initial 9 or 10]

[1 inch = 33.86395 mb. 1 mb. = 0.02952993 inch] 1/

in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.	in.	mb.
27.50	931.3	28.00	948.2	28.50	965.1	29.00	982.1	29.50	999.0	30.00	1015.9	30.50	1032.9	31.00	1049.8
27.51	931.6	28.01	948.5	28.51	965.5	29.01	982.4	29.51	999.3	30.01	1016.3	30.51	1033.2	31.01	1050.1
27.52	931.9	28.02	948.9	28.52	965.8	29.02	982.7	29.52	999.7	30.02	1016.6	30.52	1033.5	31.02	1050.5
27.53	932.3	28.03	949.2	28.53	966.1	29.03	983.1	29.53	1000.0	30.03	1016.9	30.53	1033.9	31.03	1050.8
27.54	932.6	28.04	949.5	28.54	966.5	29.04	983.4	29.54	1000.3	30.04	1017.3	30.54	1034.2	31.04	1051.1
27.55	933.0	28.05	949.9	28.55	966.8	29.05	983.7	29.55	1000.7	30.05	1017.6	30.55	1034.5	31.05	1051.5
27.56	933.3	28.06	950.2	28.56	967.2	29.06	984.1	29.56	1001.0	30.06	1018.0	30.56	1034.9	31.06	1051.8
27.57	933.6	28.07	950.6	28.57	967.5	29.07	984.4	29.57	1001.4	30.07	1018.3	30.57	1035.2	31.07	1052.2
27.58	934.0	28.08	950.9	28.58	967.8	29.08	984.8	29.58	1001.7	30.08	1018.6	30.58	1035.6	31.08	1052.5
27.59	934.3	28.09	951.2	28.59	968.2	29.09	885.1	29.59	1002.0	30.09	1019.0	30.59	1035.9	31.09	1052.8
27.60	934.6	28.10	951.6	28.60	968.5	29.10	985.4	29.60	1002.4	30.10	1019.3	30.60	1036.2	31.10	1053.2
27.61	935.0	28.11	951.9	28.61	968.8	29.11	985.8	29.61	1002.7	30.11	1019.6	30.61	1036.6	31.11	1053.5
27.62	935.3	28.12	952.3	28.62	969.2	29.12	986.1	29.62	1003.1	30.12	1020.0	30.62	1036.9	31.12	1053.8
27.63	935.7	28.13	952.6	28.63	969.5	29.13	986.5	29.63	1003.4	30.13	1020.3	30.63	1037.3	31.13	1054.2
27.64	936.0	28.14	952.9	28.64	969.9	29.14	986.8	29.64	1003.7	30.14	1020.7	30.64	1037.6	31.14	1054.5
27.65	936.3	28.15	953.3	28.65	970.2	29.15	987.1	29.65	1004.1	30.15	1021.0	30.65	1037.9	31.15	1054.9
27.66	936.7	28.16	953.6	28.66	970.5	29.16	987.5	29.66	1004.4	30.16	1021.3	30.66	1038.3	31.16	1055.2
27.67	937.0	28.17	953.9	28.67	970.9	29.17	987.8	29.67	1004.7	30.17	1021.7	30.67	1038.6	31.17	1055.5
27.68	937.4	28.18	954.3	28.68	971.2	29.18	988.2	29.68	1005.1	30.18	1022.0	30.68	1038.9	31.18	1055.9
27.69	937.7	28.19	954.6	28.69	971.6	29.19	988.5	29.69	1005.4	30.19	1022.4	30.69	1039.3	31.19	1056.2
27.70	938.0	28.20	955.0	28.70	971.9	29.20	988.8	29.70	1005.8	30.20	1022.7	30.70	1039.6	31.20	1056.6
27.71	938.4	28.21	955.3	28.71	972.2	29.21	989.2	29.71	1006.1	30.21	1023.0	30.71	1040.0	31.21	1056.9
27.72	938.7	28.22	955.6	28.72	972.6	29.22	989.5	29.72	1006.4	30.22	1023.4	30.72	1040.3	31.22	1057.2
27.73	939.0	28.23	956.0	28.73	972.9	29.23	989.8	29.73	1006.8	30.23	1023.7	30.73	1040.6	31.23	1057.6
27.74	939.4	28.24	956.3	28.74	973.2	29.24	990.2	29.74	1007.1	30.24	1024.0	30.74	1041.0	31.24	1057.9
27.75	939.7	28.25	956.7	28.75	973.6	29.25	990.5	29.75	1007.5	30.25	1024.4	30.75	1041.3	31.25	1058.2
27.76	940.1	28.26	957.0	28.76	973.9	29.26	990.9	29.76	1007.8	30.26	1024.7	30.76	1041.7	31.26	1058.6
27.77	940.4	28.27	957.3	28.77	974.3	29.27	991.2	29.77	1008.1	30.27	1025.1	30.77	1042.0	31.27	1058.9
27.78	940.7	28.28	957.7	28.78	974.6	29.28	991.5	29.78	1008.5	30.28	1025.4	30.78	1042.3	31.28	1059.3
27.79	941.1	28.29	958.0	28.79	974.9	29.29	991.9	29.79	1008.8	30.29	1025.7	30.79	1042.7	31.29	1059.6
27.80	941.4	28.30	958.3	28.80	975.3	29.30	992.2	29.80	1009.1	30.30	1026.1	30.80	1043.0	31.30	1059.9
27.81	941.8	28.31	958.7	28.81	975.6	29.31	992.6	29.81	1009.5	30.31	1026.4	30.81	1043.3	31.31	1060.3
27.82	942.1	28.32	959.0	28.82	976.0	29.32	992.9	29.82	1009.8	30.32	1026.8	30.82	1043.7	31.32	1060.6
27.83	942.4	28.33	959.4	28.83	976.3	29.33	993.2	29.83	1010.2	30.33	1027.1	30.83	1044.0	31.33	1061.0
27.84	942.8	28.34	959.7	28.84	976.6	29.34	993.6	29.84	1010.5	30.34	1027.4	30.84	1044.4	31.34	1061.3
27.85	943.1	28.35	960.0	28.85	977.0	29.35	993.9	29.85	1010.8	30.35	1027.8	30.85	1044.7	31.35	1061.6
27.86	943.4	28.36	960.4	28.86	977.3	29.36	994.2	29.86	1011.2	30.36	1028.1	30.86	1045.0	31.36	1062.0
27.87	943.8	28.37	960.7	28.87	977.7	29.37	994.6	29.87	1011.5	30.37	1028.4	30.87	1045.4	31.37	1062.3
27.88	944.1	28.38	961.1	28.88	978.0	29.38	994.9	29.88	1011.9	30.38	1028.8	30.88	1045.7	31.38	1062.7
27.89	944.5	28.39	961.4	28.89	978.3	29.39	995.3	29.89	1012.2	30.39	1029.1	30.89	1046.1	31.39	1063.0
27.90	944.8	28.40	961.7	28.90	978.7	29.40	995.6	29.90	1012.5	30.40	1029.5	30.90	1046.4	31.40	1063.3
27.91	945.1	28.41	962.1	28.91	979.0	29.41	995.9	29.91	1012.9	30.41	1029.8	30.91	1046.7	31.41	1063.7
27.92	945.5	28.42	962.4	28.92	979.3	29.42	996.3	29.92	1013.2	30.42	1030.1	30.92	1047.1	31.42	1064.0
27.93	945.8	28.43	962.8	28.93	979.7	29.43	996.6	29.93	1013.5	30.43	1030.5	30.93	1047.4	31.43	1064.3
27.94	946.2	28.44	963.1	28.94	980.0	29.44	997.0	29.94	1013.9	30.44	1030.8	30.94	1047.8	31.44	1064.7
27.95	946.5	28.45	963.4	28.95	980.4	29.45	997.3	29.95	1014.2	30.45	1031.2	30.95	1048.1	31.45	1065.0
27.96	946.8	28.46	963.8	28.96	980.7	29.46	997.6	29.96	1014.6	30.46	1031.5	30.96	1048.4	31.46	1065.4
27.97	947.2	28.47	964.1	28.97	981.0	29.47	998.0	29.97	1014.9	30.47	1031.8	30.97	1048.8	31.47	1065.7
27.98	947.5	28.48	964.4	28.98	981.4	29.48	998.3	29.98	1015.2	30.48	1032.2	30.98	1049.1	31.48	1066.0
27.99	947.9	28.49	964.8	28.99	981.7	29.49	998.6	29.99	1015.6	30.49	1032.5	30.99	1049.5	31.49	1066.4

1/ Based on standard gravity of 980.665 cm/sec^2.

TABLE 52

SYMBOL c.—*Orientation of ice limit*

Code figure	Orientation of ice limit
0	Orientation of ice limit impossible to estimate—ship *outside* the ice.
1	Ice edge lying in a direction NE to SW with ice situated to the NW.
2	Ice edge lying in a direction E to W with ice situated to the northward.
3	Ice edge lying in a direction SE to NW with ice situated to the NE.
4	Ice edge lying in a direction S to N with ice situated to the eastward.
5	Ice edge lying in a direction SW to NE with ice situated to the SE.
6	Ice edge lying in a direction W to E with ice situated to the southward.
7	Ice edge lying in a direction NW to SE with ice situated to the SW.
8	Ice edge lying in a direction N to S with ice situated to the westward.
9	Orientation of ice limit impossible to estimate—ship *inside* the ice.

12336. Bergs. (Col. 103). Icebergs are large masses of ice that have broken away from the forward edge of a glacier and moved into the sea. When icebergs are observed, enter the number in column 103, and size and height above sea in column 90. In the transmitted message, report the number of icebergs in plain language at the end of the report; e.g., "1 berg," "2 bergs," etc.

12337. Times of beginning and ending of weather and obstructions to vision. (Cols. 105 - 111). Enter the times of beginnings and endings (GCT) of weather and obstructions to vision in accordance with pars. 3930 - 3932. Enter positions to the nearest whole degree latitude and longitude.

*12338. Summary of the Day. (Cols. 112 - 128). Enter the data specified below for the period midnight to midnight GCT. Enter estimated wind data if recording equipment is not available.

(a) Maximum Wind - Enter the following data for the highest observed one-minute wind speed:

(1) Column 112 - Time to the nearest minute GCT.

(2) Column 113 - Direction and speed, using the same recording procedures as for columns 9 and 10.

(3) Columns 114 and 115 - Position to the nearest whole degree latitude and longitude.

(b) Lowest pressure - Enter the following data for the lowest observed pressure, as determined from the barogram after corrections have been applied:

(1) Column 116 - Time to the nearest minute GCT.

(2) Column 117 - Lowest pressure in millibars and tenths.

(3) Column 118 - Wind direction and speed at the time of lowest pressure, using the same recording procedures as for columns 9 and 10.

(4) Columns 119 and 120 - Position to the nearest whole degree latitude and longitude.

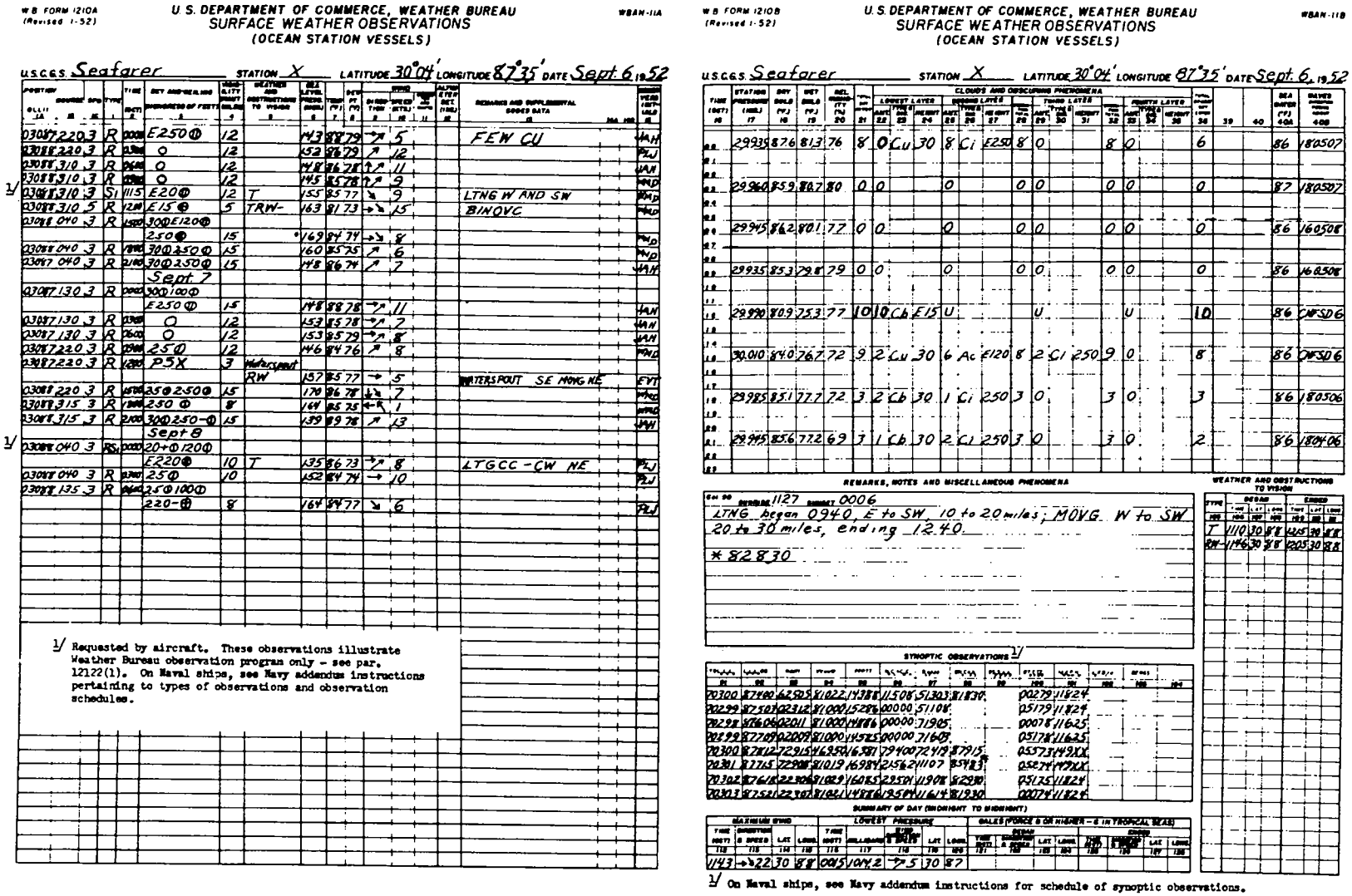
(c) Gales - Enter the following data whenever the wind speed averages force 8 or more (force 6 in tropical seas) for at least one hour during the day. If several such periods occur, enter data for additional periods in column 90.

(1) Column 121 - Time at which force 8 wind began, to the nearest minute GCT.

(2) Column 122 - Direction and speed of wind at the above time, recorded similarly to columns 9 and 10.

(3) Columns 123 and 124 - Position at above time to the nearest whole degree latitude and longitude.

(4) Columns 125 - 128 - Enter data pertaining to time at which force 8 wind ended, similarly to entries in columns 121 - 124.



WB FORM 1210A (Revised 1-52) — U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU — SURFACE WEATHER OBSERVATIONS (OCEAN STATION VESSELS) — WBAN-11A

U.S.C.G.S. Seafarer STATION X LATITUDE 30°04' LONGITUDE 87°35' DATE Sept 6, 1952

POSITION (GG11)	SOURCE	TYPE	TIME (GCT)	SKY AND WEATHER (HEIGHTS OF TOPS IN FEET)	VISIBILITY (NAUT. MILES)	WEATHER AND OBSTRUCTIONS TO VISION	SEA LEVEL PRESS. (MBS)	TEMP (°F)	DEW PT (°F)	WIND DIRECTION (TRUE)	WIND SPEED (KTS.)	WAVE HT. (FEET)	REMARKS AND SUPPLEMENTAL CODED DATA	WEATHER (SYNOPTIC CODE)
03087	2203	R	2000	E250 ⊕	12		143	88	79	→	5		FEW CU	JAH
03088	2203	R	2300	○	12		152	86	79	↗	12			PLJ
03088	3103	R	0400	○	12		148	86	78	↗	11			JAH
03088	3103	R	0800	○	12		145	85	78	↗	9			MHD
1/ 03088	3103	S	1115	E20 ⊕	12	T	155	85	77	↘	9		LTNG W AND SW	MHD
03088	3105	R	1200	E15 ⊕	5	TRW-	163	81	73	→	15		BINOVC	MHD
03088	0403	R	1500	30⊕E120⊕										
				250⊕	15		169	84	79	→	8			MHD
03088	0403	R	1800	30⊕250⊕	15		160	85	75	↗	6			MHD
03087	0403	R	2100	30⊕250⊕	15		148	86	74	↗	7			JAH
				Sept 7										
03087	1303	R	0000	30⊕100⊕										
				E250 ⊕	15		148	88	78	→	11			JAH
03087	1303	R	1300	○	12		153	85	78	→	7			JAH
03087	1303	R	1600	○	12		153	85	79	→	8			JAH
03087	2203	R	1900	25⊕	12		146	84	76	↗	8			MHD
03087	2203	R	2200	P5X	3	Haze and Smoke RW	157	85	77	→	5		WATERSPOUT SE MOVG NE	EYT
03088	2203	R	0156	25⊕2500⊕	15		170	86	78	↓↓	7			MHD
03088	3153	R	1000	250 ⊕	8		164	85	75	←R	1			MHD
03088	3153	R	2100	30⊕250-⊕	15		139	89	78	↗	13			JAH
				Sept 8										
1/ 03088	0403	RS	0000	20+⊕120⊕										
				E220⊕	10	T	135	86	73	→	8		LTGCC-CW NE	PLJ
03088	0403	R	0300	25⊕	10		152	84	74	→	10			PLJ
03088	1353	R	0600	25⊕100⊕										
				220-⊕	8		164	84	77	↘	6			PLJ

1/ Requested by aircraft. These observations illustrate Weather Bureau observation program only – see par. 12122(1). On Naval ships, see Navy addendum instructions pertaining to types of observations and observation schedules.

WB FORM 1210B (Revised 1-52) — U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU — SURFACE WEATHER OBSERVATIONS (OCEAN STATION VESSELS) — WBAN-11B

U.S.C.G.S. Seafarer STATION X LATITUDE 30°04' LONGITUDE 87°35' DATE Sept. 6, 1952

TIME (GCT)	STATION PRESSURE	DRY BULB	WET BULB	REL. HUMIDITY	CLOUDS AND OBSCURING PHENOMENA: LOWEST LAYER TYPE	LOWEST LAYER AMOUNT	LOWEST LAYER HEIGHT	SECOND LAYER TYPE	SECOND LAYER AMOUNT	SECOND LAYER HEIGHT	THIRD LAYER TYPE	THIRD LAYER AMOUNT	THIRD LAYER HEIGHT	FOURTH LAYER TYPE	FOURTH LAYER AMOUNT	FOURTH LAYER HEIGHT	SEA WATER TEMP (°F)	WAVES (CODE)
00	29935	87.6	81.3	76	8	0	Cu	30	8	Ci	E250	8	0		8	0	86	180507
03	29960	85.9	80.7	80	0	0			0			0	0		0	0	87	180507
06	29945	86.2	80.1	77	0	0			0			0	0		0	0	86	160508
09	29935	85.3	79.8	79	0	0			0			0	0		0	0	86	160508
12	29930	80.9	75.3	77	10	0	Cb	E15	U			U			U		86	WSD6
15	30.010	84.0	76.7	72	9	2	Cu	30	6	Ac	E120	8	2	Ci 250	9	0	86	WSD6
18	29985	85.1	77.7	72	3	2	Cb	30	1	Ci	250	3	0		3	0	86	180506
21	29945	85.6	77.2	69	3	1	Cb	30	2	Ci	250	3	0		3	0	86	180406

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

Sea Sp. Sunrise 1127 Sunset 0006

LTNG began 0940, E to SW 10 to 20 miles; MOVG W to SW 20 to 30 miles, ending 1240.

*82830

WEATHER AND OBSTRUCTIONS TO VISION

TYPE	BEGAN TIME	BEGAN LAT	BEGAN LONG	ENDED TIME	ENDED LAT	ENDED LONG
T	1110	30	88	1205	30	88
RW	1146	30	88	1205	30	88

SYNOPTIC OBSERVATIONS 1/

70300	87400	62505	81022	14388	11508	51303	81830		00279	11824		
70299	87507	02312	81000	15286	00000	51108			05179	11824		
70298	87606	02011	81000	14886	00000	71905			00078	11625		
70299	87708	02009	81000	14585	00000	71603			05178	11635		
70300	87812	72915	46950	16581	79400	72419	87915		05573	49XX		
70301	87715	72908	81019	16984	24562	11107	85913		05274	47XX		
70302	87618	22906	81029	16085	29504	11908	82930		05175	11824		
70303	87521	22907	81041	14886	29504	11614	81930		00078	11824		

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

MAXIMUM WIND TIME (GCT)	MAXIMUM WIND DIRECTION & SPEED	MAXIMUM WIND LAT	MAXIMUM WIND LONG	LOWEST PRESSURE TIME (GCT)	LOWEST PRESSURE MILLIBARS	LOWEST PRESSURE LAT	LOWEST PRESSURE LONG	GALES (FORCE 8 OR HIGHER – 6 IN TROPICAL SEAS) TIME BEGAN (GCT)	GALES BEGAN DIRECTION & SPEED	GALES BEGAN LAT	GALES BEGAN LONG	GALES ENDED TIME (GCT)	GALES ENDED DIRECTION & SPEED	GALES ENDED LAT	GALES ENDED LONG
1143	→22	30	88	0045	1014.2	29.5	30	87							

1/ On Naval ships, see Navy addendum instructions for schedule of synoptic observations.

Fig. 8. Entries on WBAN-11A and B.

R 3.3

Change No. → 4

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON, D. C.

MANUAL OF SURFACE OBSERVATIONS

(WBAN)

CIRCULAR N

Sixth Edition

(Revised)

JULY 1952

This change cancels portions of Change No. 3 that relate to knots and nautical miles in aviation weather reports. Substitute the attached pages and make the following additional changes in ink:

(1) Page X, List of Tables, 9th line delete "nautical".

(2) Page 11, ¶ 1444, 5th and 6th lines; delete "1.5 nautical" and substitute "1-1/2 statute".

(3) Page 16, Item (b), line 4, delete "nautical" and substitute "statute".

(4) Page 29, Table 8, delete ".5 nautical mile" and ".3 nautical mile" and substitute "5/8 statute mile" and "5/16 statute mile", respectively.

(5) Page 86, ¶ 7730, delete "14" and substitute "13".

(6) Page 93, ¶ 8310, 2nd line, add "10 mph or" between "least" and "nine".

(7) Page 93, ¶ 8310, 4th line, add "19 mph or" between "least" and "sixteen".

(8) Page 104, line 12, add "1(b)", between "Item" and "1(c)".

(9) Page 104, first observation under "Example", delete "1.7" and substitute "2".

(10) Page 132, ¶ 12325(a), 4th line, delete "267" and substitute "257".

THIS PAGE MAY BE DISCARDED AFTER MAKING THE ABOVE CHANGES

1412. SURFACE. "Surface" as used here is a horizontal plane, whose elevation above sea level equals the field elevation. At stations where the field elevation has not been established, "surface" will refer to the ground elevation at the point of observation.

1420. VARIABLE CEILING. The term "variable ceiling" describes a condition in which the ceiling rapidly increases and decreases by one or more reportable values during the period of observation. It will be reported only for ceilings less than 3000 feet. The average of all values secured will be used as the ceiling. Rapid fluctuation of the spot produced by a ceiling-light projector will indicate an irregular base whose height will be regarded as measured but variable. Distinguish this type of fluctuation from that which is due to multiple layers (see ¶ 1441.3).

1430. CEILING CLASSIFICATION. The ceiling is classified in accordance with Table 2a.

Table 2a. Ceiling-Classification Symbols

M	Measured	W	Indefinite
A	Aircraft	P	Precipitation
B	Balloon	E	Estimated

*1431. MEASURED CEILING. A ceiling is classified as measured whenever it pertains to clouds or obscuring phenomena aloft and is determined by means of:

(1) A ceiling light or ceilometer, provided penetration of the beam is not in excess of that normally experienced for the height and type of layer (see ¶ 1441.2).

(2) A raob or rawin balloon whose height is computed.

(3) The known heights of unobscured portions of objects, other than natural landmarks, with 1-1/2 statute miles of any runway of the airport.

*1432. AIRCRAFT CEILING. A ceiling is classified as an aircraft ceiling when it is determined by a pilot while in flight over, or within 1-1/2 statute miles of, any runway of the airport. Aircraft ceilings may refer to vertical visibility (see ¶ 1411), or clouds, or obscuring phenomena aloft.

1433. BALLOON CEILING. A ceiling is classified as a balloon ceiling whenever it pertains to clouds or obscuring phenomena aloft and is determined by means of ceiling or pilot balloons. (See par. 1442.)

1434. INDEFINITE CEILING. A ceiling is classified as indefinite whenever it pertains to hydrometeors, other than precipitation, or lithometeors whose bases are at the surface. All indefinite ceilings are estimations, but the height corresponding to the upper limit of a ceilometer reaction, the top of a ceiling-light projector beam, or the height at which a balloon completely disappears will be used as a guide.

1435. PRECIPITATION CEILING. A ceiling is classified as a precipitation ceiling when precipitation obscures the cloud base and prevents a determination of its height. All precipitation ceilings are estimations, but the guides indicated in par. 1434 should be used. These guides will usually indicate values that are lower than the actual vertical visibility.

*1436. ESTIMATED CEILING. A ceiling is classified as estimated:

(1) Whenever determined by means of the "Convective Cloud-Base-Height Diagram" (Fig. 1) under conditions appropriate to, and in accordance with instructions for, its use. (See par. 1447.)

(2) Whenever penetration of the ceilometer or ceiling-light beam is in excess of normal for the particular height and type of layer (see par. 1441.2).

(3) Whenever determined from the known heights of unobscured portions of natural landmarks, or of objects more than 1-1/2 miles from any runway of the airport.

(4) Whenever determined on the basis of experience provided that the sky is not obscured by surface-based hydrometeors or lithometeors, and other guides are lacking, or considered unreliable.

*1440. METHODS OF DETERMINING CEILING AND CLOUD HEIGHTS. The methods indicated in pars. 1441 to 1447.2 will be used in determining heights. Heights of 5000 feet or less will be determined to the nearest 100 feet; heights of more than 5000 feet but less than 10,000 feet to the nearest 500 feet; and heights of 10,000 feet or more to the nearest 1000 feet. When the ceiling is halfway between two reportable values, select the lower value (e.g., 50 feet will be reported as "0"). Unless otherwise specified, all heights are with reference to the height of the base of cloud layers above the surface, not above sea level.

