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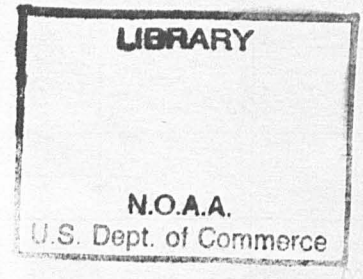
MANUAL OF
SURFACE OBSERVATIONS
ABRIDGED

(For SAWRS and A-Type Second-Order Stations)

FROM
CIRCULAR N
Sixth Edition
(Revised)



MARCH 1952

WASHINGTON, D. C.

National Oceanic and Atmospheric Administration

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March 21, 2005

RECORD OF CHANGES

Amendment number	Date effective	Pages affected	Initials	Date

FOREWORD

This manual is an abridged edition of the Manual of Surface Observations (WBAN) and the Weather Bureau addendum thereto. It will be used at the following types of second-order stations which take aviation observations:

(1) Cooperative Supplementary Aeronautical Weather Reporting Stations (SAWRS).

(2) Weather Bureau aviation, paid (A).

All material in the unabridged manual that pertains only to first-order or CAA stations has been deleted; in addition, certain paragraphs have been restated to meet the special needs of second-order stations. In all other respects, including the general organization and the numbering of paragraphs, the abridged edition corresponds to the basic manual.

Amendments to this manual will be issued as revised pages for insertion in the manual. 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.

A record of instrument maintenance performed (Form 1141) will be kept at all stations. This form will be bound after the last chapter of this manual and retained until it has been reviewed by a field aide.

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INTRODUCTION

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. Observations of clouds and obscuring phenomena 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 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 pars. 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).
O	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 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.

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, 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) 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 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 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.--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. 1/ (See Table 3 for heights computed for baselines of 500, 1000, and 1500 feet.)

1/ Baselines are expressed as the straight-line distances from the ceiling-light projector to established points of observation. When the baseline distance for an observation differs from the established distances, see par. 1441.1.

(8) Add algebraically to the value in Table 3 the difference between the height of the observation point and the field elevation; if the field elevation has not been established, add the height of the observation point above the ground. 2/

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

2/ 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.

1441.1. 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.

1441.2. Determination of Normal Penetration.—The average vertical extent of the brightest portion of the spot produced by a ceiling light is approximately 300 feet; this value 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 ceiling light, including those pertaining to very low layers, should be classified "measured."

1441.3. Correlation with Visual Observation.—Data taken from the 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.

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 field elevation; if the field elevation has not been established, add the height of the point of release above ground. 1/

1442.1. Limitations.--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.

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 filed in accordance with par. 10010.

1/ 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 Minutes and Seconds	10 gm. Spherical Nozzle lift - 45 gm.	30 gm. Nozzle lift - 139 gm.
0:10	80	120
0:20	170	230
0:30	250	350
0:40	330	470
0:50	420	590
1:00	500	710
1:10	580	820
1:20	650	920
1:30	730	1030
1:40	810	1140
1:50	880	1250
2:00	960	1360
2:30	1190	1680
3:00	1420	2010
3:30	1650	2320
4:00	1880	2630
4:30	2090	2940
5:00	2300	3250
5:30	2510	3540
6:00	2720	3840
6:30	2930	4130
7:00	3140	4430
7:30	3350	4720
8:00	3560	5020

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 layers 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 (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 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.

1451. At stations where hourly observations for scheduled transmission are taken, balloons will be used as follows during daylight hours 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