1441. CEILING LIGHT (OR CEILOMETER PROJECTOR). The ceiling light

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS

STATION _____ DATE _____

SKY and CEILING (Hundreds of Feet) 3	VISIBILITY (Miles) 4	WEATHER and OBSTRUCTIONS TO VISION 5	SEA LEVEL PRESS (mbs) 6	TEMP (°F) 7	DEW PT (°F) 8	WIND DIRECTION 9	WIND SPEED (m.p.h.) 10	WIND CHARACTER AND SHIFTS 11	ALTIMETER SET (ins.) 12	REMARKS AND SUPPLEMENTAL CODED 13
Obscuring		Phenomena	Aloft:							
15-Ⓓ	8		122	84	31	↑↖	8		010	KLYR 15-Ⓓ
M8 Ⓓ	8		200	53	38	↑	7		024	KLYR 8 Ⓓ
Obscuring		Phenomena	AT	Surface:						
P25X	2	TRWA	146	74	62	→	19		016	T W MOVG EWD FQT LTGCG HLSTO 1/2 INCH
W O X	0	L-F	176	57	57		C		020	
-X	2	F	157	62	61		C		018	
Clouds	and	Obscuring		Phenomena:						
10Ⓓ100Ⓓ	7		112	71	23	↑	6		009	KLYR 10Ⓓ
40Ⓓ60Ⓓ E200⊕	8		135	90	52	↑↗	5		013	HLYR 60Ⓓ
M5Ⓓ25⊕	4	GF	186	58	56	↖	2		022	KLYR 5Ⓓ
4Ⓓ10Ⓓ E20⊕	7		166	52	29	←↖	10		020	KLYR 20⊕
15Ⓓ 30-Ⓓ	8		129	81	30	↘	6		013	KLYR 30-Ⓓ
-X E 15 Ⓓ	5	H	081	76	61	↑	4		993	
M21Ⓓ 50-⊕	7		105	70	29	↙	7		001	HLYR 50-⊕
Multiple		Overcast		Layers:						
5-⊕20-⊕E50⊕	9		123	77	70	↘	5		012	HIR CLDS VSB

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS

STATION _____ DATE _____

EL. DITY 0	TOTAL SKY COVER 21	CLOUDS AND OBSCURING PHENOMENA: LOWEST LAYER AMT 22	LOWEST LAYER TYPE & DIR 23	LOWEST LAYER HEIGHT 24	SECOND LAYER AMT 25	SECOND LAYER TYPE & DIR 26	SECOND LAYER HEIGHT 27	SUMMATION TOTAL 28	THIRD LAYER AMT 29	THIRD LAYER TYPE & DIR 30	THIRD LAYER HEIGHT 31	SUMMATION TOTAL 32	FOURTH LAYER AMT 33	FOURTH LAYER TYPE & DIR 34	FOURTH LAYER HEIGHT 35	TOTAL OPAQUE SKY COVER 36
	4	4 K	↑	15	0			4	0			4	0			1
	9	9 K		M8	0			9	0			9	0			7
	10	10 R	→	P25	U				U				U			10
	10	10 F	C	WO	U				U				U			10
	8	8 F	↑	—	0			8	0			8	0			8
	5	4 K	↗	10	2 AC		100	5	0	→		5	0			4
	10	2 Cu	C	40	3 H		60	5	5 Ci		E200	10	U			10
	10	6 K		M5	6 Sc	→	25	10	U				U			10
	10	2 St	↑	4	1 Sc	↘	10	3	7 K		E20	10	U			10
	8	2 Cu	→	15	6 K		30	8	0			8	0			3
	8	6 H	↑	—	3 Sc		E15	8	0			8	0			8
	10	6 Sc		M21	10 H		50	10	0			10	0			4
	10	10 St	↘	5	2 Sc		20	10	6 Ac		E50	10	2 Ci	↘	250	8

Fig. 1a. Entries of clouds and obscuring phenomena - WBAN-10A and B.

*Revised (Change #4)
Eff. 7-1-52

CHAPTER 2. VISIBILITY

2000. GENERAL

*2010. Visibility is a term that denotes the greatest distance an object of specified characteristics can be seen and identified. This term may express the visibility in a single direction or the prevailing visibility based on all directions. Visibility observations will be taken from as many points as necessary to view all appropriate markers. Except as specified in par. 2011, observations should be with reference to a plane six feet above the ground or, if station facilities preclude an observation at this level, as close as practicable to it. Visibility will be observed and recorded at land stations in statute miles in accordance with Table 4c. When the visibility is halfway between two reportable values, select the lower value.

Table 4c. Reportable Visibility Values (Miles)

Fractional increments	1-mile increments when visibility is 3 to 15 miles, inclusive. 5-mile increments when visibility is more than 15.
0 7/8 1/16 1 1/8 1-1/4 3/16 1-1/2 1/4 1-3/4 5/16 2 3/8 2-1/4 1/2 2-1/2 5/8 3 3/4	

2011. Unless otherwise authorized, all stations at which control towers are situated will take visibility observations at the control-tower level, as well as at the usual point of observation, whenever the visibility at the latter point is less than three miles. At civil stations, control-tower visibilities will be used for all aviation observations, including record, coding, and summary, but will not be used for synoptic observations; at military stations, control-tower visibilities will be used only as specified in par. 2420.

2100. GUIDES IN DETERMINING VISIBILITY

*2110. CHART OF VISIBILITY MARKERS. Each station will display charts of prominent objects and their distances from the observation point. These charts will include objects suitable for determining the visibility at night as well as by day. At least two charts will be available; one

including all markers throughout the entire range of visible objects, and the other an expanded scale chart including only those markers within 1-1/2 miles of the observation point.

2120. VISIBILITY MARKERS AT NIGHT. The most suitable objects for determining visibility at night are unfocused lights of moderate intensity at known distances, and the silhouettes of mountains or hills, etc., against the sky. The brilliance of stars near the horizon may also be a useful indication. Because of their intensity, airway beacons may not be used as visibility markers, but their degree of brilliance may be used as an aid to indicate whether visibility is greater or less than the distance of the beacon. "Course lights" (red or green) of beacons may be used as definite visibility markers. These and all other lights normally used as visibility markers should be used with caution after storms, for their intensity may be reduced by snow or freezing precipitation.

2130. VISIBILITY MARKERS DURING DAYLIGHT. For accurate determinations during daylight hours, confine the choice of markers to black, or nearly black, objects against the horizon sky rather than to light-colored markers and those appearing against terrestrial backgrounds.

2140. SIZE OF VISIBILITY MARKERS. In order that visibility values may be representative, they must apply to objects of specified minimum size or larger. An object that subtends an angle of less than 0.5 degree at the eye becomes invisible at a shorter distance than larger objects under the same conditions. Therefore, objects whose angular size is 0.5 degree or greater should be selected as visibility markers whenever possible. A hole 0.3 inch (or 5/16") in diameter punched in a card that is held at arm's length subtends an angle of approximately 0.5° at the eye. If the portion of any object above the horizon completely fills the hole when the card is held as explained above, the object is of suitable size for a marker.

2150. DAY AND NIGHT VISIBILITY. Transparency of the atmosphere in the open country (except in polar regions) removed from sources of atmospheric pollutants changes but very little from daylight to darkness and vice versa. However, in areas subject to pollution (as smoke from domestic heating or cooking, and industrial exhausts) there may be systematic variations during the transition period about sunrise or sunset. In such areas a decrease in visibility often occurs near dawn particularly when a steep inversion exists near the surface. Before taking a visibility observation at night, the observer should spend two to six minutes in the dark (depending upon the contrast between office and outside illumination) to adapt his eyes to nighttime conditions.

2160. ESTIMATIONS OF VISIBILITY. When the visibility is greater than the distance to the farthest object, note the sharpness with which

the object stands out. Sharp outlines in relief, with little or no blurring of color, indicate that the visibility is much greater than the distance of the reference object. On the other hand, blurred or indistinct objects indicate the presence of haze or other phenomena that has reduced the visibility to not less than the distance of the objects.

2200. VISIBILITY IN A DEFINITE DIRECTION

2210. Visibility in a definite direction is the greatest horizontal distance in that direction at which the outlines of visibility markers can be distinguished against the horizon sky under the conditions existing at the time of observation.

2300. PREVAILING VISIBILITY

2310. DEFINITION. Prevailing visibility is the maximum visibility common to sectors comprising 1/2 or more of the horizon circle. Under nonuniform conditions the sectors may be distributed in any order. Under uniform conditions the prevailing visibility is the same as the visibility in any direction. If the visibility is variable, i.e., the prevailing visibility rapidly increases and decreases by one or more reportable values during the period of the observation, use the average of all observed values as the prevailing visibility. Report the visibility as variable only if the prevailing visibility is less than three miles.

*2320. DETERMINATION. To determine prevailing visibility under nonuniform conditions, regard the horizon circle as divided into several sectors of equal size in each of which the visibility is substantially uniform. Select the highest value that is equal to or less than the visibility of sectors that cover at least one-half of the horizon circle. For example, if the horizon circle were divided into four sectors and the respective visibility values were 1/8, 1/4, 1/2, and 1 mile, the prevailing visibility would be 1/2 mile. This is evident from the fact that 1/2 mile is the highest value equal to or less than the visibility values of 1/2 or more of the horizon circle. This is illustrated in Fig. 2.

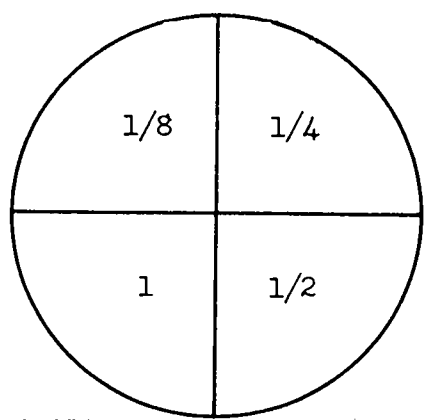


Fig. 2. Visibility in sectors of horizon circle.

2400. ENTRIES ON WBAN-10

*2410. VISIBILITY. (Col. 4) Enter the prevailing visibility in the increments listed in Table 4c. If the visibility is variable, enter "V" following the visibility (see ¶ 2310). Enter "15+" when the visibility is more than 15 miles but suitable distant markers for more precise determination are lacking. At civil stations taking control-tower visibility observations, enter the visibility at the control-tower level in this column when the visibility at the usual point of observation is less than three miles.

*2420. REMARKS. (Col. 13) Enter visibility data in this column as follows:

(1) 1/ Visibility by quadrants: Enter visibility for quadrants in which it differs from the prevailing visibility, provided the visibility in one or more quadrants is less than three miles. Prefix each value with the corresponding quadrant designator; e.g., "VSBY N1".

(2) Visibility at differing levels (see ¶ 2011 and 2410):

(a) At civil stations, when the visibility at the control-tower level (as entered in Col. 4) differs from the visibility at the usual point of observation, enter the latter value in Col. 13, followed by the height of the restricting phenomena if determinable; e.g., "SFC VSBY 2 GFDEP 50".

(b) At military stations and joint-use airports 2/ when the visibility at the control-tower level differs from the visibility at the usual point of observation, enter the former value in Col. 13, followed by the height of the restricting phenomena if determinable; e.g., "TWR VSBY 2 GFDEP 50".

(3) 1/ Variable visibility when prevailing visibility is less than three miles (see ¶ 2310): Enter range of variability separated by "V"; e.g., "VSBY 1V2".

1/ These remarks will relate to the same observation point as the value entered in Col. 4; i.e., if tower visibility is recorded in Col. 4, remarks pertaining to visibility by quadrants or variable visibility will also represent control-tower values.

2/ A joint-use airport is one at which the control tower is operated by military personnel, but weather observations are taken by Weather Bureau personnel.

CHAPTER 3. ATMOSPHERIC PHENOMENA

3000. GENERAL

3010. Atmospheric phenomena observed as weather elements of an observation comprise tornadoes, waterspouts, thunderstorms, squalls, and precipitation in any form. Hydrometeors other than precipitation, and lithometeors, are termed obstructions to vision. Igneous and luminous meteors, such as lightning, rainbows, halos, coronas, and auroras, are also observed. Observations of these phenomena, except freezing rain and the determination of intensity of precipitation (see pars. 3432 and 3510) are taken without the use of instruments, and from as many points as necessary to view the entire horizon. Terms in parentheses indicate equivalents as used in synoptic reports, e.g., Light (Slight).

3100. TORNADOES AND WATERSPOUTS

3110. DESCRIPTION. These storms occur when meteorological conditions are favorable for intense thunderstorm activity. The distinguishing feature is the funnel-shaped appendage that hangs from the base of the cloud. The storm is described as a tornado when it occurs over land and as a waterspout when it occurs over water.

3120. OBSERVATION. Note the direction from the station, and the direction toward which it is going. The direction of motion is the same as that of the cloud with which the phenomenon is associated; however, it should be remembered that the direction of motion of a cloud is observed as the direction from which the cloud is moving. Intensity values are not ascribed to tornadoes or waterspouts.

3130. TORNADO REPORTS BY PUBLIC. The cooperation of local news-gathering agencies, police departments, and other organizations having special communication facilities will be solicited in obtaining public reports of tornadoes (see par. 3920). At locations where there are both military and civil weather stations, these arrangements will be made by the civil station.

3200. THUNDERSTORMS

3210. DEFINITION. A thunderstorm is regarded as occurring at the station when thunder has been heard within the previous 15 minutes.

3220. OBSERVATION. Note the following:

(1) Occurrence of thunder.

(2) Location of storm center with respect to the station.

(3) Direction toward which the storm is moving, when this can be determined with reasonable accuracy.

(4) Whether lightning is occurring from cloud to cloud, cloud to ground, or within clouds.

(5) Intensity of the storm.

3230. DETERMINATION OF INTENSITY. Classification of a thunderstorm as light (slight),[1] moderate or heavy is based upon the appearance of the storm from the point of observation. The thunderstorm may be classified as light throughout its history as viewed from this point, or it may be classified during its passage by the station as light, moderate, heavy; and, as it recedes, moderate, and light. Description of intensity will be based on the following general guides:

*3231. LIGHT (SLIGHT) THUNDERSTORM. Lightning occurs within the cloud and rainfall accompanying it is light or moderate. Small hail may also be observed. The thunder is not loud, and lightning occurs at intervals of a minute or more. The surface wind speed at the beginning of or during the storm does not exceed 30 miles an hour (26 knots), and any sudden increase in speed is of short duration. The classification also applies to occasional peals of thunder during a general rain storm.

*3232. MODERATE THUNDERSTORM. Loud peals of thunder occur at brief intervals and frequent flashes of lightning occur from cloud to ground, as well as from cloud to cloud; rain is moderate or heavy, and small hail is light or moderate. An onrush of wind may precede the storm, with a speed as high as 40 miles an hour (35 knots). Extensive masses of dark clouds showing visible indications of turbulent motion and rapid horizontal translation are usually observable.

*3233. HEAVY THUNDERSTORM. Sharp and pronounced thunder and lightning occur almost continuously. Heavy rain usually occurs, sometimes accompanied by hail. The wind preceding and accompanying the storm may reach a speed in excess of 40 miles an hour (35 knots). A rapid drop in temperature occurs, sometimes as much as 20°F. in five minutes.

3300. SQUALLS

*3310. A squall is a strong wind that increases suddenly in speed, maintains a peak speed of 19 mph. (16 knots) or more over a period of two or more minutes, and decreases in speed; similar fluctuations will occur at succeeding intervals. The occurrence of squalls is indicative of turbulence near the surface. The essential difference between squalls and gusts is the duration of the peak wind speed (see par. 8310). Although squalls are classified as an atmospheric phenomenon, instructions for reporting them will be found in paragraph 8450, because their observational criteria are exclusively wind.

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[1]The classification "light (slight)" is used only in synoptic observations.

3840. RAINBOW. A semicircular arc seen opposite the sun, usually exhibiting all the primary colors, with red on the outside. It is caused by diffraction, refraction and reflection of light within raindrops, which often produces a secondary bow outside the primary one. In this case the colors are reversed.

3850. FOG BOW. A whitish, semicircular arc, seen opposite the sun in fog. Its outer margin has a reddish and its inner a bluish tinge. The middle of the band is white. An additional bow, with the colors reversed, sometimes appears inside the first.

3860. AURORA. A luminescence, frequently called Northern Lights. It is usually seen in the northern skies in lower latitudes, and overhead, or even to the southward of the zenith, in higher latitudes. It may appear in such forms as arcs, rays, curtains, coronas, etc. It is usually of a whitish color but may have various other colors. The lower edges of the arcs and curtains of the aurora are usually fairly well defined, while the upper edges are ill-defined.

3900. ENTRIES ON WBAN-10

*3910. WEATHER AND OBSTRUCTIONS TO VISION. (Col. 5) Enter precipitation and obstructions to vision in accordance with the symbols in Tables 8a and 8b. Use + after precipitation symbols to indicate heavy intensity, - to indicate light, and - - to indicate very light; the absence of a sign indicates moderate intensity. Precipitation will be entered in this column only if actually occurring at the time of the observation. (See par. 3920 for entry of remarks concerning intermittent precipitation.) Two or more entries for a single observation will be made in the following order:

(1) Tornado (or waterspout)

(2) Thunderstorm

(3) Liquid precipitation, in order of decreasing intensity

(4) Freezing precipitation, in order of decreasing intensity

(5) Frozen precipitation, in order of decreasing intensity

(6) Obstructions to vision, in order of decreasing predominance if discernible.

*3911. Omit entry of obstructions to vision in Col. 5 whenever the visibility recorded in Col. 4 is seven miles or more. If the visibility is less than seven miles, weather or obstructions to vision must be reported either in Col. 5 or Col. 13 (see par. 3920). If the visibility is reduced by phenomena not occurring at the station, enter an explanatory note in remarks, e.g., "GF BANK N".

TABLE 8a. Symbols for weather

TORNADO or WATERSPOUT (always written out in full) followed by direction from station.

T+	Heavy Thunderstorm	EW	Sleet Showers
T	Thunderstorm	S	Snow
R	Rain	SW	Snow Showers
RW	Rain Showers	SP	Snow Pellets
L	Drizzle	SG	Snow Grains
ZR	Freezing Rain	IC	Ice Crystals
ZL	Freezing Drizzle	A	Hail
E	Sleet	AP	Small Hail

*TABLE 8b. Symbols for obstructions to vision

F	Fog	IF	Ice Fog
GF	Ground Fog	H	Haze
BS	Blowing Snow	K	Smoke
BN	Blowing Sand	D	Dust
BD	Blowing Dust	BY	Blowing spray

*3920. REMARKS (Col. 13). Enter data pertaining to weather and obstructions to vision as follows:

Observed	Instructions for Entry
(1) Tornado and waterspout (see ¶ 9132.4)	
(a) Observed from station (still in progress)	Enter direction toward which it is moving (e.g., TORNADO MOVG NEWD) in all observations until it ends or disappears from sight.
(b) Observed from station (has ended or disappears from sight)	Enter time of occurrence (or time of beginning and ending), peak speed of gusts, and direction of movement (e.g., TORNADO 1155E G120 MOVD NE) in all observations until it has been transmitted in a record observation.
(c) Reported by public	Enter 1) location with respect to a nearby weather-reporting station, city, or town, 2) direction toward which it was moving, and 3) time tornado was observed, e.g., UNCONFIRMED TORNADO 15MI W DCA MOVG N 1600E. Repeat this remark until it has been transmitted in a record observation.
(2) Thunderstorm	
(a) In progress at station	Enter direction, if observable: (1) with respect to station (2) direction toward which storm is moving, e.g., T OVHD MOVG EWD or T SW MOVMT VRBL (omit remark concerning movement if movement unknown)

8333. In flat regions, wind shifts without precipitation, but accompanied by strong winds, sometimes occur. The visibility may be greatly restricted by blowing dust over extensive areas.

8400. ENTRIES ON WBAN-10

*8410. WIND DIRECTION. (Col. 9) Enter the wind direction to sixteen points of the compass by means of one or two short arrows, as shown in Table 16. When the wind is calm, make no entry in this column.

TABLE 16. Wind direction symbols

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

*8420 WIND SPEED. (Col. 10) Wind speed entries will be made in the following units:

Column Numbers	10	10A	10B
Civil stations	statute miles per hour		
Air Force stations		knots	statute miles per hour in red
Navy stations	knots		

If the wind is estimated enter the letter E immediately following the speed. Enter C for calm.

*8430 GUSTINESS. (Col. 11) Report gusts by the symbol "+" immediately after the one-minute wind speed. Enter the peak speed of gusts observed during the past 15 minutes immediately after this symbol. (See Fig. 6.) These data will be reported when they occur regardless of the type of wind equipment used. If estimated, enter E in accordance with ¶ 8420.

*8440. SHIFTS. (Col. 11) Enter the direction of the wind before the shift to sixteen points of the compass with short arrows followed by the local standard time of the shift (24-hour clock) and a letter denoting the local standard time zone. Since the space provided in column 11

is not sufficient for wind-shift data, distribute all wind data evenly among columns 9, 10, and 11; e.g., "↘25+40↖1614C" in these columns would indicate a wind shift from southeast to northwest at 1614 CST.

*8450. SQUALLS. (Col. 11) Report squalls by the symbol "Q" immediately following the one-minute wind speed and preceding the peak speed of gusts observed during the past 15 minutes (see Fig. 6 and Sec. 3300).

*8460. PEAK GUST. (Cols. 71 - 73) Enter this datum only at stations supplied with recording equipment other than single or multiple register. The peak gust is the highest speed recorded during the 24 hours ending at midnight. Enter (1) the direction to 16 points if suitable recording equipment is available, otherwise to eight points; (2) the speed to the nearest statute mph; and (3) the time to the nearest minute.

(2) The ceiling decreases to less than 1000 feet, or increases to 1000 feet or more.

(3) The ceiling decreases to less than 500 feet, or increases to 500 feet or more.

(4) A ceiling of less than 500 feet changes by 100 feet or more. 1/

(5) The ceiling decreases to less than the highest instrument minimum 2/ for the airport. 1/

(6) The ceiling increases to or above the highest instrument minimum 2/ for the airport. 1/

*9132.2. SKY CONDITION. Clouds are observed below:

(a) 1000 feet, and no clouds were previously reported below this altitude.

(b) the highest instrument minimum 2/ for the airport, and no clouds were previously reported below this altitude. 1/

*9132.3. VISIBILITY.

(1) The visibility decreases to less than:
(a) 3 miles
(b) 1 mile
(c) 3/4 mile
(d) 1/2 mile
(e) 1/4 mile
} 1/

(2) 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
} 1/

9132.4. TORNADO.

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

1/ Effective only at stations having scheduled air-carrier operations, and at all Air Force stations.

2/ These minimums are with reference to instrument minimums exclusive of ILS, GCA, or alternate minimums.

9132.5. THUNDERSTORM.

(1) Begins (A special observation is not required to report the beginning of a new thunderstorm if one is currently reported as in progress at the station.)

(2) Increases in intensity

(3) Ends (Special observation 15 minutes after thunder is last heard at station.)

9132.6. PRECIPITATION.

(1) Hail begins, ends, or changes in intensity.

(2) Freezing precipitation other than very light begins, ends, or changes in intensity.

(3) Sleet begins, ends, or changes in intensity.

*9132.7. 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.

9132.8. 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.

9140. LOCAL EXTRA OBSERVATIONS. Local extra observations are taken, at all stations, for local distribution only, under the circumstances specified in par. 9141-43. 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. Local extra observations will be taken at intervals not exceeding 15 minutes, beginning whenever there are impending aircraft operations 1/ and

(1) the ceiling decreases to 500 feet or less, or
(2) the visibility decreases to one mile or less.

1/ These observations will be taken at Air Force stations irrespective of impending aircraft operations.

Enter fifth figure of group in accordance with Table 23.

TABLE 23. Surf (D_S)

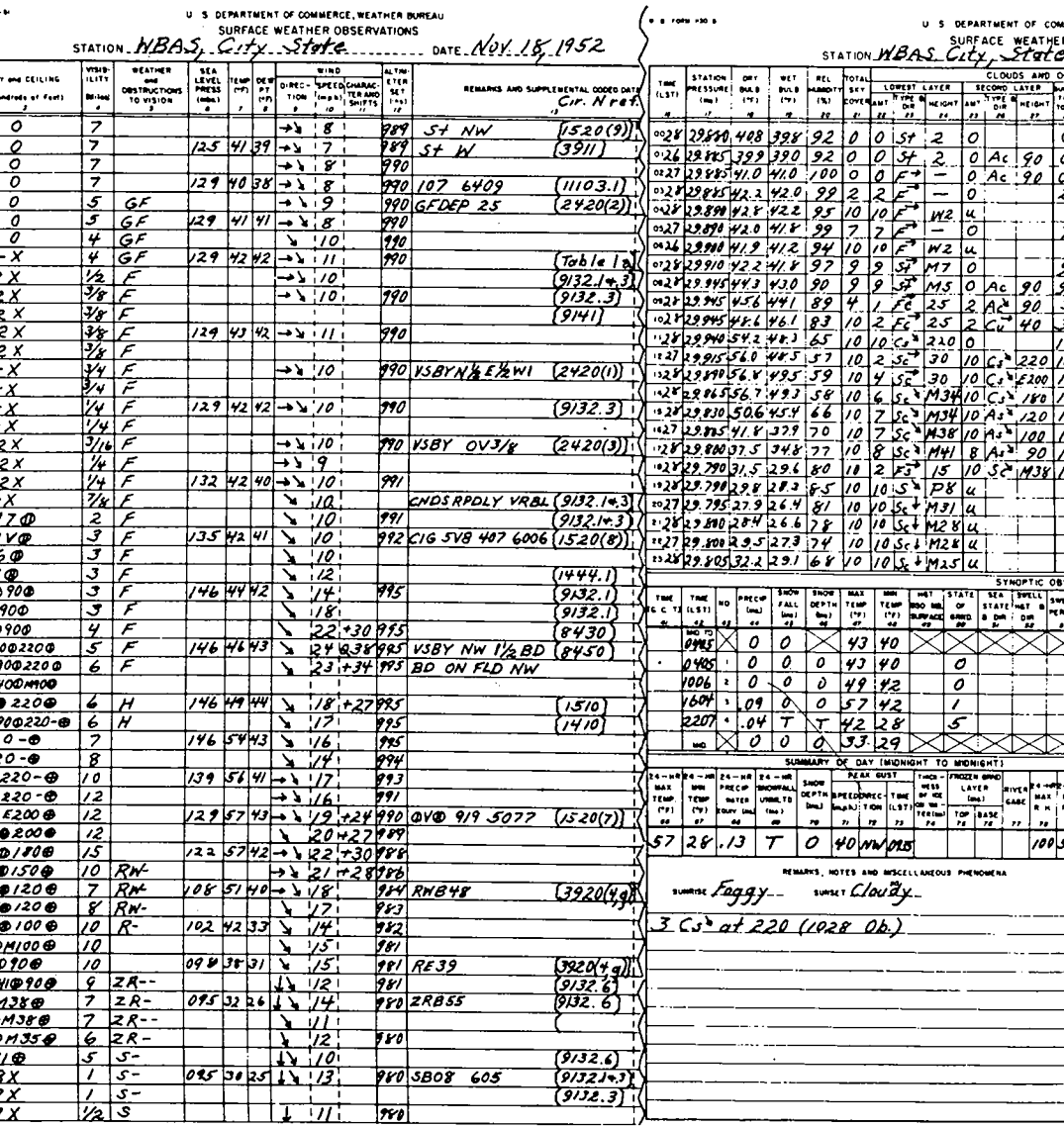
Code No.	Angle of breakers with the beach	Code No.	Angle of breakers with the beach
0	Calm.	5	0° up to 10° from the right.
1	0° up to 10° from the left.	6	10° up to 20° from the right.
2	10° up to 20° from the left.	7	More than 20° from the right.
3	More than 20° from the left.	8	Confused, but predominantly from the right.
4	Confused, but predominantly from the left.	9	Not known.

11208. THICKNESS OF ICE ON WATER. (Col. 74) At designated Weather Bureau and Navy stations, enter this datum to the nearest 0.1 inch.

11209. FROZEN GROUND LAYER. (Cols. 75-76) At designated Weather Bureau and Navy stations, enter this datum to the nearest whole inch.

11210. RIVER GAGE. (Col. 77) At Weather Bureau stations where a river gage is read, enter the river gage reading to the nearest 0.1 foot.

*11211. (Cols. 80-81) Except in accordance with ¶ 4370, any data needed locally may be entered in columns 80 and 81, provided the nature of the data is properly identified in the column headings.



U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
STATION WBAS, City, State DATE Nov. 18, 1952

TYPE	TIME (LST)	SKY and CEILING (Hundreds of Feet)	VISIBILITY (Miles)	WEATHER and OBSTRUCTIONS TO VISION	SEA LEVEL PRESS (mbs)	TEMP (°F)	DEW PT (°F)	WIND DIRECTION	WIND SPEED (m.p.h.)	WIND CHARACTER AND SHIFTS	ALTIMETER SET (hds)	REMARKS AND SUPPLEMENTAL CODED DATA	Cir. Ref.
✓	0002	0	7					→↘	8		989	St NW	(1520(9))
R	0028	0	7		125	41	39	→↘	7		989	St W	(3911)
✓	0100	0	7					→↘	8		990		
R	0126	0	7		129	40	38	→↘	8		990	107 6409	(11103.1)
✓	0200	0	5	GF				→↘	9		990	GFDEP 25	(2420(2))
R	0227	0	5	GF	129	41	41	→↘	8		990		
✓	0300	0	4	GF				↘	10		990		
R	0328	-X	4	GF	129	42	42	→↘	11		990		(Table 1a)
S1	0345	W2X	1/2	F				→↘	10				(9132.1+3)
S2	0400	W2X	3/8	F				→↘	10		990		(9132.3)
L	0415	W2X	3/8	F									(9141)
R	0428	W2X	3/8	F	129	43	42	→↘	11		990		
L	0445	W2X	3/8	F									
S3	0501	-X	3/4	F				→↘	10		990	VSBY N1/2 E1/2 W1	(2420(1))
L	0515	-X	3/4	F									
RS4	0527	-X	1/4	F	129	42	42	→↘	10		990		(9132.3)
L	0545	-X	1/4	F									
S5	0600	W2X	3/16	F				→↘	10		990	VSBY OV3/8	(2420(3))
L	0615	W2X	1/4	F				→↘	9				
R	0626	W2X	1/4	F	132	42	40	→↘	10		991		
S6	0645	-X	7/8	F				↘	10			CNDS RPDLY VRBL	(9132.1+3)
S7	0658	M7⊕	2	F				↘	10		991		(9132.1+3)
RS8	0728	M7V⊕	3	F	135	42	41	↘	10		992	CIG 5V8 407 6006	(1520(8))
✓	0800	E6⊕	3	F				↘	10				
S9	0814	A4⊕	3	F				↘	12				(1444.1)
RS10	0828	M5⊕90⊕	3	F	146	44	42	↘	14		995		(9132.1)
S11	0846	6⊕90⊕	3	F				↘	18				(9132.1)
✓	0901	6-⊕90⊕	4	F				↘	22	+30	995		(8430)
R	0928	25⊕90⊕220⊕	5	F	146	46	43	↘	24	G38	995	VSBY NW 1½ BD	(8450)
✓	1001	25⊕90⊕220⊕	6	F				↘	23	+34	995	BD ON FLD NW	
R	1028	25⊕40⊕M90⊕											
		120⊕220⊕	6	H	146	49	44	↘	18	+27	995		(1510)
✓	1101	40⊕90⊕220-⊕	6	H				↘	17		995		(1410)
R	1128	220-⊕	7		146	54	43	↘	16		995		
✓	1200	220-⊕	8					↘	14		994		
R	1227	30⊕220-⊕	10		139	56	41	→↘	17		993		
✓	1302	30⊕220-⊕	12					→↘	16		991		
R	1328	30⊕E200⊕	12		129	57	43	→↘	19	+24	990	OV⊕ 9/9 5077	(1520(7))
✓	1401	M32⊕200⊕	12					↘	20	+27	989		
R	1428	M34⊕180⊕	15		122	57	42	→↘	22	+30	988		
✓	1501	M34⊕150⊕	10	RW-				→↘	21	+28	986		
R	1528	M34⊕120⊕	7	RW-	108	51	40	→↘	18		984	RWB48	(3920(4,9))
✓	1602	M35⊕120⊕	8	RW-				↘	17		983		
R	1627	M38⊕100⊕	10	R-	102	42	33	↘	14		982		
✓	1700	38⊕M100⊕	10					↘	15		981		
R	1728	M41⊕90⊕	10		094	38	31	↘	15		981	RE39	(3920(4,9))
✓	1801	150⊕M41⊕90⊕	9	ZR--				↓↘	12		981		(9132.6)
RS12	1828	150⊕M38⊕	7	ZR-	095	32	26	↓↘	14		980	ZRB55	(9132.6)
S13	1840	120⊕M38⊕	7	ZR--				↘	11				
S14	1859	120⊕M35⊕	6	ZR-				↘	12		980		
S15	1910	M31⊕	5	S-				↓↘	10				(9132.6)
RS16	1928	P8X	1	S-	095	30	25	↓↘	13		980	SB08 605	(9132.1+3)
L	1944	P7X	1	S-									(9132.3)
S17	2000	P7X	1/2	S				↓	11		980		

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU
SURFACE WEATHER OBSERVATIONS
STATION WBAS, City, State DATE Nov. 18, 1952

TIME (LST)	STATION PRESSURE (mbs)	DRY BULB (°F)	WET BULB (°F)	REL HUMIDITY (%)	TOTAL SKY COVER	CLOUDS AND OBSCURING PHENOMENA: LOWEST LAYER TYPE & DIR	LOWEST LAYER HEIGHT	SECOND LAYER AMT	SECOND LAYER TYPE & DIR	SECOND LAYER HEIGHT	THIRD LAYER AMT	THIRD LAYER TYPE & DIR	THIRD LAYER HEIGHT	FOURTH LAYER AMT	FOURTH LAYER TYPE & DIR	FOURTH LAYER HEIGHT	TOTAL OPAQUE SKY COVER	WET 3-HR CHANGE
0028	29.880	40.8	39.8	92	0	0	St	2	0		0	0		0	0		0	
0128	29.885	39.9	39.0	92	0	0	St	2	0	Ac	90	0	0		0	0		0	1 .020
0227	29.885	41.0	41.0	100	0	0	F→	—	0	Ac	90	0	0		0	0		0	
0328	29.885	42.2	42.0	99	2	2	F→	—	0			2	0		2	0		2	
0428	29.890	42.8	42.2	95	10	10	F→	W2	u						u			10	4 .005
0527	29.890	42.0	41.8	99	7	7	F→	—	0			7	0		7	0		7	
0626	29.900	41.9	41.2	94	10	10	F→	W2	u						u			10	
0728	29.910	42.2	41.8	97	9	9	St→	M7	0			9	0		9	0		9	4 .020
0828	29.945	44.3	43.0	90	9	8	St→	M5	0	Ac	90	9	0		9	0		8	
0928	29.945	45.6	44.1	89	4	1	Fc	25	2	Ac↘	90	3	2	Ci 220	4	0		3	
1028	29.945	45.6	46.1	83	10	2	Fc→	25	2	Cu↘	40	3	5	Ac↘ M90	7	2	As↘ 120	6	1 .035
1128	29.940	54.2	48.3	65	10	10	Cs↘	220	0			10	0		10	0		4	
1227	29.915	56.0	48.5	57	10	2	Sc→	30	10	Cs↘	220	10	0		10	0		4	
1328	29.890	56.8	49.5	59	10	4	Sc→	30	10	Cs↘	E200	10	0		10	0		6	9 .055
1428	29.865	56.7	49.3	58	10	6	Sc↘	M34	10	Cs↘	180	10	0		10	0		8	
1528	29.830	50.6	45.4	66	10	7	Sc↘	M34	10	As↘	120	10	u			u		10	
1627	29.805	41.8	37.9	70	10	7	Sc↘	M38	10	As↘	100	10	u			u		10	8 .085
1728	29.800	37.5	34.8	77	10	8	Sc↘	M41	8	As↘	90	10	u			u		10	
1828	29.790	31.5	29.6	80	10	2	F3→	15	10	Sc↘	M38	10	u			u		10	
1928	29.798	29.8	28.3	95	10	10	S↘	P8	u				u			u		10	6 .015
2027	29.795	27.9	26.4	81	10	10	Sc↓	M31	u				u			u		10	
2128	29.810	28.4	26.6	78	10	10	Sc↓	M28	u				u			u		10	
2227	29.800	29.5	27.3	74	10	10	Sc↓	M28	u				u			u		10	1 .010
2328	29.805	32.2	29.1	68	10	10	Sc↓	M25	u				u			u		10	

SYNOPTIC OBSERVATIONS

TIME (G.C.T.)	TIME (LST)	NO	PRECIP (ins)	SNOW FALL (ins)	SNOW DEPTH (ins)	MAX TEMP (°F)	MIN TEMP (°F)	WET BULB TEMP (°F)	STATE OF GROUND	SEA STATE	SWELL DIR	SWELL PERIOD	SURF H1 H2 P1 P2	WATER TEMP	SOIL TEMP
	0945		0	0		43	40								
	0405	1	0	0	0	43	40		0						
	1006	2	0	0	0	49	42		0						
	1604	3	.09	0	0	57	42		1						
	2207	4	.04	T	T	42	28		5						
	END		0	0	0	93	29								

STATION PRESSURE COMPUTATIONS

TIME (LST)	0413	0914	1615	2216
ATT THERM	77.0	75.0	77.5	74.0
STA PRESS	29.869	29.832	29.969	29.958
TOTAL CORR	-.152	-.149	-.163	-.157
BAROMETER	29.889	29.943	29.806	29.801
BAR CORR	29.889	29.943	29.806	29.801
	0	0	+.085	-.010

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

24-HR MAX TEMP (°F)	24-HR MIN TEMP (°F)	24-HR PRECIP (ins)	24-HR SNOWFALL (ins)	SNOW DEPTH (ins)	PEAK GUST SPEED (m.p.h.)	PEAK GUST DIRECTION	PEAK GUST TIME (LST)	THICKNESS OF ICE OR WET SNOW (ins)	FROZEN GRND LAYER (ins) TOP	FROZEN GRND LAYER (ins) BASE	RIVER GAGE	24-HR MAX R.H.	24-HR MIN R.H.
57	28	.13	T	0	40	NW	0915					100	57

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA
SUNRISE Foggy SUNSET Cloudy
3 Cs at 220 (1028 Ob.)

PRECIP & THUNDER	BEGAN	ENDED	DUR hr	DUR min	OBSTR TO VIS	BEGAN	ENDED	DUR hr	DUR min
RW-	1448	1515			GF	0155	0340		
RW	1515	1510			F	0340	1020		
RW-	1510	1615			H	1020	1115		
R-	1615	1639							
ZR--	1755	1825							
ZR-	1825	1838							
ZR--	1838	1858							
ZR-	1858	1908							
S-	1908	1943							
S	1943	1957							
S-	1957	2120							

Fig. 6. Entries on WBAN-10A and B.

TABLE 30
Symbol dd - Direction from which wind is blowing. 1/

Code Figure	Direction	Code Figure	Direction
00	Calm	18	S
02	NNE	20	SSW
05	NE	23	SW
07	ENE	25	WSW
09	E	27	W
11	ESE	29	WNW
14	SE	32	NW
16	SSE	34	NNW
		36	N

1/ Wind speeds from 100 to 199 knots, inclusive, are reported by adding 50 to the code figure for "dd" and coding the observed speed minus 100 for "ff". See par. 12326(c).

*12327. VVwwW (Col. 94). Enter coded data as specified by the symbols shown in the column heading. These symbols have the following meaning:

(a) VV - Prevailing visibility, as recorded in column 4 and coded in accordance with Table 31.

(b) ww - Present weather (occurring at the actual time of observation or within one hour of it), coded in accordance with Table 32. Use entries in column 5 as a guide in selecting the proper code figure. If more than one code figure is applicable, use the largest numerical figure.

(c) W - Past weather (occurring at the station the past 3 or 6 hours),coded in accordance with Table 33.At 0000, 0600 1200 and 1800 GCT, W refers to the preceding six hours, while at intermediate times (0300, 0900, etc.) W refers to the preceding three hours. Use the largest applicable numerical code figure, except that W and ww should be selected so that the combined code figures describe present and past weather as completely as possible. For example, when the weatheroccurring at the time of observation (rather than for the previous hour) is coded as ww, the weather during the past six (or three) hours will be coded as W; while if the weather that occurred during the preceding hour is coded as ww, the weather during the five (or two) hours ending one hour before should be coded as W.

TABLE 31
Symbol VV - Horizontal Visibility

Code Figure	Visibility in Nautical Miles and Fractions	Code Figure	Visibility in Nautical Miles and Fractions
00	Less than 1/8	37	4
01	1/8 and 3/16	46	5
02	1/4	55	6
03	3/8	64	7
04	1/2	74	8
05	5/8	80	9 and 10
06	3/4	81	11 to 20, inclusive
07	7/8	82	25 and 30
09	1	83	35 and 40
11	1 1/4	84	45 and 50
13	1 1/2	85	55 to 80, inclusive
16	1 3/4	86	85 to 105, inclusive
18	2	87	110 to 160, inclusive
20	2 1/4	88	165 to 265, inclusive
23	2 1/2	89	270 or more
27	3		

Change No. → 5

INSTRUCTIONS FOR DISTRIBUTION: Not for use at the following Weather Bureau second-order stations: 1) SAWR, 2) A-type, 3) CAA stations designated to receive "Circular N, abridged for CAA stations."

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

MANUAL OF
SURFACE OBSERVATIONS
(WBAN)

CIRCULAR N

Sixth Edition

(Revised)

May 1953

WASHINGTON, D. C.

Instructions re: Change No. 5, Cir. N, WBAN, 6th Edition (Rev. July 1951):

(1) Page X, List of Tables: Change "10d" to read "10m" and insert "10d-k Proportional Parts Tables....78b-d, 79" following "10c Barograph...." Page XII, List of Fig's: Opposite fig. "6", delete "and B", and add to the list "6a Entries on WBAN-10B....120a"

(2) Page 5, par. 1431(3), 3rd line: Read "within 1-1/2 miles...."

(3) Page 76, par. 7245.3, last line: Read "by more than approximately 1/4 of a chart division."

(4) Page 81, par. 7430(4): Insert "Algebraic" preceding "Sum."

(5) Page 84, par. 7620:
   (a) Last word of third line: Change "or" to "and."
   (b) Last line: Change "10d" to "10m."
   (c) Table 10d: Change "10d" to "10m."

(6) Page 97, par. 9120, 2nd line: Change "teletype" to read "teletypewriter."

(7) Page 98, par. 9131: Following (2), insert "(3) Pressure jump (see par. 7730(4))."

(8) Page 100, par. 9132.8: Change "9132.8" to read "9132.9" and insert following par. 9132.7, "9132.8 PRESSURE JUMP (See Par. 7730(4).)."

(9) Page 100, par. 9141: Insert "all except SAWR stations at" in 1st line between "at" and "intervals," and "known" in 2nd line after "are."

(10) Page 124, par. 12305, 2nd line: Insert "(see par. 12120)" between "observations" and "to."

(11) Page 129, par. 12313, 2nd line: Insert "(see par. 12308)" at end of first sentence.

(12) Page 133, par. 12327(c), 1st line: Insert "within" between "station" and "the."

(13) Index:
   (a) Insert "Blowing spray.....1542(Table 4a), 3512" between "Blowing Snow" and "Buildings."
   (b) Insert "Condensation trails....1520(10), 10120, 10127" preceding "Convective cloud diagram, use...."
   (c) Insert: "jump....7730(4), 9131(3), 9132(8)" between "definition" and "methods of measurement" under "Pressure."

(14) The remainder of Change No. 5 comprises the following page changes: XIII, 13-18, 21-22, 37-38, 45-47 53-54, 59-60, 67-68, 71-74, 77-78 78a-d, 79-80, 84a-b, 85-86, 86a-b, 87-88, 101-106, 109-112, 117-120, 120a, 125-128, and 128a.

THIS PAGE MAY BE DISCARDED AFTER THE INDICATED CHANGES HAVE BEEN ACCOMPLISHED

Commerce-Weather Bureau, Washington, D. C.

*Revised
Eff. 5-1-53

INTRODUCTION

*Taking observations is, in general, the primary duty of the observer. Unless otherwise instructed, as in the case of CAA and SAWR stations, nothing except the most pressing demands upon the observer's attention should be given precedence to this fundamental duty. Since life, property, and the convenience of travelers, as well as accurate forecasts, may depend upon his observations, the observer should make every effort to take the observations as accurately and completely as possible, and to file them in sufficient time for scheduled transmission. Every observation must be accurate in all its parts, and it must convey a complete picture of the meteorological situation existing at the station.

*At CAA, SAWR, and certain other second-order civil stations, weather-observing duties are secondary with respect to primary functions such as communications, flight assistance, etc. Weather observations are made and transmitted at these stations as time is available from primary duties.

*When computations require that a number be rounded, the following procedure will be observed:

(1) If the fractional part to be disposed of is one-half or greater, the preceding digit will be increased by one.

(2) If the fractional part to be disposed of is less than one-half, the preceding digit will remain unchanged, e.g., 29.248 rounded to the nearest tenth is 29.2.

Algebraic signs will be disregarded - e.g., 1.5 = 2; -1.5 = 2.

(abscissa) corresponding to the observed dew-point temperature, and the curve (sloping upward to left) corresponding to the observed dry-bulb temperature.

(2) Find the height of the convective cloud base above the ground at the scale value (printed along the right side of the chart) corresponding to the point found in (1).

1450. FREQUENCY OF CEILING MEASUREMENTS. Whenever available, a ceiling light or ceilometer will be used as frequently as observations are taken, provided clouds are present at the observation and it appears likely that a height value can be secured. Stations not equipped with ceilometers will use balloons during daylight hours as specified in par. 1451-52. (See also par. 1442.1.)

1451. At stations where hourly observations for scheduled transmission are taken, balloons will be used as follows to determine the ceiling value:

(1) At the discretion of the observer, when the ceiling is estimated as 2000 feet or more.

(2) At hourly intervals or more frequently, when the ceiling is between 1000 and 2000 feet, unless the highest instrument minimum 1/ for the airport is above 1000 feet, in which case (3) applies.

(3) At half-hour intervals or more frequently, when the ceiling is below 1000 feet, or at or below the highest instrument minimum 1/ for the airport.

*1451.1. The use of ceiling balloons is not required at CAA stations when only one communicator is on duty, although the equipment should be kept available for emergency use; when more than one communicator is on duty, ceiling balloons should be used provided no interference with primary duties will result. (See Introduction.)

1452. At stations not taking hourly aviation observations, ceiling balloons will be used whenever the ceiling is estimated to be less than 3000 feet.

1500. ENTRIES ON WBAN-10

1510. CEILING AND SKY. (Col. 3) Enter in ascending order of height the appropriate sky-cover symbol for each layer, selected in accordance with the summation principles stated in par. 1511. Prefix the corresponding height in hundreds of feet (see par. 1440) to each

1/ These minimums are with reference to instrument minimums exclusive of ILS, GCA, or alternate minimums.

sky-cover symbol, and an appropriate ceiling classification symbol to to the ceiling layer only. Heights ascribed to "X" will represent vertical visibility. A numerical value will not be ascribed to "-X" since unlimited vertical visibility is indicated. If the ceiling is variable (see par. 1420), enter the letter "V" following the ceiling value, e.g., M5VⒹ.

*1511. SUMMATION. The sky-cover symbol for each layer represents the summation total of all sky cover (see par. 1110) at and below that level, including the amount of sky hidden by surface-based obscuring phenomena. In determining summation totals, disregard portions of surface-based obscuring phenomena that do not conceal the sky, and portions of upper-cloud layers that are visible only through transparencies in lower layers. If any portion of the sky cover is transparent, determine, in addition to the foregoing summation, the summation of opaque sky cover at each level (see examples 7 and 8 below). If, at any level aloft, the ratio of opaque to total sky cover (summation values) is 1/2 or less, prefix "-" (thin) to the corresponding sky-cover symbol. Omit this prefix if the ratio exceeds 1/2. Prefix "+" to layers that are unusually dark or threatening.

EXAMPLES

Opaque sky cover:

	Layers	Summation	Sky-Cover Symbol
(1)	0.4 sky hidden by fog	0.4	-X
	0.3 sky cover at 1000'	0.7	M10Ⓓ
	0.2 sky cover at 5000'	0.9	50Ⓓ
(2)	Less than 0.1 sky cover at 500'	0.0	—
	Less than 0.1 sky cover at 2000' (Total sky cover 0.1)	0.1	20Ⓓ
(3)	0.6 sky cover at 1000'	0.6	M10Ⓓ
	0.3 sky cover at 5000'	0.9	50Ⓓ
	0.1 sky cover at 10,000' (with breaks)	1.0	100⊕ ..(with remark: BINOVC)
(4)	0.1 sky cover at 1000' (Smoke aloft)	0.1	10Ⓓ ..(with remark: KLYR 10Ⓓ)
	0.3 sky cover at 5000'	0.4	50Ⓓ
	0.1 sky cover at 10,000'	0.5	100Ⓓ
(5)	0.2 sky cover at 500'	0.2	5Ⓓ
	Sky hidden by snow, vertical visibility 1500'	1.0	P15X
(6)	0.8 sky hidden by snow	0.8	-X
	0.2 sky cover at 500'	1.0	M5⊕

Transparent or partially opaque sky cover:

	Layers	Summation Total	Summation Opaque Portions	Sky-Cover Symbol
(7)	0.8 sky cover at 500' (0.0 opaque)	0.8	0.0	*5-⊕
(8)	0.1 sky hidden by surface smoke	0.1	0.1	-X
	0.7 sky cover at 1000' (0.1 opaque)	0.8	0.2	*10-⊕
	0.2 sky cover at 5000' (all opaque)	1.0	0.4	*50-⊕

*Note that the ceiling classification letter is omitted because the layer is classified as "thin."

1520. REMARKS. (Col. 13) Enter data pertaining to clouds and obscuring phenomena in remarks as follows:

	Observed	Instructions for Entry
(1)	Breaks in overcast; one overcast layer only.	Enter "BINOVC," followed by direction of breaks where practicable.
(2)	Breaks in higher overcast; two or more overcast layers reported (lower one classified thin).	Enter "BRKHIC"
(3)	Higher clouds visible through breaks in overcast not classified thin.	Enter "HIR CLDS VSB"
(4)	Direction of breaks in broken layer with ceiling at or below highest instrument minimums. (Omit if breaks are in all quadrants)	Enter "BRKS," followed by direction, e.g.,"BRKS N"or "BRKS OVR MID MKR"
(5)	Obscuring phenomena (smoke, etc.) aloft	Enter "KLYR," "HLYR," etc., followed by height and corresponding sky-cover symbol, e.g., "KLYR 10⊕"
(6)	Special cloud types (see Circ. S for definitions)	
	a. Towering cumulus	Enter "TWRG CU," followed by direction from station.
	b. Cumulonimbus	Enter "CB," followed by direction from station and direction of movement, if known; also enter estimated distance from station in statute miles if practicable, e.g., "CB 25 MI W MOVG NE."

Observed	Instructions for Entry
c. Cumulonimbus mammatus (mammato-cumulus)	Enter "CM," followed by same information as for Item 6(b).
d. Altocumulus castellatus	Enter "ACC," followed by direction from station.
e. Virga	Enter "VIRGA," followed by direction from station.
(7) Variable sky condition	Enter ranges of variability, separated by letter "V"; e.g., "⊕V⊕" to indicate that a layer reported as broken in Col. 3 is occasionally scattered; "1 8⊕V⊕" to indicate that one of two or more broken layers is occasionally scattered; "-⊕V⊕" to indicate that a thin layer is occasionally opaque.
(8) Variable ceiling	Enter range of variability separated by letter "V," and prefix entire remark with abbreviation "CIG"; e.g., "CIG 15V20" (see ¶ 1420).
(9) Differing ceiling or sky condition at distance from station.	Enter appropriate remarks, such as "CIG LWR OVR CITY," "LWR CLDS W APCHG STN," etc.
(10) Condensation trails if observed from the ground and still forming at time of observations--distinguish carefully from cirrus clouds or sky-writing.	Enter "CONTRAILS", followed by height in hundreds of feet MSL if reported by pilot; e.g., "CONTRAILS 450 MSL" where pilot reports height as 45,000 feet, and contrails observed from ground.

*1530. TOTAL SKY COVER. (Col. 21) At each record hourly observation, enter, as a whole number, tenths of total sky cover as defined in Par. 1110 (e.g., enter 6 for 0.6, etc.).

1540. CLOUDS AND OBSCURING PHENOMENA. (Cols. 22 - 35) Entries will be made in columns 22 - 35 for each hourly observation at Air Force, Navy, and first-order Weather Bureau stations. 1/ Data will be entered in ascending order of height. When clouds or obscuring phenomena are present at more than four levels, do not enter data for levels above the fourth in these columns, but enter additional information concerning these levels in column 90. The presence of these levels will also be indicated by the entry for total sky cover (column 21).

1/ At combined WB-CAA stations, entries will be made in these columns only when Weather Bureau personnel are on duty.

*1541. AMOUNT AND SUMMATION TOTAL. (Cols. 22, 25, 28, 29, 32, 33) Enter as a whole number the sky cover (see par. 1110) observed at each level to the nearest tenth (e.g., enter 6 for 0.6, etc.). Since a series of frequent observations or pilot reports often indicates the extent or existence of layers above a broken or overcast layer, amounts entered in columns 22, 25, 29, and 33 are not necessarily the amounts actually visible at the time of observation, and the sum of the number of tenths may exceed ten tenths. However, the entries in columns 28 and 32 will be a summation of the sky cover at and below the elevations reported in columns 27 and 31 respectively, and will not exceed 1.0. For example: If 0.4 clouds are visible at 1000 feet and a pilot reports 1.0 clouds at 3000 feet, the summation total entered in column 28 would nevertheless be only ten tenths.

1541.1. When higher layers cannot be identified because lower layers hide more than 0.9 of the sky, enter "U" in the amount columns and omit entries in the type, height, and summation columns pertaining to higher layers. When layers are not present at any level, or higher layers are not visible and 0.1 or more of the sky is visible, enter zeros in the appropriate amount columns and omit entry in type and height columns. When two or more types of clouds or obscuring phenomena occur at the same level, enter their combined amounts in the appropriate columns captioned "Amount". (See also par. 1542)

1542. TYPE, DIRECTION. (Cols. 23, 26,30, 34) Enter the appropriate abbreviation selected from Table 4a for clouds or obscuring phenomena. When two or more types of clouds or obscuring phenomena are observed at the same level, the predominating type with respect to amount will be recorded.[1] Enter the direction from which the layers are moving. When the direction is unknown, omit the entry. When motion is not discernible, enter "C" for calm; otherwise, enter an arrow denoting the motion to eight points of the compass immediately above the abbreviation. (See Table 4b.)

*TABLE 4a. Cloud types and obscuring phenomena

Cloud type and obscuring phenomena	Abbreviations	Cloud type and obscuring phenomena	Abbreviations
CLOUDS		OBSCURING PHENOMENA—continued	
		Precipitation—Continued	
Altocumulus	Ac	Ice crystals	IC
Altocumulus castellatus	Acc	Rain (any form and intensity including RW and ZR)	R
Altostratus	As	Sleet (any form and intensity including ZW)	E
Cirrocumulus	Cc	Snow (any form and intensity including SW, SP, and SG)	S
Cirrostratus	Cs		
Cirrus	Ci	*Hydrometeors other than precipitation*	
Cumulonimbus	Cb	Blowing snow	BS
Cumulonimbus mammatus (Mammato-cumulus)	Cm	Blowing spray	BY
Cumulus	Cu	Fog (any form, including GF and IF)	F
Fractocumulus	Fc		
Fractostratus	Fs	*Lithometeors*	
Nimbostratus	Ns	Dust	D
Stratocumulus	Sc	Haze	H
Stratus	St	Sand	N
OBSCURING PHENOMENA		Smoke	K
Precipitation			
Drizzle (any form and intensity including ZL)	L		
Hail (any form and intensity including AP)	A		

1/If the amounts are equal, enter the type that, in the opinion of the observer, is most significant.