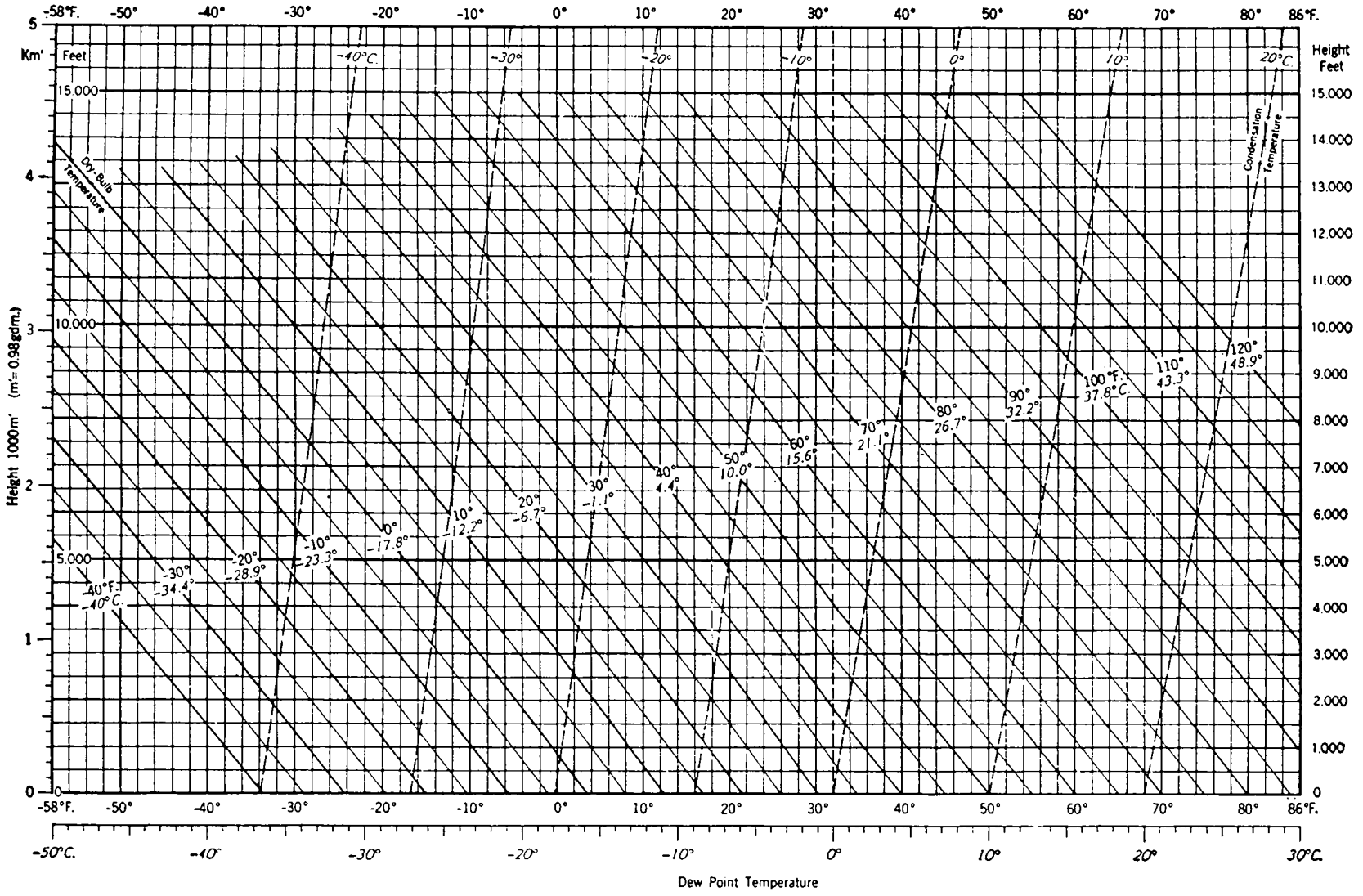


FIGURE 1.—Diagram for determining height of convective-type clouds.

(Convert sub-freezing dew-point temperatures from a water to ice basis by means of Table 9 before using this diagram)

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 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)

Opaque sky cover (cont'd.)

	Layers	Summation	Sky-Cover Symbol
(4)	0.1 sky cover at 1000' (Smoke aloft)	0.1	1⊘..(with remark: KLYR 1⊘)
	0.3 sky cover at 5000'	0.4	5⊘
	0.1 sky cover at 10,000'	0.5	1⊘⊘
(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	*1⊘-⊘
	0.2 sky cover at 5000' (all opaque)	1.0	0.4	*5⊘-⊕

*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".

Observed	Instructions for Entry
(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.
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 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. 13).—At each record hourly observation, enter tenths of total sky cover in column 13 adjacent to column 14A. (See 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.

W B FORM 1-30 A Revised 1-51

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU

SURFACE WEATHER OBSERVATIONS

STATION _____ DATE _____

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 (mph) (10)	WIND CHARACTER AND SHIFTS (11)	ALTIMETER SET (ins) (12)	REMARKS AND SUPPLEMENTAL COD (13)
		Obscuring Phenomena Aloft:										
		15-⊖										KLYR 15-⊖
		M8⊖										KLYR 8⊖
		Obscuring Phenomena At Surface:										
		P25X	2	TRWA								
		WOX	0	L-F								
		-X	2	F								
		Clouds and Obscuring Phenomena:										
		10⊖100⊖										KLYR 10⊖
		40⊖60⊖E200⊕										HLYR 60⊖
		M5⊖25⊕										KLYR 5⊖
		4⊖10⊖E20⊕										KLYR 20⊕
		15⊖30-⊖										KLYR 30-⊖
		-XE15⊖	5	H								
		M21⊖50-⊕										HLYR 50-⊕
		Multiple Overcast Layers:										
		5-⊕20-⊕E50⊕										HIR CLDS VSB

OBSERVED SKY CONDITION SERVING AS A BASIS FOR ENTRIES ON WBAN-10A

Layer of smoke covering 0.4 sky at measured (by ceiling light) height of 1500 feet. Ratio opaque to total sky cover 1/4.

Layer of smoke covering 0.9 sky at measured (by ceiling light soon after dark) height of 800 feet; 0.7 of layer opaque. Ratio opaque to total sky cover 7/9.

All of sky obscured by rain. Vertical visibility estimated 2500 feet on basis of ceiling light observation. Ratio opaque to total sky cover 10/10.

All of sky obscured by fog. Vertical visibility zero. Ratio opaque to total sky cover 10/10.