TABLE 4b. Cloud direction

↓	from north	↑	from south
↙	from northeast	↗	from southwest
←	from east	→	from west
↖	from southeast	↘	from northwest

1543. HEIGHT. (Cols. 24, 27, 31, 35) Enter height of clouds and obscuring phenomena aloft in columns captioned "Height." Enter the vertical visibility for obscuring phenomena with bases at the surface, using a dash to denote unlimited vertical visibility. Make all entries in hundreds of feet, using the intervals specified in par. 1440. Prefix an appropriate classification letter selected from Table 2a to the ceiling layer only.

*1544. TOTAL OPAQUE SKY COVER. (Col. 36) Enter, as a whole number, the tenths of sky that are hidden by clouds or obscuring phenomena. (Note that this entry is similar to the entry of total sky cover in column 21, except that sky cover through which the sky is visible is disregarded when determining the entry in column 36.)

*Revised
Eff. 5-1-53

CHAPTER 2. VISIBILITY

2000. GENERAL

*2010. Visibility is a term that denotes the greatest distance an object of specified characteristics can be seen and identified. This term may express the visibility in a single direction or the prevailing visibility based on all directions. Visibility observations will be taken from as many points as necessary to view all appropriate markers. Except as specified in Par. 2011, observations should be with reference to a plane six feet above the ground or, if station facilities preclude an observation at this level, as close as practicable to it. Visibility will be reported at land stations:

(1) in statute miles
(2) to the nearest value given in Table 4c; when the visibility is halfway between two reportable values, select the lower value.

Table 4c. Reportable Visibility Values (Miles)

Increments of Separation (miles)							
1/16	1/8		1/4	1/2	1		5
0	3/8	1-1/4	2	2-1/2	3	10	15†
1/16	1/2	1-3/8	2-1/4	3	4	11	20
1/8	5/8	1-1/2	2-1/2		5	12	25
3/16	3/4	1-5/8			6	13	30
1/4	7/8	1-3/4			7	14	35
5/16	1	1-7/8			8	15†	40
3/8	1-1/8	2			9		etc.

† "15+" is recorded when the visibility is estimated to be greater than 15 miles and suitable markers beyond 15 miles are not available (see ¶ 2410).

2011. Unless otherwise authorized, all stations at which control towers are situated will take visibility observations at the control-tower level, as well as at the usual point of observation, whenever the visibility at the latter point is less than three miles. At civil stations, control-tower visibilities will be used for all aviation observations, including record, coding, and summary, but will not be used for synoptic observations; at military stations, control-tower visibilities will be used only as specified in par. 2420.

2100. GUIDES IN DETERMINING VISIBILITY

2110. CHART OF VISIBILITY MARKERS. Each station will display charts of prominent objects and their distances from the observation point. These charts will include objects suitable for determining the visibility at night as well as by day. At least two charts will be available; one

including all markers throughout the entire range of visible objects, and the other an expanded scale chart including only those markers within 1-1/2 miles of the observation point.

2120. VISIBILITY MARKERS AT NIGHT. The most suitable objects for determining visibility at night are unfocused lights of moderate intensity at known distances, and the silhouettes of mountains or hills, etc., against the sky. The brilliance of stars near the horizon may also be a useful indication. Because of their intensity, airway beacons may not be used as visibility markers, but their degree of brilliance may be used as an aid to indicate whether visibility is greater or less than the distance of the beacon. "Course lights" (red or green) of beacons may be used as definite visibility markers. These and all other lights normally used as visibility markers should be used with caution after storms, for their intensity may be reduced by snow or freezing precipitation.

2130. VISIBILITY MARKERS DURING DAYLIGHT. For accurate determinations during daylight hours, confine the choice of markers to black, or nearly black, objects against the horizon sky rather than to light-colored markers and those appearing against terrestrial backgrounds.

2140. SIZE OF VISIBILITY MARKERS. In order that visibility values may be representative, they must apply to objects of specified minimum size or larger. An object that subtends an angle of less than 0.5 degree at the eye becomes invisible at a shorter distance than larger objects under the same conditions. Therefore, objects whose angular size is 0.5 degree or greater should be selected as visibility markers whenever possible. A hole 0.3 inch (or 5/16") in diameter punched in a card that is held at arm's length subtends an angle of approximately 0.5° at the eye. If the portion of any objectsbove the horizon completely fills the hole when the card is held as explained above, the object is of suitable size for a marker.

2150. DAY AND NIGHT VISIBILITY. Transparency of the atmosphere in the open country (except in polar regions) removed from sources of atmospheric pollutants changes but very little from daylight to darkness and vice versa. However, in areas subject to pollution (as smoke from domestic heating or cooking, and industrial exhausts) there may be systematic variations during the transition period about sunrise or sunset. In such areas a decrease in visibility often occurs near dawn particularly when a steep inversion exists near the surface. Before taking a visibility observation at night, the observer should spend two to six minutes in the dark (depending upon the contrast between office and outside illumination) to adapt his eyes to nighttime conditions.

2160. ESTIMATIONS OF VISIBILITY. When the visibility is greater than the distance to the farthest object, note the sharpness with which

Observed	Instructions for Entry
(b) Heavy thunderstorm began following the most recent record observation, but not occurring during current observation. (Enter this remark for all observations up to and including the next record observation, even though the phenomenon was previously reported in a special observation. See par. 9180.)	Enter the time of beginning and ending, peak speed of gusts, and direction of movement, e.g., T+ B34E50 G45 MOVD N
(3) Lightning, with or without audible thunder	Enter if observable: (1) Frequency (2) Type (cloud to cloud, etc.) (3) Direction from station Use authorized abbreviations, e.g., OCNL LTGCG, FQT LTGIC NW, etc.
(4) Precipitation 1/	
(a) Hail	Enter diameter in inches of largest hailstones, e.g., HLSTO 1 1/4
* (b) Intermittent and showery	Enter abbreviation for intermittent, followed by type of precipitation (e.g., INTMT R-), if intermittent precipitation has occurred within the previous 15 minutes. This entry will be made to report intermittent precipitation regardless of whether precipitation is entered in Col. 5 (see par. 3910). Enter "OCNL RW", etc. if showers have occurred within the previous 15 minutes and are not reported in Col. 5.
(c) Wet snow	Enter WET SNW
(d) Snow depth increase	Enter abbreviation SNOINCR, followed by average depth of snow accumulated during the past hour, to the nearest whole inch (e.g., SNOINCR 5). This remark will be used only if average snow depth has increased during past hour by two or more inches.
(e) Variation of intensity	Enter appropriate abbreviations, e.g., R- OCNLY R+

1/ In reporting data pertaining to snow, snow showers, or sleet in remarks, use the symbols S, SW, and E only when there is no possibility of their being confused with points of the compass. Otherwise, use established English abbreviations (SNW, SNW SHWRS, etc.).

Observed	Instructions for Entry
(f) Precipitation at a distance but not at station	Enter form and intensity of precipitation if known and direction with respect to station. Use "U" following precipitation symbols to indicate unknown intensity, e.g., RU OVR RDG N or PCPN W INTSTY UNKN
*(g) Times of beginning or ending of precipitation	Enter remarks in the next record observation to report the time of beginning or ending of types (i.e., liquid, freezing, or frozen) or separate periods of precipitation, when the time is within one hour of the reference time appearing at the head of the collection, unless: a) this time is apparent from a transmitted special observation (see par. 9132.6 and 9180), or b) for endings or beginnings pertaining to the cessation and recommencement of precipitation (of the same or different types), the interval between them is 15 minutes or less, or it appears likely that precipitation will recommence within this time (see example 4). Use the symbol appropriate to the type of precipitation, without regard for intensity or changes in character (e.g., S for S- or S+, or S changing to SW+). Suffix each precipitation symbol with the symbol "E" followed by the local standard time in minutes past the hour to signify the time of ending, and the symbol "B" similarly to signify the time of beginning.

Examples

1. RW- reported in 1228 obs; RW- ended at 1305. Enter remark in 1328 obs: "RWE05".

2. No precipitation reported in 1228 obs; S- began at 1235 and continued through 1330. Enter remark in 1328 obs: "SB35".

3. No precipitation reported in 1228 obs. S began at 1240, ended 1255; began 1305, ended at 1315. Enter as remark in 1328 obs: "SB40E15"

4. RW- began 0515E and ended 0620E; no precipitation falling at actual time of 0628E observation, but recommencement within 15 minutes of 0620E appeared probable at time of observation. Enter remarks: (Cont. on page 39.)

4221. UNDRIFTED SNOW. Thrust the measuring stick vertically into the snow so that the end rests on the ground surface. Read the depth to the nearest 0.1 inch. Repeat at several spots and take the average of the readings as the snow depth. If the ground is covered with ice, cut through the ice with some suitable implement, and measure the thickness. Add the thickness of the ice to the depth of snow above the ice.

4222. DRIFTED SNOW. When the snow is drifted, a reasonably accurate depth measurement may be made by taking the average of several measurements over representative areas. These should include the greatest and least depths. For example, if spots with no snow are visible, one of the values should be zero.

4230. SNOWFALL WITHIN SPECIFIED PERIODS. These measurements are most conveniently made on a surface that has been cleared of previous snowfall. If such a spot is not available, measure the total depth of snow and subtract the depth previously measured. If the previous snowfall has crusted, the new fall may be measured by permitting the end of the measuring stick to rest on the crust. If different falls of snow are mixed by drifting, measure the total depth of snow and subtract the previously measured depth. The remainder is the approximate depth of the new fall, which will be adjusted if necessary to correct for melting, evaporation, and run-off. If several snow showers occur between observations and each melts before the following one occurs, the total snowfall for the period will be the sum of the maximum depths (measured or estimated) for each occurrence.

4300. ENTRIES ON WBAN-10

4310. PRECIPITATION. (Col. 44) Enter in the 6-hourly spaces the total precipitation (water equivalent), in inches and hundredths, occurring during the six hours ending with the observation. On the line captioned "Mid" enter the amount measured at midnight; i.e., the amount that has occurred between midnight and the preceding 6-hourly observation. 1/ On the line captioned "Mid to" enter the amount that has occurred between midnight and the following 6-hourly observation. (Note that the entry for the first 6-hourly observation after midnight is the sum of the entries opposite "Mid" (for the preceding day) and "Mid to". Enter "T" for trace (see par. 4020) and "0" if no precipitation has fallen.

4311. If no precipitation has fallen during the six hours preceding the time of measurement of precipitation for the 6-hourly observation, but begins shortly thereafter and before the coded synoptic observation (or additive data group) is filed, enter "T" in Col. 44. This procedure will be followed even though a measurable amount may have fallen.

1/For purposes of entries on WBAN-10, the midnight observation will be considered as the last observation of the day; e.g., a midnight observation taken at 0000 LST on the 15th will be entered on WBAN-10 for the 14th.

4320. SNOWFALL. (Col. 45) Enter in the 6-hourly spaces the maximum (unmelted) depth (inches and tenths) of frozen precipitation (see par. 3443) that has fallen during the six hours ending with the observation, obtained in accordance with Sec. 4200. On the line captioned "Mid", enter the amount occurring between midnight and the preceding 6-hourly observation.1/ On the line captioned "Mid to", enter the amount that has occurred between midnight and the following 6-hourly observation. (Note that the entry for the first 6-hourly observation after midnight is the sum of the entries opposite "Mid" (for the preceding day) and "Mid to". Entries for hail will be followed by an asterisk, and "*Hail" will be recorded in Col. 90. Enter "T" for trace (see par. 4020) and "0" if no frozen precipitation has fallen. When frozen precipitation melted as it fell, i.e., there is no visible accumulation on the ground, enter "T" with a note " Melted as it fell" in Col. 90. If there is a visible accumulation of snow but some melting has occurred within the past six hours, enter an estimated amount in Col. 45 and a note "Estimated due to partial melting" in Col. 90.

4330. SNOW DEPTH. (Col. 46) Enter in the 6-hourly spaces the depth of frozen precipitation (see par. 3443) and ice on the ground at each 6-hourly observation, to the nearest inch. On the line captioned "Mid", enter the amount on the ground at midnight.1/ Entries for hail will be followed by an asterisk and "*Hail" will be recorded in Col. 90. Enter "T" for amounts of less than 0.5 inch, and "0" when none is on the ground in exposed areas, even though snow is still present in surrounding forested or otherwise protected areas. If snow melts as it falls, and there is no visible accumulation on the ground (see par. 4320), enter "0". When snow that occurs between observations melts partially before the following observation, enter in Col. 90 the maximum depth (measured or estimated) between observations.

*4340. TWENTY-FOUR HOUR PRECIPITATION. (Col. 68) Enter the total precipitation (water equivalent in inches and hundredths) for the 24 hours ending at midnight1/. Enter "T" for trace (see par. 4020), and "0" if none has fallen. The sum of any number of "T" observations will be regarded as a trace unless recording gages indicate the total is .005 inch or more. (Note that the entry in this column is the sum of the entries in column 44, exclusive of the first 6-hourly observation of the day, provided a midnight observation is taken and, where a recording gage is used, no traces have been recorded. Entries may be omitted in this column at CAA stations if the equivalent value is available by summation of the entries in col. 44 of the forms constituting the day's record (see par. 11001.1)).

*4350. TWENTY-FOUR HOUR SNOWFALL. (Col. 69) Enter to inches and tenths the total amount (unmelted) of frozen precipitation that has fallen during the twenty-four hours ending at midnight1/. (Note that the entry in this column is the sum of the entries in Col. 45, exclusive of

1/For purposes of entries on WBAN-10, the midnight observation will be considered as the last observation of the day; e.g., a midnight observation taken at 0000 LST on the 15th will be entered on WBAN-10 for the 14th.

the entry for the first 6-hourly observation of the day, provided a midnight observation is taken.) Entries for hail will be followed by an asterisk and "*Hail" entered in column 90. Enter "T" for trace, and "0" if none has fallen. When precipitation melts as it falls, enter "T" with a note "Melted as it fell" in column 90.

*4360. SNOW DEPTH. (Col. 70) Transcribe the value recorded in column 46 for the 1230*1/ GCT observation. If personnel are not on duty at 1230 GCT, enter depth as measured at a time as close as practicable to 1230 GCT, and indicate the time in Col. 90.

4370. WATER EQUIVALENT OF FROZEN PRECIPITATION (Col. 80) At Air Force, Navy, and first-order Weather Bureau stations, whenever snow depth as entered in column 70 is two inches or more, enter in column 80 the water equivalent as measured at approximately 1200 GCT daily *1/. Enter the data in inches and hundredths, determined in accordance with ¶ 4053. If an appropriate column heading is not printed in this column, write or stamp "WATER EQUIV." in the heading.

*1/ In areas other than continental United States, the time of the observations referred to in par. 4360 and 4370 may be modified as necessary to meet regional needs.

wet-bulb readings has a progressively greater effect upon the accuracy of humidity values computed from them.

5151.5. Read the dry- and wet-bulb temperatures at the time of the lowest wet-bulb reading. (See par. 5120.1.)

5151.6. Apply corrections, if necessary, in accordance with par. 5140.

5160. MAXIMUM READINGS. The maximum thermometer is a mercurial thermometer made with a constriction in the bore near the bulb to prevent the mercury from withdrawing into the bulb when the temperature falls.

5161. To read the maximum thermometer, release the catch on the support and lower the bulb end slowly until the thermometer is vertical or approximately so, and the mercury column is resting on the constriction at the base. Read similarly to the dry-bulb thermometer.

5162. Before setting the maximum thermometer, be sure that the mercury column is resting on the constriction at the base. Otherwise, the glass forming the constriction may be broken when the thermometer is spun. To set it, spin the thermometer until its reading is the same as that of the dry-bulb temperature. If the readings of the dry-bulb and maximum thermometer disagree, check the thermometers for the source of error in accordance with maintenance instructions. Lock the thermometer in place on the support. Reset the maximum thermometer at each synoptic and midnight observation.

5163. If the maximum thermometer reading is known to be in error, obtain the maximum temperature to the nearest whole degree from a thermogram, if one is available; otherwise, use the highest corrected temperature observed within the observation period.

5170. MINIMUM READINGS. Alcohol is used in the minimum thermometer. A freely moving dark-colored glass index is placed in the bore. As the temperature falls, the retreating upper end of the alcohol column retracts the index, which remains at the position of the lowest temperature until reset.

5171. The minimum temperature is read at the end of the colored glass index farther from the bulb. Read the thermometer without disturbing it and while it is in its correct position for exposure. It will be read before reading the maximum thermometer. Set the minimum thermometer after the maximum thermometer has been set, by turning it to a vertical position and holding it bulb end up until the index reaches the end of the column and the reading is the same as the dry-bulb temperature. If the readings of the minimum and dry-bulb thermometer disagree, check the thermometers for the possible source of error in

accordance with par. 5172 or separate maintenance instructions. Return the thermometer to its correct position. Reset the minimum thermometer at each synoptic and midnight observation.

5172. Minimum thermometers are subject to errors caused by separation of the spirit column. Sometimes the spirit vapor condenses in the upper end of the bore to form one or two short segments above the rest of the column. At other times, bubbles that form in the column may trap the index. Erroneous readings will result in both cases, and therefore the thermometer should be examined at each observation for separation of the column. Errors also result from recession of the index owing, chiefly, to the shelter's being jarred or subjected to vibration by the wind.

5173. If the minimum thermometer reading is known to be erroneous, obtain the minimum temperature to the nearest whole degree from the thermogram, if one is available, or use the lowest corrected temperature observed within the observation period.

5180. TELETHERMOSCOPE READINGS. The telethermoscope is used to obtain air temperatures at a location remote from the observer. It is an electrical resistance thermometer, the resistance of which changes with the temperature. The instruments are calibrated to read directly in degrees Fahrenheit.

5200. RECORDING THERMOMETERS

5210. THERMOGRAPH. The thermograph consists of a temperature-sensitive element whose movements are communicated by suitable linkage to a pen bearing upon a chart that is mounted on a clock-driven drum. A continuous record of temperature is traced upon the chart, which is called a thermogram. The temperature-sensitive element is either a bimetallic thermometer or a Bourdon-tube assembly. When the thermograph is combined with a humidity measuring instrument it is called a hygrothermograph. The thermograph should be mounted on a horizontal platform with the base at least six inches above the bottom of the shelter. The case should be so oriented as to place the temperature-sensing unit as close to the center of the shelter as practicable.

*5210.1. As the temperature changes in the Bourdon-tube thermograph, the change in the volume of the liquid in the Bourdon tube modifies the curvature of the tube. When one end of the tube is in a fixed position, and the free end connected to a pen through a linkage system, a continuous temperature record is traced on the thermogram. The effective pen-arm length (the distance from the pen point to the axis of rotation of the pen arm) should be maintained. This distance is the radius of curvature of the time arcs on the chart in use, e.g., for use with WB. Form 1076, the effective pen-arm length is 5.51 inches (14 cm.); for WB. Form 1075, the length is 7 inches (17.75 cm.) with center of rotation 4.8 cm. (approx. 1-7/8 in.) above the trim line of the chart. The period of rotation of the record cylinder is determined by the gear and pinion used; 29- and 176-hour (generally referred to as 1- and 7-day) gear-and-pinion sets are available, with

5340. HEIGHT OF DRY-BULB ABOVE SNOW SURFACE. Favorable exposure sites within 200 feet of the instrument shelter should be sketched on a map to assist in selecting a suitable site for exposing the snow surface thermometer under various conditions. When there is no snow on the ground, compute the differences in elevation between these exposure sites and the dry-bulb thermometer. The height of the dry-bulb above the snow surface at each observation thereafter will be determined by subtracting algebraically the depth of snow under the exposed thermometer from the difference in elevation between the exposure site and the dry-bulb thermometer.

5400. WATER TEMPERATURE OBSERVATIONS (WEATHER BUREAU AND NAVY STATIONS ONLY)

5410. At Weather Bureau and Navy stations having sea or lake water thermometer installations available, read the temperature of the water surface to the nearest 0.1°F.

5500. ENTRIES ON WBAN-10

5510. TEMPERATURE. (Col. 7) Enter the dry-bulb temperature to the nearest whole degree Fahrenheit. Prefix a minus sign to temperatures below zero.

5520. REMARKS. (Cols. 14A and 14B) At Weather Bureau stations enter dry- and wet-bulb temperature readings taken for specialized purposes in these columns.

5530. DRY-BULB. (Col. 18) Enter the dry-bulb temperature to the nearest degree and tenth, Fahrenheit, prefixing minus signs as required.

5531. At Weather Bureau stations equipped with telepsychrometers, when the dry-bulb is above 20°F., but the wet-bulb is 33° or less, enter the dry-bulb temperature obtained from the telepsychrometer in column 18.

*5540. WET-BULB. (Col. 19) Enter the temperature of the wet-bulb to the nearest degree and tenth, prefixing minus signs as required. At stations using form WBAN-10B, when the dry-bulb temperature is below -35°F., enter the dry-bulb temperature from column 18 in parentheses in column 19. (See par. 11020.)

5541. At Weather Bureau stations equipped with telepsychrometers, when the wet-bulb is 33°F. or less and the dry-bulb is above 20°F., enter in column 19 the wet-bulb temperature as computed on the psychrometric diagram[1/], using (1) the dry-bulb temperature obtained from the telepsychrometer and (2) the dew point obtained from mercurial thermometers.

1/ Relating dew point, dry- and wet-bulb temperatures.

5550. MAXIMUM AND MINIMUM TEMPERATURES. (Cols. 47 and 48) Enter these data only at stations equipped with maximum and minimum thermometers, telepsychrometers, or thermographs. Enter the maximum and minimum temperatures to whole degrees Fahrenheit for the six hours ending with the observation. Take the data from telepsychrometer or maximum and minimum thermometers, if available; if not, from the thermomograph. Note that these temperatures must be as high and low respectively as any temperature recorded in the preceding six hours, including the current temperature. If the hourly temperatures are inconsistent with the maximum and minimum readings, assume that the hourly readings are correct and adjust the maximum and minimum readings accordingly. On the line captioned "Mid" enter the maximum and minimum temperatures occurring between midnight and the preceding 6-hourly observation1/. On the line captioned "Mid to", enter the maximum and minimum temperatures occurring between midnight and the succeeding 6-hourly observation. Note that these are not necessarily the maximum and minimum temperatures for the 6-hourly observation. At stations not taking midnight observations, the data will be taken from the thermograph, if available; otherwise, the entry will be omitted.

5560. WATER TEMPERATURE. (Col. 55) On ships and at Weather Bureau and Navy land stations where water temperatures are read, enter data to degrees and tenths Fahrenheit.

5570. SOIL TEMPERATURE. (Col. 56) At designated Weather Bureau stations, enter soil temperature to degrees and tenths Fahrenheit.

*5580. MAXIMUM AND MINIMUM TEMPERATURES. (Cols. 66-67) Enter these data in whole degrees Fahrenheit. Entries may be omitted in these columns at CAA stations if the equivalent values are available from the entries in columns 47 and 48, as appropriate, from the forms constituting the day's record (see par. 11001.1). Note that the maximum and minimum temperatures must be at least as high and low, respectively, as any temperature recorded through the day.

5590. SNOW SURFACE TEMPERATURE. (Col. 90) At Weather Bureau stations observing these data (see par. 5310), enter snow surface temperature and related data. Example: "SNW SFC TMP -20°C., 0410 GCT, 4.6 FT. DIF."

1/ See footnote to par. 4310.

TABLE 10B—*Relative humidity conversion table*

Tabular values are relative humidities with respect to water (RH_w) corresponding to relative humidities with respect to ice (RH_i) given at heads of the columns]

Dry-bulb temp. (°F)	Relative humidity with respect to ice (RH_i)										Dry bulb temp. (° F)	Relative humidity ratio RH_w/RH_i
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		
	%	%	%	%	%	%	%	%	%	%		
−60	6.1	12.3	18.4	24.5	30.7	36.8	42.9	49.0	55.2	61.3	−60	0.6130
−59	6.2	12.3	18.5	24.6	30.8	37.0	43.1	49.3	55.4	61.6	−59	.6160
−58	6.2	12.4	18.6	24.8	31.0	37.1	43.3	49.5	55.7	61.9	−58	.6191
−57	6.2	12.4	18.7	24.9	31.1	37.3	43.5	49.8	56.0	62.2	−57	.6220
−56	6.3	12.5	18.8	25.0	31.3	37.5	43.8	50.0	56.3	62.5	−56	.6252
−55	6.3	12.6	18.9	25.1	31.4	37.7	44.0	50.3	56.6	62.8	−55	.6284
−54	6.3	12.6	18.9	25.3	31.6	37.9	44.2	50.5	56.8	63.1	−54	.6315
−53	6.3	12.7	19.0	25.4	31.7	38.1	44.4	50.8	57.1	63.5	−53	.6347
−52	6.4	12.8	19.1	25.5	31.9	38.3	44.7	51.0	57.4	63.8	−52	.6379
−51	6.4	12.8	19.2	25.6	32.1	38.5	44.9	51.3	57.7	64.1	−51	.6412
−50	6.4	12.9	19.3	25.8	32.2	38.7	45.1	51.5	58.0	64.4	−50	.6444
−49	6.5	13.0	19.4	25.9	32.4	38.9	45.4	51.8	58.3	64.8	−49	.6479
−48	6.5	13.0	19.5	26.0	32.5	39.0	45.6	52.1	58.6	65.1	−48	.6507
−47	6.5	13.1	19.6	26.2	32.7	39.2	45.8	52.3	58.9	65.4	−47	.6541
−46	6.6	13.2	19.7	26.3	32.9	39.5	46.0	52.6	59.2	65.8	−46	.6576
−45	6.6	13.2	19.8	26.4	33.1	39.7	46.3	52.9	59.5	66.1	−45	.6611
−44	6.6	13.3	19.9	26.6	33.2	39.9	46.5	53.2	59.8	66.5	−44	.6646
−43	6.7	13.4	20.0	26.7	33.4	40.1	46.7	53.4	60.1	66.8	−43	.6677
−42	6.7	13.4	20.1	26.9	33.6	40.3	47.0	53.7	60.4	67.2	−42	.6716
−41	6.8	13.5	20.3	27.0	33.8	40.5	47.3	54.0	60.8	67.5	−41	.6751
−40	6.8	13.6	20.4	27.1	33.9	40.7	47.5	54.3	61.1	67.8	−40	.6785
−39	6.8	13.6	20.5	27.3	34.1	40.9	47.7	54.6	61.4	68.2	−39	.6820
−38	6.9	13.7	20.6	27.4	34.3	41.1	48.0	54.8	61.7	68.6	−38	.6855
−37	6.9	13.8	20.7	27.6	34.5	41.4	48.3	55.2	62.1	69.0	−37	.6895
−36	6.9	13.9	20.8	27.7	34.6	41.6	48.5	55.4	62.3	69.3	−36	.6928
−35	7.0	13.9	20.9	27.9	34.8	41.8	48.8	55.7	62.7	69.6	−35	.6965
−34	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	63.0	70.0	−34	.7002
−33	7.0	14.1	21.1	28.2	35.2	42.2	49.3	56.3	63.4	70.4	−33	.7039
−32	7.1	14.2	21.2	28.3	35.4	42.5	49.5	56.6	63.7	70.8	−32	.7077
−31	7.1	14.2	21.3	28.5	35.6	42.7	49.8	56.9	64.0	71.1	−31	.7114
−30	7.2	14.3	21.5	28.6	35.8	42.9	50.1	57.2	64.4	71.5	−30	.7152
−29	7.2	14.4	21.6	28.8	36.0	43.2	50.3	57.5	64.7	71.9	−29	.7192
−28	7.2	14.5	21.7	28.9	36.1	43.4	50.6	57.8	65.1	72.3	−28	.7229
−27	7.3	14.5	21.8	29.1	36.3	43.6	50.9	58.1	65.4	72.7	−27	.7267
−26	7.3	14.6	21.9	29.2	36.5	43.8	51.2	58.5	65.8	73.1	−26	.7308
−25	7.3	14.7	22.0	29.4	36.7	44.1	51.4	58.8	66.1	73.4	−25	.7344
−24	7.4	14.8	22.2	29.5	36.9	44.3	51.7	59.1	66.5	73.9	−24	.7386
−23	7.4	14.8	22.3	29.7	37.1	44.5	52.0	59.4	66.8	74.2	−23	.7425
−22	7.5	14.9	22.4	29.9	37.3	44.8	52.3	59.7	67.2	74.6	−22	.7465
−21	7.5	15.0	22.5	30.0	37.5	45.0	52.5	60.0	67.5	75.0	−21	.7504
−20	7.5	15.1	22.6	30.2	37.7	45.3	52.8	60.4	67.9	75.5	−20	.7546
−19	7.6	15.2	22.8	30.3	37.9	45.5	53.1	60.7	68.3	75.9	−19	.7586
−18	7.6	15.3	22.9	30.5	38.1	45.8	53.4	61.0	68.6	76.3	−18	.7627
−17	7.7	15.3	23.0	30.7	38.3	46.0	53.7	61.3	69.0	76.7	−17	.7668
−16	7.7	15.4	23.1	30.8	38.5	46.3	54.0	61.7	69.4	77.1	−16	.7709
−15	7.8	15.5	23.3	31.0	38.8	46.5	54.3	62.0	69.8	77.5	−15	.7751
−14	7.8	15.6	23.4	31.2	39.0	46.8	54.6	62.4	70.1	77.9	−14	.7794
−13	7.8	15.7	23.5	31.3	39.2	47.0	54.8	62.7	70.5	78.4	−13	.7835
−12	7.9	15.8	23.6	31.5	39.4	47.3	55.1	63.0	70.9	78.8	−12	.7878
−11	7.9	15.8	23.8	31.7	39.6	47.5	55.5	63.4	71.3	79.2	−11	.7922

NOTE: Saturation vapor pressures over ice and water, used in computing this table, are based on formulas by J. A. Goff and S. Gratch, *Trans. Amer. Soc. Heat. and Vent. Eng.*, vol. 52, p. 95 (1946). Formula for saturation vapor pressure over water assumed to apply from −60° F. to 140°F.

6200. HYGROGRAPH

6210. GENERAL. The hygrograph provides a continuous record of relative humidity. To read the relative humidity from the hygrograph, follow the same procedure as that for the thermograph, described in par. 5211. The scale is based on relative humidity values from 0 to 100 percent. When the hygrograph is adjusted to correspond with a psychrometric reading made at dry-bulb temperatures below freezing, the psychrometric value of relative humidity with respect to water will be used. Hygrograms will be evaluated according to local needs and the records disposed of locally. Hygrograph data will not be entered on observational records unless specifically authorized.

6300. HYGROTHERMOGRAPH (WEATHER BUREAU STATIONS ONLY)

6310. The hygrothermograph is a combination of the hygrograph and thermograph. The actuating elements - - a Bourdon tube for temperature and a bundle of hairs for humidity - - are placed side by side, each with its separate linkage and pen arm. Temperature and humidity are recorded simultaneously on separate portions of the chart. Instructions in Sec. 5200 will be followed with respect to the temperature portion of the record, and instructions in Sec. 6200 with respect to the humidity portion.

6400. ENTRIES ON WBAN-10

*6410. DEW POINT. (Col. 8) Enter the dew-point temperature to the nearest whole degree. Prefix a minus sign to dew-point temperatures below zero. At military and W.B. first-order stations only, whenever the air temperature is below -35°F., (1) regard the wet-bulb temperature as the same as the dry-bulb temperature, and (2) determine the corresponding dew point, with respect to water (see par. 6010.1). Enter the dew point in column 8 in parentheses. (See par. 11020.)

6420. RELATIVE HUMIDITY. (Col. 20) At Air Force, Navy, and first-order Weather Bureau stations, enter relative humidity for each record observation unless the air temperature is below -35°F. (See ¶ 11010.)

6421. At Weather Bureau stations equipped with telepsychrometers, whenever the wet-bulb is 33°F. or less and the dry-bulb is above 20°F., enter in column 20 the relative humidity as computed on the psychrometric calculator, using 1) the dry-bulb temperature obtained from the telepsychrometer, and 2) the dew-point temperature obtained from the mercurial thermometers.

6430. TWENTY-FOUR HOUR MAXIMUM RELATIVE HUMIDITY. (Col. 78) At stations computing hourly relative humidity, enter the maximum relative humidity as obtained from column 20. Omit entry if twenty-four record observations are not taken daily.

6440. TWENTY-FOUR HOUR MINIMUM RELATIVE HUMIDITY. (Col. 79) At stations computing hourly relative humidity, enter the minimum relative humidity as obtained from column 20. Omit entry if twenty-four record observations are not taken daily.

*7120. FIXED-CISTERN BAROMETERS. The Bowen fixed-cistern barometer is calibrated to give pressure readings in millibars; the attached thermometer is in the Celsius 1/ (centigrade) scale.

7121. Before reading the Bowen barometer:
(1) Read the attached thermometer to the nearest 0.5°C.
(2) Tap the barrel near the meniscus.
(3) Set the vernier as for the adjustable-cistern type.

7122. The vernier on this barometer is so made that 10 spaces on the vernier are equal in length to 19 millibar spaces on the scale. That is, the length of 1 division on the vernier is equivalent to 1.90 millibars.

7123. Read the barometer to the nearest 0.01 millibar as follows:
(1) If the zero line of the vernier is exactly opposite a line on the scale, read the scale directly to whole millibars at that line. If the zero line of the vernier falls between two lines on the scale, read the value of the lower line, and continue as indicated in (2) and (3) below.
(2) Select the line on the vernier that lies exactly opposite, or the shortest distance above, a line on the scale. Multiply the number of this vernier line by 0.10, and add the product to the reading obtained in step (1).
(3) Estimate the hundredths of millibars, and add the value to the result obtained in step (2).

7200. DETERMINATION OF STATION PRESSURE

7210. GENERAL. Station pressure is determined at fixed intervals by means of corrected mercurial barometer readings, and at intermediate times by means of aneroid barometers or barographs periodically corrected to mercurial readings. Station pressure from mercurial barometer readings is the pressure value obtained after all required corrections have been applied to the observed mercurial reading. Station pressure from aneroid barometers and barographs is the value obtained after the correction established from the mercurial barometer reading has been applied.

7220. STATION ELEVATION. Station pressure is related to an assigned station elevation (H_b) above mean sea level. This assigned elevation remains constant even should the station be moved to a different elevation. If it should be moved, a "removal correction" is applied to readings taken at the new location. The corrected reading is then very close to what it would have been if it had been taken at the original location.

7230. CORRECTIONS TO BAROMETER READINGS—GENERAL. Atmospheric pressure from the observed barometer readings must be corrected for temperature, local gravity, and instrumental error. In addition, to make the pressure value comparable with previous pressure values at the same station, the application of a removal correction may be required (see paragraph 7220). Corrections to be applied to the different types of mercurial barometers are described as follows.

*7231. CORRECTIONS TO ADJUSTABLE-CISTERN BAROMETERS. Corrections applied to readings of adjustable-cistern barometers comprise a temperature correction, a scale error and capillarity (instrumental) correction, local gravity correction, and sometimes a correction to assigned station elevation. The temperature correction is determined from the publication "Correction of Mercurial Barometer for Temperature, English Measures." Corrections for scale error and capillarity, local gravity, and removal are collectively referred to as the "sum of corrections." They are listed on the barometer correction card furnished with each barometer. The correction to station elevation may be constant. If the correction varies with temperature, owing to the amount of difference between assigned station elevation and the elevation of the barometer, the "sum of corrections" will be found on the back of the card. It will facilitate computation if the "sum of corrections" and the temperature corrections are incorporated into a single table. The algebraic sum of the temperature correction and the "sum of corrections," as defined above, in such a table is referred to as the total correction. To obtain the total correction from this table use as arguments the attached thermometer reading to the nearest 0.5° Fahrenheit or Celsius 1/ (centigrade) and the observed barometer reading in inches and thousandths or millibars and tenths.

1/ As defined in "The International Temperature Scale of 1948", 9th General Conference of International Committee on Weights and Measures at Paris, 1948.

7232. CORRECTIONS TO BOWEN FIXED-CISTERN BAROMETER. Corrections applied to the Bowen barometer comprise temperature, volume, gravity, residual, and removal (if required). These corrections are incorporated into a table furnished to the stations requiring it. To obtain the total corrections from this table, use as arguments the attached thermometer reading to the nearest 0.5° C. and the observed reading in millibars and hundredths.

7240. ANEROID BAROGRAPH. A continuous record of station pressure is recorded on a chart by the aneroid barograph. The barograph consists of an aneroid pressure unit with pen linkage, and a clock-driven drum upon which the chart is fastened. The scale of the 2½ to 1 open-scale microbarograph is magnified, or opened, so that a pressure difference of 1 inch of mercury is represented on the chart by a linear distance of 2½ inches. The distance between adjacent pressure ordinates printed on the chart is equivalent to 0.020 inch of mercury. On the 1 to 1 scale, a pressure difference of 1 inch of mercury is represented on the chart by a linear distance of 1 inch. The distance between adjacent pressure ordinates is equivalent to 0.050 inch of mercury.

7241. To determine station pressure from the barograph:

(1) Tap the instrument lightly, on the top of the case.

(2) Read to the nearest 0.005 inch the pressure value indicated by the position of the pen on the chart, estimating for values lying between the printed ordinates.

(3) Apply the correction established for the barograph in accordance with instructions in par. 7242.

7242. A barograph will not be used for original determination of pressure unless a correction is established every six hours by comparison with the station pressure determined from the mercurial or precision aneroid barometer or altimeter setting indicator. Determine to the nearest 0.005 inch or 0.1 mb. the correction necessary to make the barograph reading agree with the station pressure computed from the barometer reading. If this correction exceeds 0.05 inch, the barograph should be reset at the time the barometer reading is made. If the barometer is calibrated in millibars, the barograph correction will be determined by converting station pressure from millibars and tenths to inches and hundredths. Apply this correction to all barograph readings until another correction is established at the next succeeding 6-hourly comparison. Post the correction by entry on WBAN-10 and, if necessary, on a separate indicator so that it will be available to all personnel taking pressure readings from the barograph.

7243. Make a time-check line on the barograph sheet after the barograph correction is determined. This line should be about equal in length to the width of two divisions on the chart and should be made carefully to avoid injury to the delicate mechanism of the barograph. If the instrument is so exposed that the dash-pot liquid becomes cold, which prevents the pen from returning to position, do not make a time-check line.

7244. Whenever a reading is taken, ascertain that the clock is running and that the ink is flowing properly. When it appears that the pen will pass off the printed divisions of the chart, set the pen up or down, equivalent to one full inch of pressure, by means of the adjusting screw, renumber the lines accordingly, and indicate on the chart the time of the adjustment. (See Fig. 4.)

*7245 CHARTS. The elevation range of the barograph is indicated on the nameplate. At civil land stations, (1) select the chart for 4-day barographs to conform with the elevation of the barometer in accordance with Table 10c, and (2) use WB Form 1068E on 12-hour barographs. In general, military stations are provided with only one type of chart for each type of barograph, and will use 12-hour barographs only if specifically designated.

TABLE 10c. Barograph Charts (2-1/2 to 1 scale)

Elevation of Station Barometer (ft.)	Midway Isobar Pressure (inches)	Elevation of Station Barometer (ft.)	Midway Isobar Pressure (inches)	Elevation of Station Barometer (ft.)	Midway Isobar Pressure (inches)
0-30	30.25* or 29.75#	2361-2860	27.25*	6111-6710	23.75#
		2861-3370	26.75#	6711-7310	23.25*
31-490	29.75#	3371-3890	26.25*	7311-7920	22.75#
491-950	29.25*	3891-4420	25.75#	7921-8540	22.25*
951-1415	28.75#	4421-4970	25.25*	8541-9165	21.75#
1416-1880	28.25*	4971-5530	24.75#	9166-9790	21.25*
1881-2360	27.75#	5531-6110	24.25*	9791-10420	20.75#

*Use WB Form 1068C #Use WB Form 1068D

*7245.1. CHANGING CHARTS. Charts will be changed on 4-day barographs on the 1st, 5th, 9th, 13th, 17th, 21st, 25th, and 29th of the month, and on weekly barographs on the 1st, 8th, 15th, 22nd, and 29th. Charts on 12-hour barographs will be changed daily (i.e., after two rotations). The charts should be changed at the standard synoptic hour (0030 GCT, 0630 GCT, etc.) nearest to noon, LST. If for any reason the chart is not changed at the usual time, it will not be changed before the following 3-hourly pressure-tendency observation at stations where these data are observed, since an unbroken record is desirable for this observation; at stations not observing pressure tendency, the charts will be changed as soon as practicable.

*7245.11. Before placing a chart on the barograph, use a typewriter, rubber stamp, or pen and ink to enter the following data:

(1) In the upper left-hand corner, or in spaces provided, enter the name of the station and the type (WBO, WBAS, AFB, NAS, etc.), 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 chart on each noon line, or in the spaces provided, enter the date of the day's record.

(3) Immediately preceding the printed figures along the first and last time arcs, enter the appropriate figures to indicate the range and calibration of the chart (e.g., 28 preceding the printed "00" on the 28.00 inch line of charts graduated in inches of mercury).

(4) Near the point where the trace will begin, enter "ON," the time 1/, and the current station pressure 2/.

7245.12. To replace the chart, remove the pen from the chart by means of the lever mechanism, and lift the cylinder vertically until it is free of the spindle. Remove the cylinder and loosen the clip holding the chart to the cylinder, and remove the chart. Avoid storing or handling charts in a manner that might smear the trace before it is dry. Fit the replacement chart smoothly and tightly on the cylinder, with the bottom edge of the chart uniformly in contact with the flange at the bottom of the cylinder, and replace the clip. Inaccurately-cut charts should be trimmed along a line parallel to and 1/4 inch below the lower, horizontal boundary ordinate. Wind the clock and lower the cylinder gently over the center spindle until the gears have fully meshed, holding the cylinder by the top and bottom to avoid disturbing the position of the chart. Fill the pen with ink and return it almost to the surface of the chart. Adjust the pen, if necessary, for pressure and time (see pars. 7245.2 and 7245.3). Return the pen to the surface of the chart and check the inking action of the pen.

*7245.13. After adjustments or removal of a completed barogram:

(1) Enter the time of each adjustment, and an arrow to indicate the point of adjustment.

(2) Near the end of the trace, enter "OFF," the time 1/ of removal, and the current station pressure 2/.

(3) At military and first-order Weather Bureau stations only, enter, above the time-check lines, the corrections from column 65 of WBAN-10B (or column 60 of WB Form 1001B). Enter corrections in red ink.

(4) When adjustment for pressure is made, enter the current station pressure 2/, and corrections applying to both the preceding and following record, e. g., -.055/0, above the break in the trace (see Fig. 4).

(5) On 12-hour barograms, whenever the trace for successive cycles of rotation intersect, identify intervening segments of the trace as necessary to preserve the identity of the trace for each rotation (e.g., when each rotation is on a different day, enter the day of the month in a circle and use arrows to point to appropriate segments of the trace for one rotation.)

1/ Enter the local standard time to minutes.
2/ Enter the current station pressure (before rounding) as obtained from the mercurial or precision-aneroid barometer, or the altimeter setting indicator.

(3) Apply any necessary correction established in accordance with par. 7252.

7252. Corrections to be applied to precision-type aneroid barometers will be determined in accordance with instructions issued to the stations requiring them. Other types of aneroid barometers will not be used for original determination of pressure unless a correction is established at 6-hourly intervals by comparison with the station pressure determined from the mercurial or precision-aneroid barometer; or altimeter-setting indicator. This correction is the difference between the station pressure computed from the mercurial barometer reading and the pressure indicated at the same time by the aneroid barometer. Apply the correction to all aneroid readings until another is established at the next succeeding 6-hourly observation. Post the correction so that it will be available to all personnel taking pressure readings from the aneroid barometer.

7260. STATION PRESSURE FROM ALTIMETER-SETTING INDICATORS. At Weather Bureau and CAA stations, station pressure will be determined from altimeter-setting indicators in accordance with the following instructions, provided that the indicators are periodically compared with mercurial barometers as required by instructions issued to stations having both instruments.

(1) Determine the corrected altimeter setting to the nearest 0.005 inch from the altimeter-setting indicator.

(2) Find in the altimeter setting tables the tabular value corresponding to the altimeter setting determined in (1).

(3) Read at the side and top of the table the corresponding station pressure interpolating to the nearest 0.005 inch.

NOTE:- If the exact value of the altimeter setting determined in (1) does not appear in the altimeter setting tables, interpolate to obtain the station pressure and dispose of the thousandths digit in accordance with instructions in the Introduction.

7300. SEA-LEVEL PRESSURE

*7310. GENERAL. Sea-level pressure represents the atmospheric pressure at sea level under prevailing meteorological conditions of temperature and station pressure. When the station is not at sea level, the station pressure is said to be reduced to sea level. The reduction is accomplished by the use of tables supplied each station. The tables are based on the elevation of the individual station at which they are to be used, and upon certain assumptions implicit in the hypsometric equation employed in their computation. The reduction table may be expressed in inches of mercury, or expressed directly in millibars, according as the original pressure readings are in inches

or millibars. The arguments used in the tables are station pressure and temperature. Mean temperature intervals in the reduction tables generally vary with the station elevation as follows 1/:

Station elevation	Mean temperature intervals
0— 50 feet	None (constant correction)
51— 500 feet	10°
501—1000 feet	5°
1001 feet or more	2°

7320. REDUCTION OF STATION PRESSURE TO SEA-LEVEL PRESSURE. In reducing station pressure to sea-level pressure, use as arguments:

(1) The station pressure rounded to the nearest 0.01 inch or 0.1 millibar in accordance with instructions contained in the Introduction.

(2) The 12-hour mean temperature, to tenths, obtained from the current air temperature, and the air temperature 12 hours previously. If a temperature observation was not made 12 hours previously, determine from the thermograph, to whole degrees, the temperature 12 hours previously.

7321. Determine the sea-level pressure from reduction tables as follows:

(1) When observed values of mean temperature and station pressure correspond exactly with tabular arguments, find the sea-level pressure as a tabular value at the intersection of the respective columns.

(2) In all other instances, interpolate for pressure or temperature or both, by use of Proportional Parts Tables 10 d, e, f, and g, or by means of arithmetical interpolation.

7323. The station pressure will be reduced to sea-level by use of a sea-level reduction table and the Proportional Parts Tables 10d - k, in accordance with the following instructions. Each step in the instructions is illustrated by an example based upon a given station pressure and a given 12-hour mean temperature. A portion of the sea-level reduction table necessary for evaluation of the example is reproduced following par. 7324.

Given: Station pressure=24.17
12-hour mean temperature=58.7°

(1) Find the station pressure argument in the table next lower to the actual station pressure. In the example, 24.10 would be selected as next lower to 24.17.

(2) Find the temperature argument in the sea-level table next higher to the 12-hour mean temperature. In the example, 60 would be selected as next higher to 58.7.

(3) Find the tabular value at the intersection of the columns selected in accordance with (1) and (2) above. In the example, this tabular value would be 30.71.

(4) Find the vertical pressure difference between the tabular value selected in accordance with (3) above and the next higher tabular value. In the example this would be 0.01 (difference between 30.71 and the next higher value, 30.72).

(5) Find the horizontal pressure difference between the value found in accordance with (3) above and the next higher tabular value. In the example, the difference would be 0.12 (difference between 30.71 and the next higher horizontal value, 30.83).

(6) Find the temperature difference to tenths between the actual 12-hour mean temperature and the value selected in accordance with (2) above. In the example this would be 1.3 (the difference between 58.7 and 60.0).

(7) Find the pressure difference between the actual station pressure and the value selected in accordance with (1) above. In the example, this would be 0.07 (the difference between 24.17 and 24.10).

1/ Exceptions are treated individually by the service having administrative jurisdiction.

(8) To summarize, the following values have been found:
(a) Vertical pressure difference (this equals 0.01 in the example).
(b) Horizontal pressure difference (this equals 0.12 in the example).
(c) Temperature difference (this equals 1.3 in the example).
(d) Pressure difference (this equals 0.07 in the example).

(9) Select the vertical pressure versus temperature table of proportional parts appropriate to the station sea-level table in accordance with paragraph 7322. In the example, the difference between successive temperature arguments is 2°; therefore, proportional parts Table 10d is used.

(10) Using the table selected in accordance with (9), find the vertical pressure argument corresponding to the value found in (4) and the temperature argument corresponding to the value found in (6). Find the tabular value at the intersection of the respective columns. In the example this would be 0.007.

(11) Using proportional parts Table 10g, find the horizontal pressure argument corresponding to the value found in (5), and the pressure difference found in (7). Find the tabular value at the intersection of the respective columns. In the example, this would be 0.084.

(12) Add the values found in (3), (10), and (11). The sum is the sea-level pressure. In the example this would be 30.800, which is obtained as follows:
(a) From (3), a tabular value of sea-level pressure=30.71.
(b) From (10), an interpolated value of pressure using Table 10d = 0.007.
(c) From (11), an interpolated value of pressure using Table 10g = 0.084.
(d) From (12) a sum that equals the sea-level pressure=30.801.
The thousandths digit is disposed of in accordance with instructions contained in the Introduction.

*7324. Sea-level reductions in terms of millibars will be made similarly to the foregoing by use of Proportional Parts Tables 10d - k. In all operations, values as they appear in the tables will be carried forward to the final computation before disposing of the final digit.

PORTION OF SEA-LEVEL REDUCTION TABLE

Mean temperature (° F.)	Station pressure (inches)			
	24. 00	24. 10	24. 20	24. 30
56	30. 61	30. 74	30. 87	30. 99
58	30. 60	30. 72	30. 85	30. 98
60	30. 58	30. 71	30. 83	30. 96
62	30. 57	30. 69	30. 82	30. 95

Tables of Proportional Parts for Reduction of Pressure to Sea Level

Table 10d. Table of proportional parts for use with sea-level reduction tables having increments of 2° in temperature and 0.10 inch in pressure.

Temperature Increments °F	Vertical Tabular Differences (inch)			
	.01	.02	.03	.04
0.0	.000	.000	.000	.000
0.1	.001	.001	.002	.002
0.2	.001	.002	.003	.004
0.3	.002	.003	.005	.006
0.4	.002	.004	.006	.008
0.5	.003	.005	.008	.010
0.6	.003	.006	.009	.012
0.7	.004	.007	.011	.014
0.8	.004	.008	.012	.016
0.9	.005	.009	.014	.018
1.0	.005	.010	.015	.020
1.1	.006	.011	.017	.022
1.2	.006	.012	.018	.024
1.3	.007	.013	.020	.026
1.4	.007	.014	.021	.028
1.5	.008	.015	.023	.030
1.6	.008	.016	.024	.032
1.7	.009	.017	.026	.034
1.8	.009	.018	.027	.036
1.9	.010	.019	.029	.038
2.0	.010	.020	.030	.040

Table 10e. Table of proportional parts for use with sea-level reduction tables having increments of 5° in temperature and 0.10 inch in pressure.

Temperature Increments °F	Vertical Tabular Differences (inch)			
	.01	.02	.03	.04
0.0	.000	.000	.000	.000
0.1	.000	.000	.001	.001
0.2	.000	.001	.001	.002
0.3	.001	.001	.002	.002
0.4	.001	.002	.002	.003
0.5	.001	.002	.003	.004
0.6	.001	.002	.004	.005
0.7	.001	.003	.004	.006
0.8	.002	.003	.005	.006
0.9	.002	.004	.005	.007
1.0	.002	.004	.006	.008
2.0	.004	.008	.012	.016
3.0	.006	.012	.018	.024
4.0	.008	.016	.024	.032
5.0	.010	.020	.030	.040

Tables of Proportional Parts for Reduction of Pressure to Sea Level

Table 10f. Table of proportional parts for use with sea-level reduction tables having increments of 10° in temperature and 0.10 inch in pressure.

Temperature Increments °F	Vertical Tabular Differences (inch)			
	.01	.02	.03	.04
0.0	.000	.000	.000	.000
0.1	.000	.000	.000	.000
0.2	.000	.000	.001	.001
0.3	.000	.001	.001	.001
0.4	.000	.001	.001	.002
0.5	.001	.001	.002	.002
0.6	.001	.001	.002	.002
0.7	.001	.001	.002	.003
0.8	.001	.002	.002	.003
0.9	.001	.002	.003	.004
1.0	.001	.002	.003	.004
2.0	.002	.004	.006	.008
3.0	.003	.006	.009	.012
4.0	.004	.008	.012	.016
5.0	.005	.010	.015	.020
6.0	.006	.012	.018	.024
7.0	.007	.014	.021	.028
8.0	.008	.016	.024	.032
9.0	.009	.018	.027	.036
10.0	.010	.020	.030	.040

Table 10g. Table of proportional parts for use with all sea-level reduction tables in inches.

Pressure Increments (inch)	Horizontal Tabular Differences (inch)					
	.10	.11	.12	.13	.14	.15
0.00	.000	.000	.000	.000	.000	.000
0.01	.010	.011	.012	.013	.014	.015
0.02	.020	.022	.024	.026	.028	.030
0.03	.030	.033	.036	.039	.042	.045
0.04	.040	.044	.048	.052	.056	.060
0.05	.050	.055	.060	.065	.070	.075
0.06	.060	.066	.072	.078	.084	.090
0.07	.070	.077	.084	.091	.098	.105
0.08	.080	.088	.096	.104	.112	.120
0.09	.090	.099	.108	.117	.126	.135
0.10	.100	.110	.120	.130	.140	.150

Table 10h. Proportional parts for use with sea-level reduction tables, in millibars, having increments of 2° F. and 0.10 inch. Tabular values are tenths of millibars.

Temperature Increments (°F)	Vertical Tabular Differences														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
0.2	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2
0.3	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2
0.4	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3
0.5	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4
0.6	0	1	1	1	2	2	2	2	3	3	3	4	4	4	5
0.7	0	1	1	1	2	2	2	3	3	4	4	4	5	5	5
0.8	0	1	1	2	2	2	3	3	4	4	4	5	5	6	6
0.9	0	1	1	2	2	3	3	4	4	5	5	5	6	6	7
1.0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
1.1	1	1	2	2	3	3	4	4	5	6	6	7	7	8	8
1.2	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9
1.3	1	1	2	3	3	4	5	5	6	7	7	8	8	9	10
1.4	1	1	2	3	4	4	5	6	6	7	8	8	9	10	11
1.5	1	2	2	3	4	5	5	6	7	8	8	9	10	11	11
1.6	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12
1.7	1	2	3	3	4	5	6	7	8	9	9	10	11	12	13
1.8	1	2	3	4	5	5	6	7	8	9	10	11	12	13	14
1.9	1	2	3	4	5	6	7	8	9	10	10	11	12	13	14
2.0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Table 10i. Proportional parts for use with sea-level reduction tables, in millibars, having increments of 5° F. and 0.10 inch. Tabular values are tenths of millibars.

Temperature Increments (°F)	Vertical Tabular Differences														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
0.3	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
0.4	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
0.5	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2
0.6	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2
0.7	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2
0.8	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2
0.9	0	0	1	1	1	1	1	1	2	2	2	2	2	3	3
1.0	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3
2.0	0	1	1	2	2	2	3	3	4	4	4	5	5	6	6
3.0	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9
4.0	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12
5.0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Table 10j. Proportional parts for use with sea-level reduction tables, in millibars, having increments of 10° F. and 0.10 inch. Tabular values are tenths of millibars.

Temperature Increments (°F)	Vertical Tabular Differences														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
0.5	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
0.6	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
0.7	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
0.8	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
0.9	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
1.0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2
2.0	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3
3.0	0	1	1	1	2	2	2	2	3	3	3	4	4	4	5
4.0	0	1	1	2	2	2	3	3	4	4	4	5	5	6	6
5.0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
6.0	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9
7.0	1	1	2	3	4	4	5	6	6	7	8	8	9	10	11
8.0	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12
9.0	1	2	3	4	5	5	6	7	8	9	10	11	12	13	14
10.0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Table 10k. Proportional parts for use with all sea-level reduction tables in millibars. Tabular values are tenths of millibars.

Pressure Increments (inch)	Horizontal Tabular Differences																				
	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.01	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5
0.02	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10
0.03	9	9	10	10	10	11	11	11	11	12	12	12	13	13	13	14	14	14	14	15	15
0.04	12	12	13	13	14	14	14	15	15	16	16	16	17	17	18	18	18	19	19	20	20
0.05	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	24	25	25
0.06	18	19	19	20	20	21	22	22	23	23	24	25	25	26	26	27	28	28	29	29	30
0.07	21	22	22	23	24	25	25	26	27	27	28	29	29	30	31	32	32	33	34	34	35
0.08	24	25	26	26	27	28	29	30	30	31	32	33	34	34	35	36	37	38	38	39	40
0.09	27	28	29	30	31	32	32	33	34	35	36	37	38	39	40	41	41	42	43	44	45
0.10	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

PROPORTIONAL PARTS TABLE

7400. COMPUTATION OF HEIGHT OF THE 850-MILLIBAR SURFACE ABOVE SEA LEVEL

*7410. DESCRIPTION OF DIAGRAMS. The height in geopotential feet (gpft.) of the 850-millibar surface (25.10 inches of mercury) is computed by means of one of the hypsometric diagrams listed below. The diagrams used for the computation must have ranges of pressure and temperature that include the current values of station pressure and mean virtual temperature.

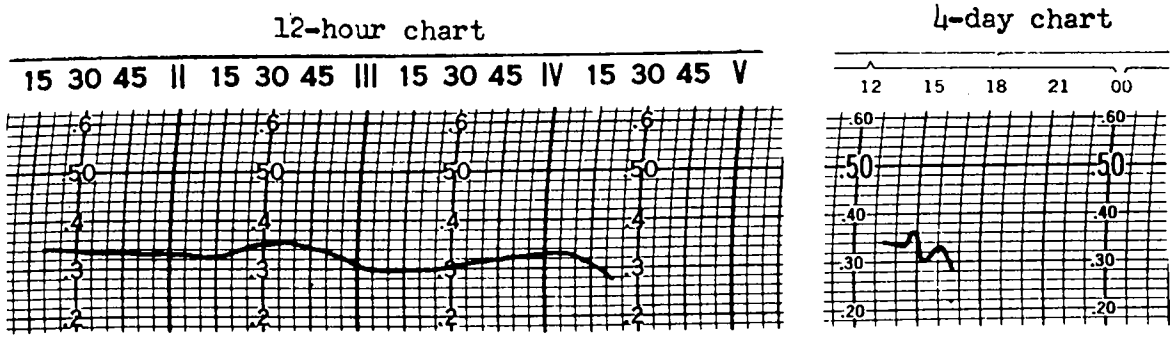
Form number	Temperature Range, °F	Pressure range, inches of mercury
1154C	10 to 90	28.80 to 25.10
1154D	10 to 90	27.70 to 22.75
1154E	10 to 90	25.10 to 20.60
1154F	−50 to 30	28.80 to 25.10
1154G	−50 to 30	28.00 to 22.50
1154H	−50 to 30	25.10 to 20.60

Forms 1154D and G are for intermediate values of pressure that overlap pressure ranges of other diagrams. Two linear scales, one in gpft. and one in kilometers, are printed at the left of the diagram. To the right of the diagram is a millibar-inch pressure conversion scale for use at stations supplied with barometers calibrated in millibars.

7420. DESCRIPTION OF SCALE. A gpft. scale which is available as a separate form, is used in computing the height of the 850-millibar surface. It is furnished in a height range from 2350 to 9500 feet for use with all diagrams listed in par. 7410. A kilometer scale is printed on the right in a range equivalent to the range of the gpft. scale. The station elevation in gpft. should be indicated on the scale with a fine, thin penciled arrow that extends across the width of the scale. The position of this arrow on the scale should be verified for accuracy by another of the station personnel, after which the arrow should be re-

*7621. Classify tendencies as 2 or 7 only if the difference in height between adjacent troughs and crests in two or more instances (such as between two adjacent crests and the intervening trough), equals or exceeds the distance represented by 0.02 inch of mercury (approx. 0.68 mb.) on the chart (see example A).

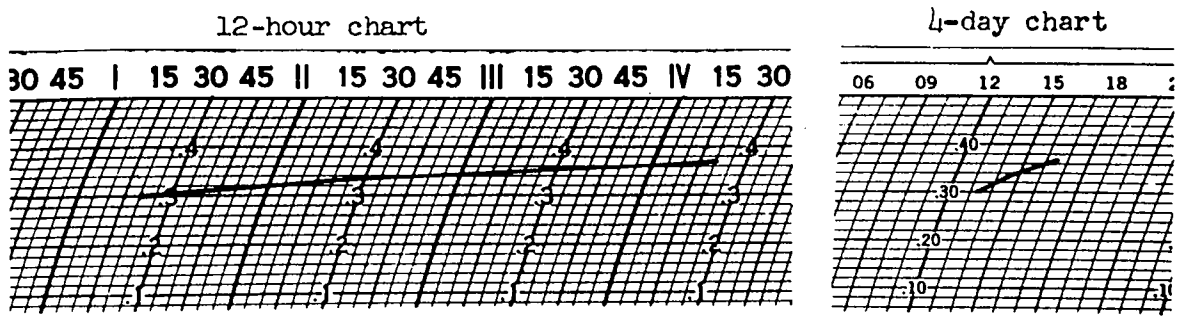
EXAMPLE A



This tendency should be classified as 7 because the amplitude of the pressure changes between the two crests and the intervening troughs are equal to 0.02 inch or more.

*7621.1. Classify tendencies as 3 or 8 only if the trace contains no points of discontinuity (see example B). A point of discontinuity is defined as a point at which the predominant slope of the latter part of the trace represents a change from the predominant slope of the earlier part of 0.02 inch of mercury (approx. 0.7 mb.) per hour or more.

EXAMPLE B

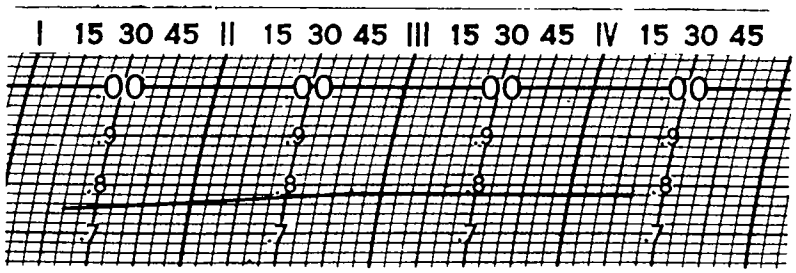


This tendency should be classified as 3 because the change in slope at the discontinuity is less than 0.02 inch per hour.

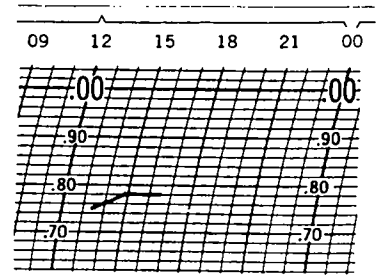
*7621.2. Classify tendencies as "0," "1," "4," "5," or "9" according to the general criteria in Table 10m and the additional instructions in par. 7622 when neither of the criteria in par. 7621 and 7621.1 applies (see example C).

EXAMPLE C

12-hour chart



4-day chart

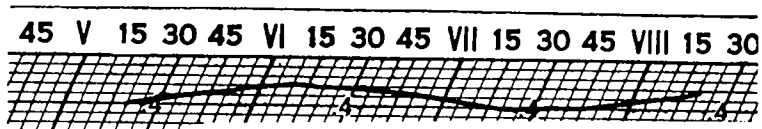


This tendency should be classified as 1 because the predominant slope of the latter part of the trace differs from the predominant slope of the earlier part by more than 0.02 inch of mercury per hour.

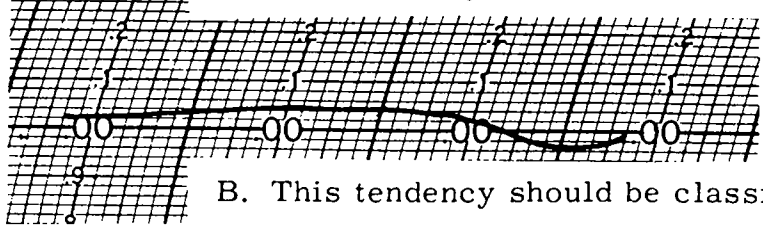
7622. When two or more characteristics apply, select the tendency that is representative of the latter portion of the trace (see examples A and B below), unless this tendency is not compatible with the net amount of change in the past three hours. In this latter case, select the tendency that is most descriptive of the entire 3-hour period and is also compatible with the net 3-hour change. (See examples C and D.)

EXAMPLES

12-hour chart

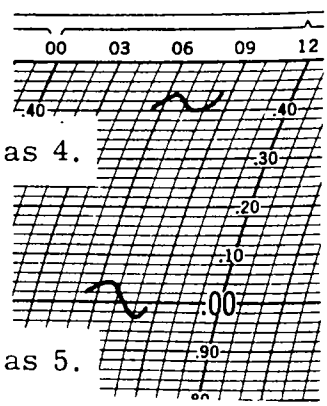


A. This tendency should be classified as 4.



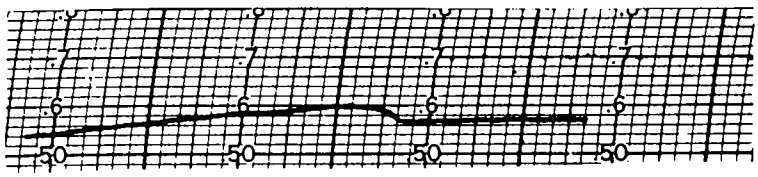
B. This tendency should be classified as 5.

4-day chart

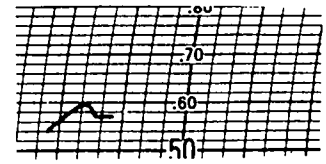


EXAMPLES

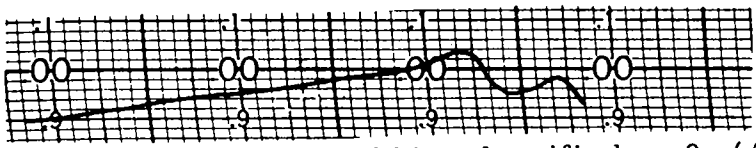
12-hour chart

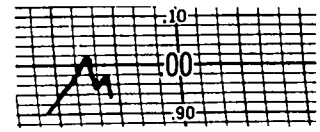


4-day chart



C. This tendency should be classified as 0. (Although numeral 6 of the tendency code is more representative of the latter portion of the period, it is not compatible with the positive sign of the net 3-hour change.)





D. This tendency should be classified as 0. (Although numeral 7 of the tendency code is more representative of the latter portion of of the period, it is not compatible with the positive sign of the net 3-hour change.)

7630. To find the amount of change, determine to the nearest 0.005 inch the net change over the interval. (See par. 7760.)

7640. When the barogram indicates a rapid fall in pressure followed by an abrupt rise, with both rise and fall at the rate of 0.06 inch per hour or more, the lowest pressure in the "V" will be noted and converted to sea-level pressure for reporting in accordance with par. 7730. The mean temperature used in the reduction will be determined in accordance with the following:

(1) When a thermograph is available, select the temperatures corresponding to the time of the lowest pressure and to the time 12 hours previously.

(2) When a thermograph is not available, select the temperatures at the preceding observation and at a time 12 hours previously.

7700. ENTRIES ON WBAN-10

7710. SEA-LEVEL PRESSURE. (Col. 6) Omit the initial "9" or "10" of the sea-level pressure and enter it as three figures (without a decimal point) representing tens, units, and tenths of millibars; e.g., enter 1013.2 as "132".

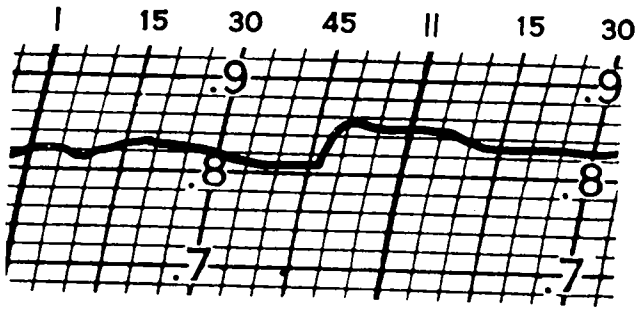
7720. ALTIMETER SETTING. (Col. 12) Omit the initial "2" or "3" of the altimeter setting and enter it as three figures (without a decimal point) representing units, tenths, and hundredths of inches; e.g., enter 29.94 as "994". At stations not equipped with mercurial barometers but requiring altimeter settings for operational purposes, prefix an "E" to the entry.

*7730. REMARKS. (Col. 13) Enter pressure data in column 13 as follows:

Observed	Entry
(1) Pressure rising or falling at rate of .06 inch per hour or more.	PRESRR or PRESFR
(2) Barogram "V" (see par. 7640)	Enter in the next record observation the lowest sea-level pressure in tens, units, and tenths of millibars, and time of occurrence LST; e.g., "LOWEST PRES 631 1745C".
(3) Pressure unsteady, as shown on the barogram by sharp troughs or crests that depart at least .03 inch from the mean trend.	PRES UNSTDY
(4) A pressure jump, as indicated by a pressure rise at a rate exceeding 0.005 inch per minute (0.01", or 0.34 mb. per two minutes), will be reported provided all of the following requirements are satisfied. (a) the rise is at least 0.02" (0.68 mb.) (b) the pressure for 20 minutes or more following the beginning of the jump remains at least 0.02" higher than at the beginning. (c) the beginning of the jump is distinctly separated from the beginning of any preceding jump by at least 20 minutes, and by a segment of the trace having a rise less rapid than 0.01" per two minutes, or steady, or falling.	PRJMP, followed by (1) magnitude of the jump (in hundredths of an inch), (2) the time that the jump began (in minutes past the hour) and (3) the time that the jump ended. If sent as a special (see par. 9131 and 9132.8), repeat this remark on the next succeeding record observation. Prefix the hour (LST) to minute values for times of more than one hour ago (with respect to filing time of observation); do not transmit data ending more than two hours ago. Use slants to separate numerical data, e.g.,"PRJMP 8/12/18" where 8 is the magnitude of the jump (i.e., .08"), 12 is the time (in minutes past the hour) when the jump began, and 18 is the time that the jump ended.

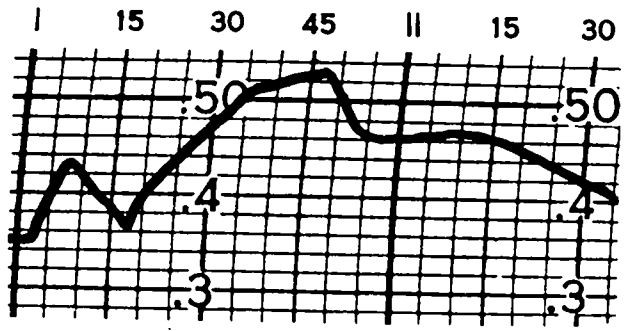
Note: Pressure jump data are observed and transmitted only at stations having 12-hour microbarographs (see Par. 9131 and 9132.8).

A.



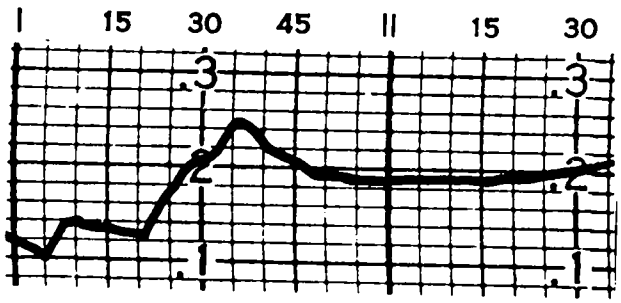
From 1347 to 1349 LST, the pressure increased from 28.81" to 28.85" at a rate in excess of 0.005"/min. The pressure remained at least 0.02" higher than at 1347 LST for at least 20 minutes. This jump was coded in a special observation as PRJMP 4/47/49. These data were reported again as remarks in the 1428 observation as PRJMP 4/47/49.

B.



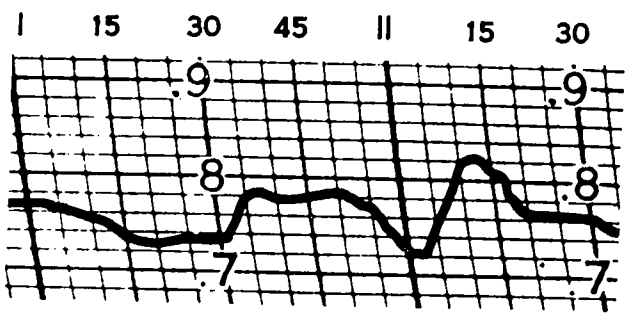
From 1302 to 1307 LST, the pressure increase satisfied requirement (a), but not (b). From 1318 to 1335 LST, (a), (b), and (c) were satisfied by an increase of 0.14" (from 28.37" to 28.51"). The jump was coded in a special as PRJMP 14/18/35. It was sent in the 1428 record observation as PRJMP 14/1318C/35.

C.



From 1305 to 1308 LST, the pressure increase (0.035") satisfied requirements (a), (b), and (c), therefore it was coded in a record-special observation at 1328 as PRJMP 4/05/08. The increase between 1322 and 1328 LST satisfied requirements (a) and (b) only, and the increase between 1331 and 1335 LST satisfied only requirement (a), therefore, neither was reported.

D.



From 1332 to 1335 LST, the pressure increase (0.045") satisfied requirements (a), (b), and (c), therefore the jump was coded in a special as PRJMP 5/32/35. Another jump of 0.095" between 1403 and 1410 LST was coded in a record-special with the preceding jump as PRJMPS 5/32/35 10/03/10.

* PRESSURE-JUMP EXAMPLES

*7740. STATION PRESSURE. (Col. 17) Enter station pressure to the nearest 0.005 inch determined from the available instrument appearing highest in the priority list in ¶ 7011. Omit entry if a mercurial barometer is not used for periodic comparisons with other pressure-measuring instruments. (Entries in this column will be used in determining sea-level pressure and altimeter setting, after being rounded to the nearest 0.01 inch.)

7750. PRESSURE TENDENCY. (Col. 37) Make this entry for 3- and 6-hourly synoptic observations at stations equipped with a barograph or microbarograph. Enter a single code figure, taken from Table 10d for pressure tendency during the 3-hour period ending at the time of observation. (See Sec. 7600.)

7760. NET THREE-HOUR PRESSURE-CHANGE. (Col. 38) Make entries in this column at stations where pressure tendencies are entered in accordance with ¶ 7750. Determine the net change in station pressure for the preceding three hours to the nearest 0.005 inch by subtracting corresponding entries in column 17. If an observation was not taken three hours earlier, determine the change from the barogram.

7770. HEIGHT OF 850-MILLIBAR SURFACE. (Col. 49) At stations whose elevations are between 2500 and 9500 feet, enter the height of the 850-millibar surface above sea level in feet to the nearest ten gpft.

7780. STATION PRESSURE COMPUTATIONS. (Lines 59-65) Enter station pressure computations for the 6-hourly synoptic observations as specified below:

7781. TIME. (Line 59) Enter the time of reading the barometer. (Note that this time will usually differ from that ascribed to the observation in columns 2 and 16.)

*7782. **ATTACHED THERMOMETER.** (Line 60) Enter the temperature of the thermometer attached to the mercurial barometer to the nearest 0.5° Fahrenheit or Celsius1/ (centigrade). Omit entries when the pressure readings are taken from precision aneroid barometers or altimeter-setting indicators.

1/ As defined in "The International Temperature Scale of 1948," 9th General Conference of International Committee on Weights and Measures at Paris, 1948.

7783. OBSERVED BAROMETER. (Line 61) Enter the uncorrected observed reading of the mercurial barometer to the nearest .001 inch or .05 mb.; or of the precision aneroid barometer to the nearest .005 inch or .1 mb. Omit entry if an altimeter-setting indicator is being used to determine station pressure (see par. 7011).

7784. TOTAL CORRECTION. (Line 62) Enter the sum of all corrections required to reduce the observed reading to station pressure. Omit entry if an altimeter-setting indicator is being used to determine station pressure.

7785. STATION PRESSURE. (Line 63) Enter to the nearest .001 inch or .05 mb. for mercurial barometer reading; to the nearest .005 inch or .1 mb. for precision aneroid or altimeter-setting indicator readings.

7786. BAROGRAPH READING. (Line 64) Enter to the nearest .005 inch or .2 mb. according as the barogram is graduated in millibars or inches. When the barogram is changed at the time of the 6-hourly observation, take the barograph reading from the new barogram.

7787. BAROGRAPH CORRECTION. (Line 65) Enter to the nearest .005 inch or .1 mb. with proper sign, the difference between the entries in lines 63 and 64, that is, line 63 minus line 64. If for any reason the barogram is changed after the time of the 6-hourly observation, enter the new barograph correction in column 90 and an asterisk in column 65 preceding the correction established at the time of the 6-hourly observation.

Observations will be discontinued when values above these minimums have been reported or when there are no impending aircraft operations. 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. 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, or to meet other local needs, will be taken and recorded, even though weather conditions do not warrant taking a special observation.1/ In this case, the name of the agency requesting the local extra observation will be noted under "Remarks."

*9143. Local extra observations of all elements ordinarily included in a record observation will be taken immediately following any aircraft accident or report of an aircraft in distress in the vicinity of the observing station. These observations are for record purposes only and need not be disseminated. The note "ACFT ACCIDENT" will be entered in column 13. 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 this observation may be taken promptly. If notification of an accident is not received immediately, the observation should nevertheless be taken immediately after notification, unless there has been an intervening observation. An explanatory note should be entered in column 90 (column 13 at SAWR stations) of WBAN-10 whenever this observation has been delayed.

*9150. CHECK OBSERVATIONS. The most recent observation will serve as the check observation for broadcast purposes. Specifically, a check observation:

A. Will be taken:
   (1) at all stations where scheduled aviation broadcasts of local weather are made, even though no significant changes in weather have occurred.
   (2) within 20 minutes of the time of broadcast, preferably as near that time as practicable, except when all personnel are engaged in duties authorized as paramount to the taking of check observations (e.g., the taking of a pilot balloon observation).

B. Will not be taken:
   (1) If an aviation observation has been taken within 20 minutes of broadcast time (see par. 9130).

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

(2) If the broadcast cannot be made because of equipment failure.1/

C. Need not be recorded on WBAN-10 if all elements in the observation remain unchanged from the immediately preceding record/or special observations.

9151. The check observations will include the following elements:

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

9160. GROUPING OF ELEMENTS. Aviation observations are disseminated in a code that consists of symbols and numerals arranged in relatively fixed positions. Word and phrase contractions or complete words are used in a specified manner to supplement the coded data. The letter symbol "M" is used to indicate missing data, or data entered in parentheses (see par. 11020), pertaining to an element normally included in a report. Elements regularly omitted are indicative of data not observed at a particular station. The elements of the observation are placed in groups as specified below, with slants and spaces used to separate numerical data that might otherwise be misinterpreted.

9161. HOURLY REPORTS. Data pertaining to record observations are coded in groups as follows: Station identification (space) ceiling, sky, visibility, weather, obstructions to vision (space) pressure (slant) temperature (slant) dew point, wind direction and speed (slant) altimeter setting (slant) and remarks. Additive data are separated by a slant and a space from the last element of the aviation observation. Except as stated in separate coding instructions (see also par. 11103.1), no specified sequence need be observed in appending these additional groups to the aviation observation.

EXAMPLE: DCA E18V⊕12 271/74/58 ← ↙ 8/032/CIG 16V20/ 2002

9162. OTHER REPORTS. Data pertaining to special, check, and local extra reports are grouped similarly to hourly observations insofar as the same data are transmitted (see pars. 9131, 9141, and 9150). Spaces will be used following type of report and time of report, which are sent for all special observations and for local extra and check observations if they are transmitted on local teletype circuits.

EXAMPLE: DCA S8 1009E E18V⊕12 ← ↙ 8/CIG 16V20

*9163. CORRECTED REPORTS. A report correcting a previously transmitted report will be identified by the letters "COR" immediately following the station identification. The report will include station

1/ A notation indicating the period of and reason for suspension of check observations will be entered on WBAN-10.

identifier and time. If the observation to be corrected is a special, record-special, or local extra report, the correcting report will also include type of report. If an error in a record, or record-special observation is discovered within the hour after the observation has been transmitted on the teletype, a correction will be filed immediately, regardless of special observations that might have been transmitted in the meantime. If an error is discovered in a special or local extra observation before the next succeeding observation is given teletype or local distribution, a correction will be filed. If an error is discovered in a check observation, a correction will be given to the broadcaster. When more than an hour has elapsed before an error in a transmitted observation has been discovered at the originating station, a corrected report will not be transmitted.

9163.1. A correction message may consist of a complete, corrected observation, or of a single element properly identified (e.g., COR 1328E ALSTG 969), whichever procedure is the shorter.

9170. CODING. Instructions in Chapters 1-8 will be observed in coding individual elements of observations for teletype and radio distribution. Instructions for the coding of station identification, type of report, and time are given in pars. 9171-9173.

9171. STATION IDENTIFICATION. The station identification is a three letter symbol assigned to the station for use in teletype transmissions. These symbols are listed in the Civil Aeronautics Administration publication "Location Identifiers."

9172. TYPE. Record observations are not identified by any symbol in teletype transmission. Special and record-special reports are identified by the letter "S" followed by a serial number (see par. 11101). Local extra reports transmitted on local teletype circuits are identified by the contraction "LCL."

*9173. TIME. The time of record and record-special observations is not included in the report, since the time of the sequence in which the reports are included appears at the heading of the sequence collection. Times will be included in corrected and special observations as specified in communications manuals (CAA or AACS).

9174. DELAYED OBSERVATIONS. When an observation is not available for transmission at the scheduled time but will be available later, file the abbreviation "DLAD" at the time of the scheduled observation.

*9180. DISSEMINATION. Record and special aviation observations will

be transmitted by teletype or radio where suitable facilities are available. These transmissions will be made in accordance with communication manuals specified by the individual services. When transmission is delayed until time for the next record or special observation, transmit only the latest observation and enter "FIBI" in column 13 of the observation not transmitted. When the observation not transmitted pertains to the phenomena listed in pars. 9132.4 to 9132.8, enter in remarks of the next succeeding transmitted observation: (a) the time of the observation not transmitted, (b) weather, obstructions to vision, and wind reported in that observation. (This remark may be omitted or abridged insofar as it duplicates data pertaining to tornadoes, waterspouts, or heavy thunderstorms, entered in accordance with Item 1(b), 1(c) and 2(b) of par. 3920.)

Examples

S5 1437E M15⊕2RW+ ↘25Q55↑1432E (FIBI)

S6 1448E M20⊕6RW- ↘15/1437E RW+ ↘25Q55↑1432E.

9181. LOCAL DISTRIBUTION. All observations will be distributed by a common airport communications system, when available, to local operational offices desiring them. If a single airport communications system is not available, observations will always be furnished to the tower, GCA units, and air-ground positions if desired by these units, and to other local operations if time and station workload permits.

9200. SYNOPTIC OBSERVATIONS

9210. Data to be included in synoptic observations are those specified in current synoptic codes. The required data will be observed and evaluated in accordance with instructions in this manual. Synoptic observations are coded directly from the corresponding hourly aviation observation, and are not separately recorded on WBAN-10A. In the event that rapidly changing conditions require that the synoptic observation differ from the corresponding aviation observation, enter a brief explanatory note in column 90.

9300. MIDNIGHT OBSERVATION

*9310. At midnight, local standard time, an observation of maximum and minimum temperatures and precipitation will be taken at all stations having personnel in duty status at that time, except that in time zones where a synoptic observation is begun within ten minutes of local midnight, the midnight observation need not be taken. Where the midnight observation is not taken, omit entries in columns 41 to 58 of WBAN-10 on the lines captioned "Mid" and "Mid to."

*Revised
Eff. 5-1-53

CHAPTER 10. PILOTS' REPORTS

10000. GENERAL

10010. Pilots' reports of meteorological phenomena encountered in flight are termed PIREPS. These reports of weather are an extremely valuable source of information that often is not otherwise available. Observers will cooperate to the fullest extent possible with pilots and with ground personnel to secure all available pilots' reports promptly.

10100. CODING

10110. GENERAL. All reference to heights of phenomena encountered in flight will be expressed in hundreds of feet to the nearest hundred above mean sea level 1/. Authorized weather symbols, international cloud abbreviations, and word and phrase contractions will be used; or if they are lacking, complete words. All phenomena having an authorized symbol (see Tables 8a and 8b) will be reported in symbol form followed, if required, by the appropriate intensity indicator. "U" will be used for "intensity unknown." If the phenomenon has been reported in general terms by the pilot ("precipitation" without indication of rain or snow, etc.) the phenomenon and its intensity will be reported in an authorized phrase contraction or, lacking that, in one or more complete words.

*10120. ARRANGEMENT OF ELEMENTS. Pireps will be coded in accordance with ¶ 10121 - 10128. In general, the order and contents of the coded elements will be:

(1) Station identification.

(2) Time and appropriate time zone indicator from Table 17 (page 112) corresponding to:
   a) time of entering report on WBAN-12 where this form is used, or
   b) time report is prepared for transmission at CAA stations.

(3) The term PIREP.

(4) Location or extent of phenomena with respect to an observing station or other well-known point. (If the original report by the pilot is with respect to a fan-marker or intersection point, it will be converted to the foregoing basis by the ground observer.)

(5) Time of pilot's observation, whenever known, and time-zone indicator from Table 17.

(6) Phenomena reported.

1/ Note.- Pilot reports of cloud heights used as a ceiling in aviation observations will be converted to feet above the surface by the observer and coded in accordance with ¶ 1440.

(7) Altitude of phenomena.

* (8) Type of aircraft, in reports of turbulence, condensation trails, and icing only.

10121. ICING. Use the contraction "ICG" with indication of intensity and type, if known. For example:

TRACE ICG = Trace of ice.
LGT RIME ICG = Light rime icing condition.
MDT ICG = Moderate icing condition.
HVY ICG = Heavy icing condition.

* EXAMPLES:

The pilot of a Stinson, flying between Seattle and Oakland, reports to Medford that at 0700 PST he encountered light icing conditions 5 to 20 miles north of Eugene, Ore., at 2000 feet MSL.

MFR 0715P PIREP 5-20 N EUG 0700P LGT ICG 20 STSN

The pilot of an F-51 flying between Oakland and Burbank reports that he encountered heavy icing conditions at 0925 PST over mountains north of Burbank, with the top of the icing at 11,500 MSL, base 10,000 (note that Air Force stations use GCT.):

SRF 1731Z PIREP MTNS N BUR 1725Z HVY ICG 100-115 F51

10122. ELECTRICAL DISCHARGE OR LIGHTNING STROKE. Use the word "DISCHARGE."

EXAMPLES:

A pilot flying a PBY between Richmond, Va., and Washington, D.C., reports to Washington that at 1620 EST his aircraft experienced an electrical discharge 20 miles south of Washington at an altitude of 5000 feet MSL:

DCA 1629E PIREP 20 S DCA 1620E DISCHARGE 50

The pilot of a liaison aircraft enroute from St. Louis, Mo. to

A pilot flying between Casper and Sheridan, Wyo., reports to Sheridan that the cloud base over Kaycee is 14,000 feet MSL. The type of aircraft was not reported, nor the time of the observation.

SHR 1850M PIREP 65 S SHR 140⊕

*10127. CONDENSATION TRAILS. Use the term CONTRAILS, followed by altitude in hundreds of feet MSL at which pilot reports CONTRAILS occurred, and type of aircraft when available.

EXAMPLE: A pilot of an F-86 30 miles south of Omaha, Nebraska, at 1425CST reports CONTRAILS occurring at 45,000 feet MSL:

OMA 1428C PIREP 30 S OMA 1425C CONTRAILS 450 F86

*10128. In addition to the elements indicated in ¶ 10121-10127, any other elements of meteorological or operational significance will be coded in the general form outlined in ¶ 10120.

10200. DISSEMINATION

10210. All pireps, including those pertaining to ceilings within 1.5 miles of any runway of the airport, will be disseminated in the same manner as special observations. (See ¶ 1444.1 for conditions under which pilots' reports of ceiling will also be incorporated into the current aviation observation.) Stations will enter pireps on Service A or, if Service A is not available, transmit them to the station designated to receive its scheduled observations. If a pirep and a record or special observation are available for transmission at the same time, the pirep will be added as a remark to the record or special observation. Similarly, two or more pireps may be combined to avoid repetition of the station identifier or other identical items. When two or more pireps that contain substantially the same information are available for transmission at the same time, only the most recent one will be sent. Air Force stations will disseminate pireps in accordance with instructions issued by wing or group commanders.

10300. ENTRY ON WBAN-12

10310. Pireps will be entered on WBAN-12. A new WBAN-12 will be started the first of each month, LST, and pireps for as many days as possible entered on each page. The period covered by each page will be indicated in the space provided for the date. Pireps for consecutive days will be separated by a line space and the date pertaining to the succeeding entries will be entered in this space near the center of the form. Dates will not be entered for days on which pireps are not

received. Duplicate entries of pireps on WBAN-10A are not required even though a pirep is appended to a record or special observation in accordance with ¶ 10210; however, such entries are optional if convenient for coding purposes. Column entries will be made on WBAN-12 in accordance with ¶ 10311 to 10314.

10311. TIME OF ENTRY. (Col. 1). Enter time in accordance with ¶ 11102.

10312. LOCATION OR EXTENT OF PHENOMENA, TIME OF OBSERVATION, PHENOMENA REPORTED, ALTITUDE OF PHENOMENA, TYPE OF AIRCRAFT. (Col. 2 - 6). Enter coded data in accordance with ¶ 10120 - 10127 (see Fig. 5). Omit entries in columns for which data are missing.

10313. DISSEMINATION. (Col. 7). At Air Force and Navy stations, enter "T" when the report has been disseminated by teletypewriter and "I" when it has been disseminated by interphone or other means to local operational interests; enter the GCT time in four figures (24-hour clock) following each entry of "I" or "T". Omit entry in this column at civil stations.

10314. OBSERVER'S INITIALS. (Col. 8). Enter initials of observer entering the observation on WBAN-12.

*Revised
Eff. 5-1-53

CHAPTER 11. ENTRIES ON FORM WBAN-10

11000. GENERAL

*11001. Form WBAN-10 will constitute the basic original record of surface observations at all land stations taking aviation observations.

*11001.1. Parts A and B will be used at all stations, except (1) at CAA stations designated to use part (CAA), and (2) SAWR and W.B. A-type stations which use part A only[1]. Unless otherwise specified[2], each day's observations, beginning with the first observation at or following 0000 local standard time, will begin on new pages. Additional pages will be used as required. At CAA stations, enter data in columns 41 to 90 on the sheet in use at the time of observation and prepare the form in duplicate.

*11001.2. Part D is not prepared at Air Force Stations; at other stations it will be prepared in accordance with instructions on the form, in the addendum, or both.

11002. Instructions in this chapter relate primarily to entry of nonmeteorological data. Instructions relating to meteorological elements will be found in the chapters pertaining to these elements.

11003. Enter observations as legibly as possible in chronological order, restricting data, so far as possible, to the columns appropriate to them as indicated by the column headings. Ditto marks will not be used. Use a black-lead drawing pencil (Venus 2H or 3H or equivalent), employing sufficient pressure to ensure legible copies and ample contrast for photographic reproduction. At stations where the form is used by the communications operator directly, slants to separate data in the aviation code may be used as specified in Chapter 9.

11004. The name of the station and date will be entered in the spaces provided. If stamps are used, use black ink.

11010. MISSING DATA. The symbol "M" will be entered only for missing data normally recorded. Appropriate notes explaining the missing data will be entered in column 90, or column 13 at SAWR stations.

11020. STATISTICAL DATA. Data entered in parentheses are for statistical purposes only, and are not to be transmitted as an element of an aviation observation.

11030. CORRECTION OF ENTRIES. When incorrect data have been entered, corrections will be made as follows:

11031. If the error is discovered before the report is transmitted, the erroneous entry will be neatly erased from all copies and correct entry made.

1/ SAWR and A-type W.B. stations provided with a mercurial barometer will use WBAN-10B for the entry of pressure data normally determined at the station.

2/ At W.B. SAWR stations, data for several days may be entered on each form, with the date corresponding to the data for each day entered on the line preceding them.

11032. If an error is discovered in an observation after the report is transmitted, a red line will be drawn through the erroneous entry only and the correction entered in red immediately above it. If a correction is transmitted, enter the phrase "COR (Time)" in red in column 13 of the erroneous observation. Carbon copies, if prepared will also be corrected in red.

* 11100. WBAN-10A and 10 (CAA)

11101. TYPE. (Col. 1) The type of report will be indicated by one of the following designations:

(1) R Record observation.

(2) S (followed by serial number) Special observation. Serial numbers are assigned consecutively for each day. Number 1 is the first special (or record-special) filed for transmission on or after 0000 LST, of a given day.

(3) RS (followed by serial number) Record-special observation.

(4) L Local extra observation.

(5) ✓ Check observation. (If a check observation requires local extra procedure, enter "L.")

11102. TIME ENTRIES. (Col. 2) The time ascribed to an observation is that of the last entry on WBAN-10. Entries will be in local standard time to the nearest minute in terms of the 24-hour clock, unless use of GCT is specifically authorized. The first two figures will indicate the hour, and the last two, the minutes. For example, 0000 indicates the beginning of the day; 0235 indicates 2:35 a.m.; 1346 indicates 1:46 p.m.; 2359 indicates the end of the day. The time based upon any of the standard time meridians can be converted to GCT by adding one hour for each 15° of longitude west of Greenwich. (See Table 17.)

TABLE 17. Meridians of standard time zones and conversion to GCT

Standard Time Zone	Letter Designator	Meridian	To Convert To GCT, add -
Atlantic Standard Time	- -	60°	4 hours.
Eastern Standard Time	E	75°	5 hours.
Central Standard Time	C	90°	6 hours.
Mountain Standard Time	M	105°	7 hours.
Pacific Standard Time	P	120°	8 hours.
Yukon Standard Time	Y	135°	9 hours.
Alaskan Standard Time	A	150°	10 hours.
Bering Standard Time	B	165°	11 hours.

11204.2. The direction of the sea is the direction, to eight points of the compass, from which the sea is coming. It is recorded as an arrow.

EXAMPLE: A rough sea (waves 5-8 feet) from the southwest would be recorded as "5↗."

*TABLE 20. State of sea

Code figures	Description	Approximate average wave height, feet[1]
0	Calm, sea like mirror	0
1	Smooth	Less than 1 ft.
2	Slight	1-3
3	Moderate	3-5
4	Rough	5-8
5	Very rough	8-12
6	High	12-20
7	Very high	20-40
8	Mountainous	More than 40
9[2]	Confused	— [2]

1/ Use smaller value when two code figures apply.
2/ Code figure 9 is used with code figures 1 through 8 to indicate that the direction of the waves is indeterminate. For example, a a very rough confused sea is entered 5-9; a mountainous confused sea is entered 8-9.

11205. SWELL, HEIGHT AND DIRECTION. (Col. 52) The term "swell" is restricted in usage to the wave motion that underlies the "sea" raised and driven by the local wind. Swell usually has traveled over a considerable distance from the point where it was generated by the wind, and its direction and height may often differ widely from those of the local wind-driven waves ("sea").

11205.1. Height of swell is recorded as the estimated average height of swell in the open sea, measured in whole feet from crest to trough.

11205.2. Direction of swell is the direction, to eight points of the compass, from which the swell is coming. It is recorded as an arrow.

EXAMPLE: A three-foot swell from the west would be recorded as "3→."

11206. SWELL PERIOD. (Col. 53) Swell period is the average time between successive crests, measured to the nearest second. The swell period usually can be observed best by watching the rise and fall in the swell of a patch of foam or other floating object. When the elapsed time, measured by a stop watch, of ten successive rises of such an object has been obtained, a good average period may be recorded by taking one-tenth of the value.

11207. SURF. (Col. 54) A five-figure code comprises the "Primary Data Group" of the combined Surf Code (SURFCO). Enter it every six hours at stations (and ships when appropriate) with means of observing surf condition.

11207.1. PRIMARY SURF DATA GROUP. A five-figure code group, symbol form $H_sH_sM_sP_sD_s$.

11207.2. SYMBOL H_sH_s. Average height of waves in feet. Ninety-nine indicates average height impossible to estimate. Two figures to be entered for whole feet.

EXAMPLE: 01 for 1 foot, 12 for 12 feet, etc.

11207.3. SYMBOL M_s. Difference between height of maximum waves and average waves in a 5-minute interval. Third figure in group to be entered in accordance with code Table 21.

TABLE 21. Surf (M_s)

Code No.	Difference between height of maximum waves and average waves	Code No.	Difference between height of maximum waves and average waves
0	0	7	7 feet.
1	1 foot.	8	8 feet.
2	2 feet.	9	Greater than 8 feet except when H_sH_s is reported as 99, in which case this figure means that an estimate is impossible.
3	3 feet.		
4	4 feet.		
5	5 feet.		
6	6 feet.		

11207.4. SYMBOL P_s. Period, i.e., time between passage of successive breakers at a fixed point. Fourth figure of group to be entered in accordance with code Table 22.

TABLE 22. Surf (P_s)

Code No.	Time between successive breakers	Code No.	Time between successive breakers
0	No surf.	5	11 or 12 seconds.
1	Less than 5 seconds.	6	13 to 15 seconds.
2	5 or 6 seconds.	7	16 to 18 seconds.
3	7 or 8 seconds.	8	Greater than 18 seconds.
4	9 or 10 seconds.	9	Time impossible to estimate.

11207.5. SYMBOL D_s. Angle of breakers with the beach and direction of wave travel (referred to observer on beach facing the sea.)

Enter fifth figure of group in accordance with Table 23.

TABLE 23. Surf (D_s)

Code No.	Angle of breakers with the beach	Code No.	Angle of breakers with the beach
0	Calm.	5	0° up to 10°
1	0° up to 10°	6	10° up to 20° from the right.
2	10° up to 20° from the left.	7	More than 20°
3	More than 20°	8	Confused, but predominantly from the right.
4	Confused, but predominantly from the left.	9	Not known.

11208. THICKNESS OF ICE ON WATER. (Col. 74) At designated Weather Bureau and Navy stations, enter this datum to the nearest 0.1 inch.

11209. FROZEN GROUND LAYER. (Cols. 75-76) At designated Weather Bureau and Navy stations, enter this datum to the nearest whole inch.

11210. RIVER GAGE. (Col. 77) At Weather Bureau stations where a river gage is read, enter the river gage reading to the nearest 0.1 foot.

*11211. (Cols. 80-81) Except in accordance with ¶ 4370, any data needed locally may be entered in columns 80 and 81, provided the nature of the data is properly identified in the column headings.

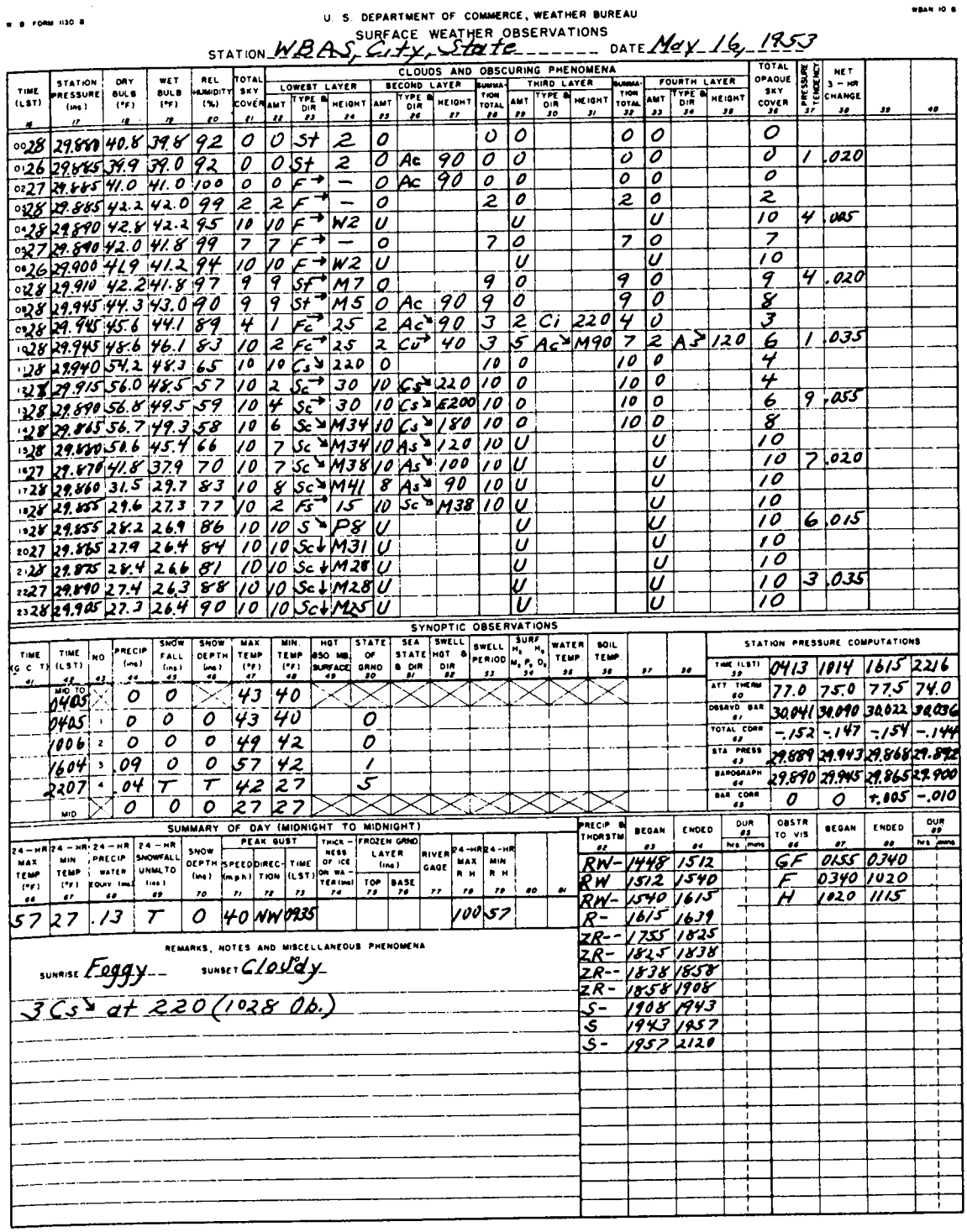
W B FORM 1130 A Revised 1-51 — U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU — WBAN 10A

SURFACE WEATHER OBSERVATIONS

STATION WBAS, City, State DATE May 16, 1953

TYPE 1	TIME (LST) 2	SKY and CEILING (Hundreds of Feet) 3	VISIBILITY (Miles) 4	WEATHER and OBSTRUCTIONS TO VISION 5	SEA LEVEL PRESS (mbs) 6	TEMP (°F) 7	DEW PT (°F) 8	WIND DIRECTION 9	WIND SPEED (m.p.h.) 10	WIND CHARACTER AND SHIFTS 11	ALTIMETER SET (ins) 12	REMARKS AND SUPPLEMENTAL CODED DATA 13	Selected Cir. N. References:
✓	0008	0	7					→	3		989	St NW	(1520(9)) (3911)
R	0028	0	7		125	41	39	→↘	4		989	PATCHS GF W	
✓	0106	0	7					→↗	2		990		
R	0126	0	7		129	40	38	→↗	3		990	107 6409	(11103.1) (2420(2))
✓	0208	0	5	GF				→↘	4		990	SFC VSBY 2 GFDEP 15	
R	0227	0	5	GF	129	41	41	→	5		990		
✓	0307	0	4	GF				→	4		990		
R	0328	-X	4	GF	129	42	42	→↘	5		990	SFC VSBY 2 GFDEP 25	(2420(2)) 1110 Tab. 1a
S1	0345	W2X	5/8	F				→↘	7				(9132.14.3)
S2	0402	W2X	3/8	F				→↘	10		990		(9132.3)
L	0415	W2X	3/8	F									(9141)
R	0428	W2X	3/8	F	129	43	42	→↘	11		990		
L	0445	W2X	3/8	F									
S3	0506	-X	7/8	F				→↘	10		990	VSBY N½E½W1	(2420(1))
L	0515	-X	7/8	F									
RS4	0527	-X	1/4	F	129	42	42	→↘	10		990		(9132.3)
L	0545	-X	1/4	F									
S5	0600	W2X	3/16	F				→↘	10		990	VSBY OV3/8	(2420(3))
L	0614	W2X	1/4	F				→↘	9				
R	0626	W2X	1/4	F	132	42	40	→↘	10		991		
S6	0645	-X	1/8	F				↘	10				(2010, 9132.14.3)
S7	0658	M7⊙	2	F				↘	10		991		(9132.14.3)
RS8	0728	M7V⊙	3	F	135	42	41	↘	10		992	CIG 5V8 407 6006	(1520(8), 11103.1)
✓	0808	E6⊙	3	F				↘	10				
S9	0816	A4⊙	2¼	F				↘	12				(1444.1)
RS10	0828	M5⊙90⊙	3	F	146	44	42	↘	14		995		(9132.1(4))
S11	0846	6⊙90⊙	3	F				↘	18				(9132.1(1))
✓	0907	6-⊙90⊙	4	F				↘	22 +30		995	CONTRAILS 220 MSL	(1520, 8430)
R	0928	25⊙90⊙220⊙	5	F	146	46	43	↘	24 Q 38		995	VSBY NW1½ BD	(8450)
✓	1005	25⊙90⊙220⊙	6	F				↘	23 +34		995	BD ON FLD NW	
R	1028	25⊙40⊙M90⊙											
		120⊙220⊕	6	H	146	49	44	↘	18 +27		995		(1510)
✓	1109	40⊙90⊙220-⊕	6	H				↘	17		995		(1410)
R	1128	220-⊕	7		146	54	43	↘	16		995		
✓	1206	220-⊕	8					↘	14		994		
R	1228	30⊙220-⊕	10		139	56	41	→↘	17		993		
✓	1302	30⊙220-⊕	12					→↘	16		991		
R	1328	30⊙E200⊕	12		129	57	43	→↘	19 +24		990	⊙V⊙ 919 5077	(1520(7))
✓	1406	M32⊙200⊕	12					↘	20 +27		989		
R	1428	M34⊙180⊕	15		122	57	42	→↘	22 +30		988		
✓	1507	M34⊙150⊕	10	RW-				→↘	21 +28		990		
RS12	1528	M34⊙120⊕	7	RW	125	51	40	→↘	V8		989	RWB48 PRJMP 4/58/59 LOWEST PRES 102.14.58P	(3920(4g), 7730(4))
✓	1609	M35⊙120⊕	8	RW-				↘	17		988		
R	1627	M38⊙100⊕	10	R-	116	42	33	↘	14		988		
✓	1710	38⊙M100⊕	10					↘	15		988		
R	1728	M41⊙90⊕	10		115	32	26	↘	25		987	RE39	(3920(4g))
✓	1806	15⊙M41⊙90⊕	9	ZR--				↓↘	12		987		
RS13	1828	15⊙M38⊕	7	ZR-	115	30	23	↓↘	14		987	ZRB55	(9132.6)
S14	1840	12⊙M38⊕	7	ZR--				↘	11				
S15	1859	12⊙M35⊕	6	ZR-				↘	12		987		
S16	1910	M31⊕	5	S-				↓↘	10				(9132.6)
RS17	1928	P8X	1	S-	115	28	24	↓↘	13		987	605	(9132.14.3)
L	1944	P7X	1/2	S									(9132.3)
S18	2000	P7X	3/4	S-				↓	11		987		

Fig 6. Entries on WBAN-10A.



W B FORM 1130 B — U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU — WBAN 10 B

SURFACE WEATHER OBSERVATIONS

STATION WBAS, City, State ——— DATE May 16, 1953

TIME (LST)	STATION PRESSURE (ins)	DRY BULB (°F)	WET BULB (°F)	REL HUMIDITY (%)	TOTAL SKY COVER	CLOUDS AND OBSCURING PHENOMENA: LOWEST LAYER AMT	LOWEST LAYER TYPE & DIR	LOWEST LAYER HEIGHT	SECOND LAYER AMT	SECOND LAYER TYPE & DIR	SECOND LAYER HEIGHT	SUMMATION TOTAL	THIRD LAYER AMT	THIRD LAYER TYPE & DIR	THIRD LAYER HEIGHT	SUMMATION TOTAL	FOURTH LAYER AMT	FOURTH LAYER TYPE & DIR	FOURTH LAYER HEIGHT	TOTAL OPAQUE SKY COVER	PRESSURE TENDENCY	NET 3-HR CHANGE		
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0028	29.880	40.8	39.8	92	0	0	St	2	0			0	0			0	0			0				
0126	29.885	39.9	39.0	92	0	0	St	2	0	Ac	90	0	0			0	0			0	1	.020		
0227	29.885	41.0	41.0	100	0	0	F→	—	0	Ac	90	0	0			0	0			0				
0328	29.885	42.2	42.0	99	2	2	F→	—	0			2	0			2	0			2				
0428	29.890	42.8	42.2	95	10	10	F→	W2	U				U				U			10	4	.005		
0527	29.890	42.0	41.8	99	7	7	F→	—	0			7	0			7	0			7				
0026	29.900	41.9	41.2	94	10	10	F→	W2	U				U				U			10				
0128	29.910	42.2	41.8	97	9	9	St→	M7	0			9	0			9	0			9	4	.020		
0228	29.945	44.3	43.0	90	9	9	St→	M5	0	Ac	90	9	0			9	0			8				
0328	29.945	45.6	44.1	89	4	1	Fc→	25	2	Ac↘	90	3	2	Ci	220	4	0			3				
1028	29.945	48.6	46.1	83	10	2	Fc→	25	2	Cu→	40	3	5	Ac↘	M90	7	2	As↘	120	6	1	.035		
1128	29.940	54.2	48.3	65	10	10	Cs↘	220	0			10	0			10	0			4				
1228	29.915	56.0	48.5	57	10	2	Sc→	30	10	Cs→	220	10	0			10	0			4				
1328	29.890	56.8	49.5	59	10	4	Sc→	30	10	Cs↘	6200	10	0			10	0			6	9	.055		
1428	29.865	56.7	49.3	58	10	6	Sc↘	M34	10	Cs↘	180	10	0			10	0			8				
1528	29.850	56.6	45.4	66	10	7	Sc↘	M34	10	As↘	120	10	U				U			10				
1627	29.870	41.8	37.9	70	10	7	Sc↘	M38	10	As↘	100	10	U				U			10	7	.020		
1728	29.860	31.5	29.7	83	10	8	Sc↘	M41	8	As↘	90	10	U				U			10				
1828	29.855	29.6	27.3	77	10	2	Fs→	15	10	Sc↘	M38	10	U				U			10				
1928	29.855	28.2	26.9	86	10	10	S↘	P8	U				U				U			10	6	.015		
2027	29.865	27.9	26.4	84	10	10	Sc↓	M31	U				U				U			10				
2128	29.875	28.4	26.6	81	10	10	Sc↓	M28	U				U				U			10				
2227	29.890	27.4	26.3	88	10	10	Sc↓	M28	U				U				U			10	3	.035		
2328	29.905	27.3	26.4	90	10	10	Sc↓	M25	U				U				U			10				

SYNOPTIC OBSERVATIONS

TIME (GCT)	TIME (LST)	NO	PRECIP (ins)	SNOW FALL (ins)	SNOW DEPTH (ins)	MAX TEMP (°F)	MIN TEMP (°F)	HGT (850 MB SURFACE)	STATE OF GRND	SEA STATE & DIR	SWELL HGT & DIR	SWELL PERIOD	SURF H_s H_s M_s P_s D_s	WATER TEMP	SOIL TEMP		
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
	MID TO 0405	X	0	0	X	43	40	X	X	X	X	X	X	X	X		
	0405	1	0	0	0	43	40		0								
	1006	2	0	0	0	49	42		0								
	1604	3	.09	0	0	57	42		1								
	2207	4	.04	T	T	42	27		5								
	MID	X	0	0	0	27	27	X	X	X	X	X	X	X	X		

STATION PRESSURE COMPUTATIONS

TIME (LST) 39	0413	1014	1615	2216
ATT THERM 60	77.0	75.0	77.5	74.0
OBSRVD BAR 61	30.041	30.090	30.022	30.036
TOTAL CORR 62	-.152	-.147	-.154	-.144
STA PRESS 63	29.889	29.943	29.868	29.892
BAROGRAPH 64	29.890	29.945	29.865	29.900
BAR CORR 65	0	0	+.005	-.010

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

24-HR MAX TEMP (°F)	24-HR MIN TEMP (°F)	24-HR PRECIP WATER EQUIV (ins)	24-HR SNOWFALL UNMELTED (ins)	SNOW DEPTH (ins)	PEAK GUST SPEED (mph)	PEAK GUST DIRECTION	PEAK GUST TIME (LST)	THICKNESS OF ICE ON WATER (ins)	FROZEN GRND LAYER (ins) TOP	FROZEN GRND LAYER (ins) BASE	RIVER GAGE	24-HR MAX R H	24-HR MIN R H		
66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
57	27	.13	T	0	40	NW	0935					100	57		

PRECIP & THDRSTM 82	BEGAN 83	ENDED 84	DUR 85 hrs	DUR 85 mins	OBSTR TO VIS 86	BEGAN 87	ENDED 88	DUR 89 hrs	DUR 89 mins
RW-	1448	1512			GF	0155	0340		
RW	1512	1540			F	0340	1020		
RW-	1540	1615			H	1020	1115		
R-	1615	1639							
ZR-	1755	1825							
ZR-	1825	1838							
ZR-	1838	1858							
ZR-	1858	1908							
S-	1908	1943							
S	1943	1957							
S-	1957	2120							

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

SUNRISE Foggy-- SUNSET Cloudy

3 Cs↘ at 220 (1028 Ob.)

Fig. 6a. Entries on WBAN-10B.

apparent size of the ship (or other object), and the portion visible. Use Table 25 as a guide in determining distances (e.g., in accordance with line 7 of Table 25, the horizon when viewed from a bridge 40 feet above sea level is 7.6 nautical miles away).

TABLE 25. Distance to objects on the horizon at sea (nautical miles)

Height of observer's eyes above sea level (feet)	Height of object above sea level (feet)														
	0 [1]	10	20	30	40	60	80	100	150	200	300	400	600	800	1,000
10	3.8	7.2	8.7	9.9	10.8	12.5	13.9	15.1	17.7	19.8	23.5	26.5	31.6	36.0	39.8
15	4.6	8.0	9.5	10.7	11.6	13.3	14.7	15.9	18.5	20.6	24.3	27.3	32.4	36.8	40.6
20	5.4	8.7	10.2	11.4	12.3	14.0	15.4	16.6	19.2	21.3	25.0	28.0	33.1	37.5	41.3
25	6.0	9.3	10.8	12.0	12.9	14.6	16.0	17.2	19.8	21.9	25.6	28.6	33.7	38.1	41.9
30	6.6	9.9	11.4	12.6	13.5	15.2	16.6	17.8	20.4	22.5	26.2	29.2	34.3	38.7	42.5
35	7.1	10.4	11.9	13.1	14.0	15.7	17.1	18.3	20.9	23.0	26.7	29.7	34.8	39.2	43.0
40	7.6	10.8	12.3	13.5	14.4	16.1	17.5	18.7	21.3	23.4	27.1	30.1	35.2	39.6	43.4
45	8.0	11.3	12.8	14.0	14.9	16.6	18.0	19.2	21.8	23.9	27.6	30.6	35.7	40.1	43.9
50	8.5	11.7	13.2	14.4	15.3	17.0	18.4	19.6	22.2	24.3	28.0	31.0	36.1	40.5	44.3
60	9.3	12.5	14.0	15.2	16.1	17.8	19.2	20.4	23.0	25.1	28.8	31.8	36.9	41.3	45.1
70	10.0	13.2	14.7	15.9	16.8	18.5	19.9	21.1	23.7	25.8	29.5	32.5	37.6	42.0	45.8
80	10.7	13.9	15.4	16.6	17.5	19.2	20.6	21.8	24.4	26.5	30.2	33.2	38.3	42.7	46.5
90	11.4	14.5	16.0	17.2	18.1	19.8	21.2	22.4	25.0	27.1	30.8	33.8	38.9	43.3	47.1
100	12.0	15.1	16.6	17.8	18.7	20.4	21.8	23.0	25.6	27.7	31.4	34.4	39.5	43.9	47.7

[1] Horizon.

12308. WEATHER AND OBSTRUCTIONS TO VISION (Col. 5). Enter weather and obstructions to vision in accordance with ¶ 3910 and 3911. Remarks referred to in ¶ 3920 are not required in marine observations, but may be entered on an optional basis when appropriate (see Fig. 8). Precipitation measurements referred to in Chapter 4 will not be made unless specifically authorized.

12309. SEA-LEVEL PRESSURE (Col. 6). Enter sea-level pressure in accordance with par. 7710, as determined from an aneroid barometer which has been compared with a mercurial barometer as specified in the addendum.

12310. TEMPERATURE AND DEW POINT (Cols. 7 and 8). Enter dry-bulb and dew-point temperature in accordance with pars. 5510 and 6410.

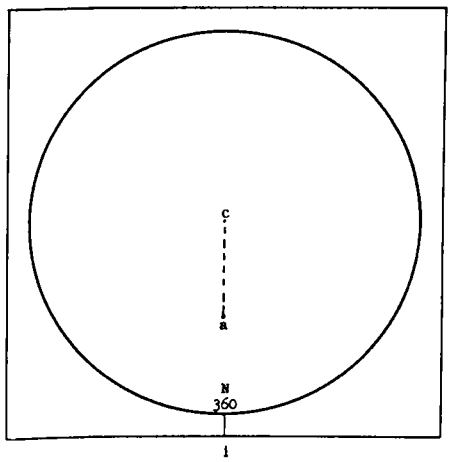
*12311. WIND (Cols. 9 - 11). Enter the true wind direction, speed (in knots), wind shifts, and gustiness in accordance with Section 8400. Compute true wind from apparent wind relative to the bow of the ship in accordance with par. 12311.1. Obtain apparent wind from instrumental equipment whenever available and adequately exposed; otherwise, estimate the apparent wind direction to the nearest 10 degrees off the starboard bow (clockwise), and the apparent wind speed to the nearest five knots in accordance with Table 26.

TABLE 26. Apparent wind speed

Speed (knots)	Indication
Less than 1	Calm; smoke rises vertically.
1–3	Smoke drifts from funnel.
4–6	Wind felt on face.
7–10	Wind extends light flag.
11–16	Wind raises dust, cinders, loose paper.
17–21	Wind waves and snaps flag briskly.
22–27	Whistling in rigging.
28–33	Inconvenience felt walking against wind.
34–40	Generally impedes progress.

* TABLE 27. Determination of true wind speed by sea condition

Speed in knots	Descriptive terms	Sea conditions	Wind force (Beaufort)
Less than 1	Calm	Sea smooth and mirror-like	0
1–3	Light air	Scale-like ripples without foam crests	1
4–6	Light breeze	Small, short wavelets; crests have a glassy appearance and do not break.	2
7–10	Gentle breeze	Large wavelets; some crests begin to break; foam of glassy appearance. Occasional white foam crests.	3
11–16	Moderate breeze	Small waves, becoming longer; fairly frequent white foam crests.	4
17–21	Fresh breeze	Moderate waves, taking a more pronounced long form; many white foam crests; there may be some spray.	5
22–27	Strong breeze	Large waves begin to form; white foam crests are more extensive everywhere; there may be some spray.	6
28–33	Moderate gale	Sea heaps up and white foam from breaking waves begin to be blown in streaks along the direction of the wind; spindrift begins.	7
34–40	Fresh gale	Moderately high waves of greater length; edges of crests break into spindrift; foam is blown in well-marked streaks along the direction of the wind.	8
41–47	Strong gale	High waves; dense streaks of foam along the direction of the wind; sea begins to roll; spray may reduce visibility.	9
48–55	Whole gale	Very high waves with long overhanging crests. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole, the surface of the sea is white in appearance. The rolling of the sea becomes heavy and shocklike. Visibility is reduced.	10
56–63	Storm	Exceptionally high waves that may obscure small and medium-sized ships. The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility reduced.	11
64 and above	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very much reduced.	12

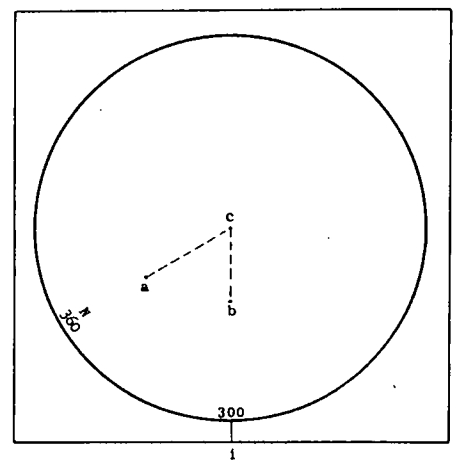


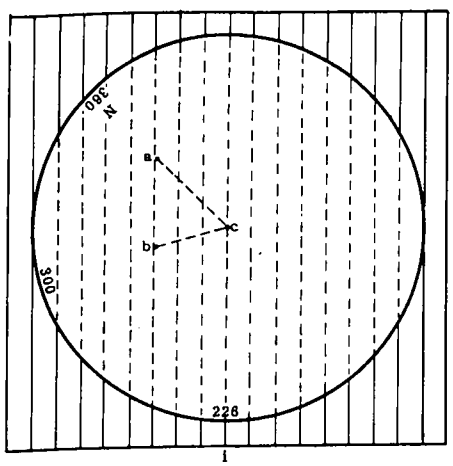
Given: 1) Ship's speed 20 knots.
2) Apparent wind 300° at 15 knots.
3) Ship's heading 160°.

Computation:

Step 1. Rotate the protractor until 360° is at bottom of protractor on index line "ci." Using any convenient scale, locate & identify point "a" on line "ci" 20 units distant from center of protractor "c" & toward point "i." The distance "ac" now represents the ship's speed of 20 knots.

Step 2. Rotate the protractor until the apparent wind direction, i.e., 300°, coincides with index line "ci." Using the same scale as in step 1, plot "b" along the index line 15 units distant from "c" and toward "i." This distance "bc" represents the apparent wind speed.





Step 3. Using the same scale as in step 1, obtain the true wind speed by measuring the distance from "a" to "b."

Step 4. Turn the protractor until the line determined by points "a" & "b" is parallel to the vertical parallel lines on the plotting board (beneath the protractor), and until point "a" is above point "b." Read the computed wind direction relative to the bow, i.e., 226°, from the edge of the protractor closest to the observer on line "ci."

Step 5. Add the ship's heading, i.e., 160°, to the direction obtained in step 4, i.e., 160 + 226 = 386. Since this sum is greater than 360, subtract 360 to obtain the true wind direction, i.e., 386 minus 360 = 26°, which is the true wind direction.

* Fig. 7. Computation of true wind from apparent wind (i.e., from the wind speed and direction relative to the bow).

*12311.01. Use the values in Table 27 as a check on computed true wind speeds. The following may also be used to check computed wind values:

(1) The true direction of the wind is always on the same side as, but farther from, the bow (port or starboard) than the apparent direction.

(2) The true speed of the wind is greater than the apparent whenever the apparent direction is aft of the beam.

(3) The true speed of the wind is less than the apparent whenever the true direction is forward of the beam.

*12311.1 To compute true wind from apparent wind (relative to the ship's bow), adjust a rotary protractor such as the winds-aloft plotting board so that 0° or 360° coincides with the index line at the edge of the protractor closest to the observer. Using any suitable scale, plot point "a" along this index line, at a distance from the center of the protractor representative of the ship's speed (see Fig. 7). Turn the protractor until the apparent wind direction (relative to the bow) in degrees coincides with the index line at the edge of the protractor closest to the observer. Using the same scale, plot point "b" along the index line at a distance from the center corresponding to the apparent wind speed. With the same scale, obtain the true wind speed by measuring the distance from "a" to "b". Turn the protractor so that point "a" is above point "b," and the line determined by "ab" is parallel to the index line (or any other vertical line - see Fig. 7, index line "ic"). Read the computed wind direction relative to the bow from the edge of the protractor at the index closest to the observer. The true wind direction is obtained by adding the ship's heading to the foregoing computed wind direction, and by subtracting 360 from sums that are greater than 360.

12312. ALTIMETER SETTING (Col. 12). Enter altimeter setting in accordance with par. 7720 on Naval vessels from which aircraft are operated. Omit entry on all other ships.

12312.1. Compute altimeter setting by applying a constant correction to the aneroid barometer reading. Compute this correction by determining the difference in height to the nearest foot between (a) the aneroid barometer and (b) a point ten feet above the landing area (flight deck, landing platform, or ocean surface). Multiply this difference by .001" and round to the nearest .01". Subtract this correction from the aneroid barometer reading if (a) is lower than (b), and add it if (a) is higher than (b).

EXAMPLE:

Given:

(a) Aneroid barometer height - 50 feet

(b) Flight deck height - 55 feet

(c) Aneroid barometer reading - 30.00

Computations:

(a) 55 feet (height of flight deck) + 10 feet = 65 feet

(b) 65 - 50 = 15 feet

(c) 15 x .001 = .015 (or .02 by rounding)

(d) Altimeter setting = 30.00 - .02 = 29.98

Change No. ⟶ 6

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UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

MANUAL OF

SURFACE OBSERVATIONS

(WBAN)

CIRCULAR N

Sixth Edition

(Revised)

October 1, 1954

WASHINGTON, D. C.

M 91.1
N

Change No. 6, effective October 1, 1954, consists of the following:

A. Pen and ink changes:

1. Change "statute miles" or "miles" to read "nautical miles" in the following places:

   a. Page 5, Par. 1431(3), line 3.

   b. Page 5, Par. 1432, line 3.

   c. Page 6, 1436(3), line 3.

   d. Page 15, Par. 1520(6,b), column captioned "Instructions for Entry."

2. Page 19, Figure 1a, add "At civil stations during the period Oct. 1 through Dec. 31, 1954, enter wind speeds in accordance with Pars. 8420 & 11004."

3. Page 36, Par. 3920(1), under the caption, "Instructions for Entry:"

   a. Insert "in knots" in item (b), line 3, following "gusts."

   b. In item (c), add "Distances other than visibility will be reported in nautical miles."

4. Page 105, Par. 10110, following the caption "GENERAL," add "All distances will be expressed in nautical miles, except visibility will be in statute miles."

5. Page 111, Par. 11004, add "At civil stations, delete "(m.p.h.)" and add "(kts.)" in the caption to column 10."

6. Page 120, Figure 6, add "At civil stations during the period Oct. 1 through Dec. 31, 1954, enter wind speeds in accordance with Pars. 8420 & 11004."

B. Page changes consist of pages 11-12, 95-96, and 113-114.

C. THIS PAGE MAY BE DISCARDED WHEN THE FOREGOING CHANGES HAVE BEEN MADE.

*1444. PILOT OBSERVATIONS. Height of clouds and obscuring phenomena will ordinarily be expressed by the pilot in terms of feet above mean sea level, and will be converted to feet above field elevation if necessary. It must be determined, in any case, whether the report refers to field elevation or sea level, and to a location within 1-1/2 nautical miles of any runway of the airport. Pilots' reports in which the ceiling is indicated as estimated, rather than obtained by actual flight near the base, will not be used as "aircraft" ceilings.

1444.1. When a pilot's report of ceiling meets the requirements for "aircraft" ceiling as specified in ¶ 1432 and 1444, but differs from the ceiling reported in the current observation, redetermine the ceiling immediately, provided a "measured" ceiling classification can be expected. Unless a "measured" ceiling can be obtained, the "aircraft" ceiling value will be considered current, and a special observation will be filed if required by ¶ 9132.1. If the redetermined ceiling value is classified as measured, the measured value will be considered as the current ceiling, but the pilot's report will nevertheless be distributed in accordance with ¶ 10210.

1445. BUILDINGS, ETC. Determination of heights may be based on the point at which layers are intercepted by objects (buildings, etc. other than natural landmarks) whose heights are known. Allow, so far as possible, for any appreciable slope in the layer from the point of observation to the point of interception of the object.

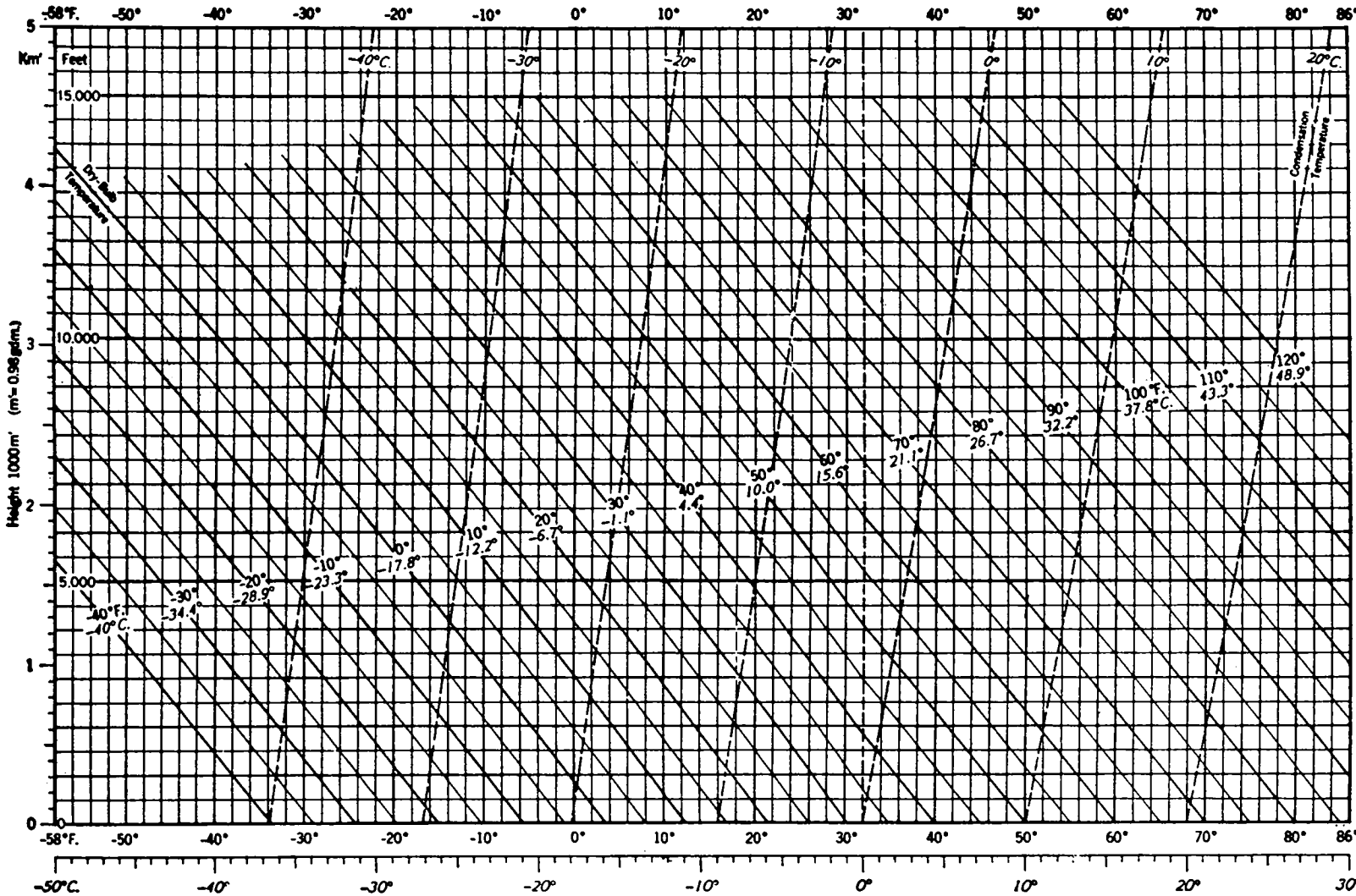
1446. NATURAL LANDMARKS. Heights based on the unobstructed portion of hills or mountains surrounding the station, when their height above the elevation of the station is known, will be classified as estimated. Orographic lifting may cause layers to differ in height from those immediately above the station. Estimates of height based on mountains more than 50 nautical miles away will not be regarded as applicable to those overhead.

1447. CONVECTIVE CLOUD HEIGHT DIAGRAM. This diagram eliminates the computations necessary in determining height of convective-type clouds by use of a dew-point formula. It is not suitable for use at stations situated in mountainous or hilly terrain and will, therefore, not be used at these stations. Heights determined in this manner will be classified as estimated. (See Fig. 1.)

1447.1. The diagram will be used only when the clouds present are formed by active surface convection near the point of observation. The diagram is usually most accurate when used to compute the height of cloud bases at or below 5000 feet; but at land stations in coastal regions, sea breezes frequently render it inapplicable to clouds formed over land before the onset of the sea breeze.

1447.2. Obtain the estimated height of a cloud base above the point of observation as follows:

(1) Locate the point of intersection of the vertical line



Dew-Point Temperature

FIGURE 1. - Diagram for determining height of convective-type clouds.

(Convert sub-freezing dew-point temperatures from a water to ice basis by means of Table 9 before using this diagram)

8333. In flat regions, wind shifts without precipitation, but accompanied by strong winds, sometimes occur. The visibility may be greatly restricted by blowing dust over extensive areas.

8400. ENTRIES ON WBAN-10

8410. WIND DIRECTION. (Col. 9) Enter the wind direction to sixteen points of the compass by means of one or two short arrows, as shown in Table 16. When the wind is calm, make no entry in this column.

TABLE 16. Wind direction symbols

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

*8420. WIND SPEED. (Cols. 10 & 11) Wind speed entries will be made in the following units:

Column No's.	10	10A	10B	11
Civil Stations	Knots 2/			Statute miles per hour in red 1/
Air Force Stations		Knots	Statute miles per hour in red	
Navy Stations	Knots			

1/ Enter at W.B. first-order and CAA stations for record observations only, following wind shift, gustiness and squall data (see Par. 8430-50).

2/ See Par. 11004.

Enter E immediately following the speed in knots for winds that are estimated. Enter C for calm.

*8430. GUSTINESS. (Col. 11) Report gusts by the symbol "+" immediately following the one-minute wind speed. Enter the peak speed, in knots, of gusts observed during the past 15 minutes immediately following this symbol. (See Fig. 6.) These data will be reported when they occur regardless of the type of wind equipment used. If estimated, enter E in accordance with par. 8420.

8440. **SHIFTS.** (Col. 11) **Enter the direction of the wind before the shift to sixteen points of the compass with short arrows followed by the local standard time of the shift (24-hour clock) and a letter denoting the local standard time zone. Since the space provided in column 11** is not sufficient for wind-shift data, distribute all wind data evenly among columns 9, 10, and 11; e.g., "↘25+40↖1614C" in these columns would indicate a wind shift from southeast to northwest at 1614 CST.

*8450. SQUALLS. (Col. 11) Report squalls by the symbol "Q" immediately following the one-minute wind speed and preceding the peak speed of gusts observed during the past 15 minutes (see Fig. 6 and Sec. 3300).

*8460. PEAK GUST. (Cols. 71 - 73) Enter this datum only at stations supplied with recording equipment other than single or multiple register. The peak gust is the highest speed recorded during the 24 hours ending at midnight. Enter (1) the direction to 16 points if suitable recording equipment is available, otherwise to eight points; (2) the speed to the **nearest knot; and (3) the time to the nearest minute.**

*11103. REMARKS. (Col. 13) Enter remarks in symbols or abbreviations specified in the CAA publication "Contractions" whenever possible; otherwise, use plain English. If necessary, use additional lines; it is not intended that the physical dimensions of the column shall limit in any way the information to be reported. Enter also additive data groups and raob data. Contractions pertaining to non-meteorological data, such as notices to airmen concerning broadcast facilities, may also be entered in the column if desired. Enter all distances in nautical miles except visibility.

*11103.1 Enter additive data pertaining to pressure, precipitation, clouds, and temperature in accordance with Table 18. (See par. 11103.11 for supplementary requirements pertaining to elements not generally observed at all stations.) Consult the 1949 Synoptic Code (or the abridgement provided stations that transmit additive data only) for coding instructions on individual elements.

*TABLE 18. Additive Data Requirements

(Note: The following specifications do not apply to SAWRS, nor to other second-order civil stations that have been individually authorized to omit certain elements listed below.)

Type of Station	Additive data at 6-hourly periods (0030Z, 0630Z, etc.)	Additive data at 3-hourly periods (0330Z, 0930Z, etc.)
(1) All Air Force and Navy stations; all civil stations in Alaska and overseas; and all first-order Weather Bureau stations that do not file either 3- or 6-hourly synoptic observations on Service C.	Pressure tendency and change; precipitation; clouds; and maximum and minimum temperatures. (appRR[1]/$C_LC_MC_HD_C$ $T_{n/x}T_{n/x}$)	Pressure tendency and change; clouds (app[1]/$C_LC_MC_HD_C$)
(2) First-order Weather Bureau stations filing both 3- and 6-hourly synoptic observations on Service C.	None	None
(3) First-order Weather Bureau stations filing 6-hourly but not 3-hourly synoptic observations on Service C.	None	Pressure tendency and change; clouds (app[1]/$C_LC_MC_HD_C$)
(4)[2] All second order civil stations designated to transmit additive data.	Pressure tendency and change; precipitation; maximum and minimum temperatures. (appRR[1]/$T_{n/x}T_{n/x}$)	Pressure tendency and change (app)

1/Plain language precipitation data and group 99ppp will be used to supplement these groups in accordance with synoptic coding instructions.

2/At combined Weather Bureau-CAA stations, when observations are taken by CAA personnel, additive data will be transmitted in accordance with (4), except that if CAA personnel file synoptic observations on Service C all additive data on Service A for the corresponding time will be omitted; when observations are taken by Weather Bureau personnel at this type of station, additive data will be filed in accordance with (1)-(3).