Fog obscures 0.8 sky; 0.2 sky visible overhead; therefore, vertical visibility unlimited, and obscuration is termed partial (see par.1510).

Layer of smoke (0.2 opaque) covering 0.4 sky at height of 1000 feet. Layer of clouds (0.2 opaque) covering 0.2 sky at 10,000 feet. Total sky cover 0.5. Ratio opaque to total sky cover 4/5.

Layer of clouds covering 0.2 sky at height of 4000 feet. Layer of smoke (0.2 opaque) covering 0.3 sky at 6000 feet; summation total at this level 0.5. Layer of clouds covering 0.6 sky at estimated height of 20,000 feet. Total sky cover 1.0. Ratio opaque to total sky cover 10/10.

Layer of smoke (0.5 opaque) covering 0.6 sky at measured height of 500 feet. Layer of clouds (0.6 opaque) covering 0.6 sky at 2500 feet. Total sky cover 1.0. Ratio opaque to total sky cover 10/10.

Layer of clouds (0.2 opaque) covering 0.2 sky at 400 feet. Layer of clouds (0.1 opaque) covering 0.1 sky at 1000 feet; summation total at this level 0.3. Layer of smoke (0.7 opaque) covering 0.7 sky at estimated height of 2000 feet. Total sky cover 9 . Ratio opaque to total sky cover 9+/9+.

Layer of clouds (0.2 opaque) covering 0.2 sky at 1500 feet. Layer of smoke (0.1 opaque) covering 0.6 sky at 3000 feet. Total sky cover 0.8. Ratio opaque to total sky cover 3/8.

Layer of haze obscuring 0.6 sky at surface. Layer of clouds (0.3 opaque) covering 0.3 sky at estimated height of 1500 feet. Total sky cover 0.8. Ratio opaque to total sky cover 8/8.

Layer of clouds (0.4 opaque) covering 0.6 sky at measured height of 2100 feet. Layer of haze (completely transparent) covering all of sky at 5000 feet. Total sky cover 1.0. Ratio opaque to total sky cover 4/10.

Layer of clouds (0.2 opaque) covering 1.0 sky at 500 feet. Layer of clouds (0.2 opaque) covering 0.2 sky at 2000 feet; summation total at this level 1.0; ratio opaque to summation-total sky cover at this level 4/10. Layer of clouds (0.4 opaque) covering 0.6 sky at estimated height of 5000 feet; summation total at this level 1.0; ratio opaque to summation-total sky cover at this level 8/10. Layer of clouds (0.1 opaque) covering 0.2 sky at 25,000 feet. Total sky cover 1.0. Ratio opaque to total sky cover 9/10.

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

A1300. CEILING LIGHTS

A1310. General.--A ceiling-light projector consists of a light source mounted at the focus of a parabolic reflector. The light is adjusted and aligned to project a vertical beam of light approximately three degrees in width.

A1311. The lights are rigidly mounted on a pipe support, which is usually set in or on a firmly-anchored concrete base. The light is controlled by a switch in the power-supply cable. The switch should be located conveniently near the office or point of observation, preferably the latter so that the observer may turn it on and off during an observation to facilitate identification of indistinct light spots. A pilot light is usually installed at the switch to indicate whether the light is on or off. Do not leave the lamp on longer than is necessary to take an observation. This precaution is particularly important at stations having projectors that use 1000 watt, 105-120 volt lamps.

A1320. K100- and K100B-Type Projectors.—The instructions in this paragraph are applicable to K100 (see Figs. A1-38 and A1-39) and K100B projectors,and are also generally applicable to older style projectors. The effectiveness of the lamp in the K100 and K100B projectors is increased by the use of a small reflector (A) mounted just above the lamp so that it increases the concentration of the light at the focal point of the parabolic reflector (B). A step-down transformer, mounted either in the lower portion of the reflector housing or housed separately below the light, provides the necessary line-voltage reduction for 11.8 volt lights (12-volt nominal voltage). A hinged glass cover (C) provides access to the lamp and reflector. Ventilation and drainage holes, about one-half inch in diameter and fitted with wire screens, are usually provided in the bottom of the housing. Setscrews in an adapter below the transformer are used to fasten the projector to a vertical, rigidly-mounted, four-inch pipe.

A1321. Maintenance.--Once a week, and more frequently if necessary to insure full beam intensity, clean the cover glass on the projector housing and the surface of the reflectors. Inspect the drainage holes in the mirror and housing, and clean them as frequently as is necessary to insure adequate drainage and ventilation of the enclosure. When bright sunlight is shining into the projector, the intensity of heat and light concentrated in the area above the parabolic reflector, especially near its focal point, may be sufficient to burn the skin or seriously injure the eyes. Dark glasses must always be worn when looking directly into the reflector or at the lighted filament of the lamp. Liquid glass-cleaner and other non-abrasive cleaners (e.g., Bon-Ami), used with soft, clean cloths are recommended for cleaning the cover glass and reflectors. Avoid scratching or otherwise damaging the reflectors. Repair or replace the cover-glass gasket (E) whenever it appears that water is leaking into the housing.

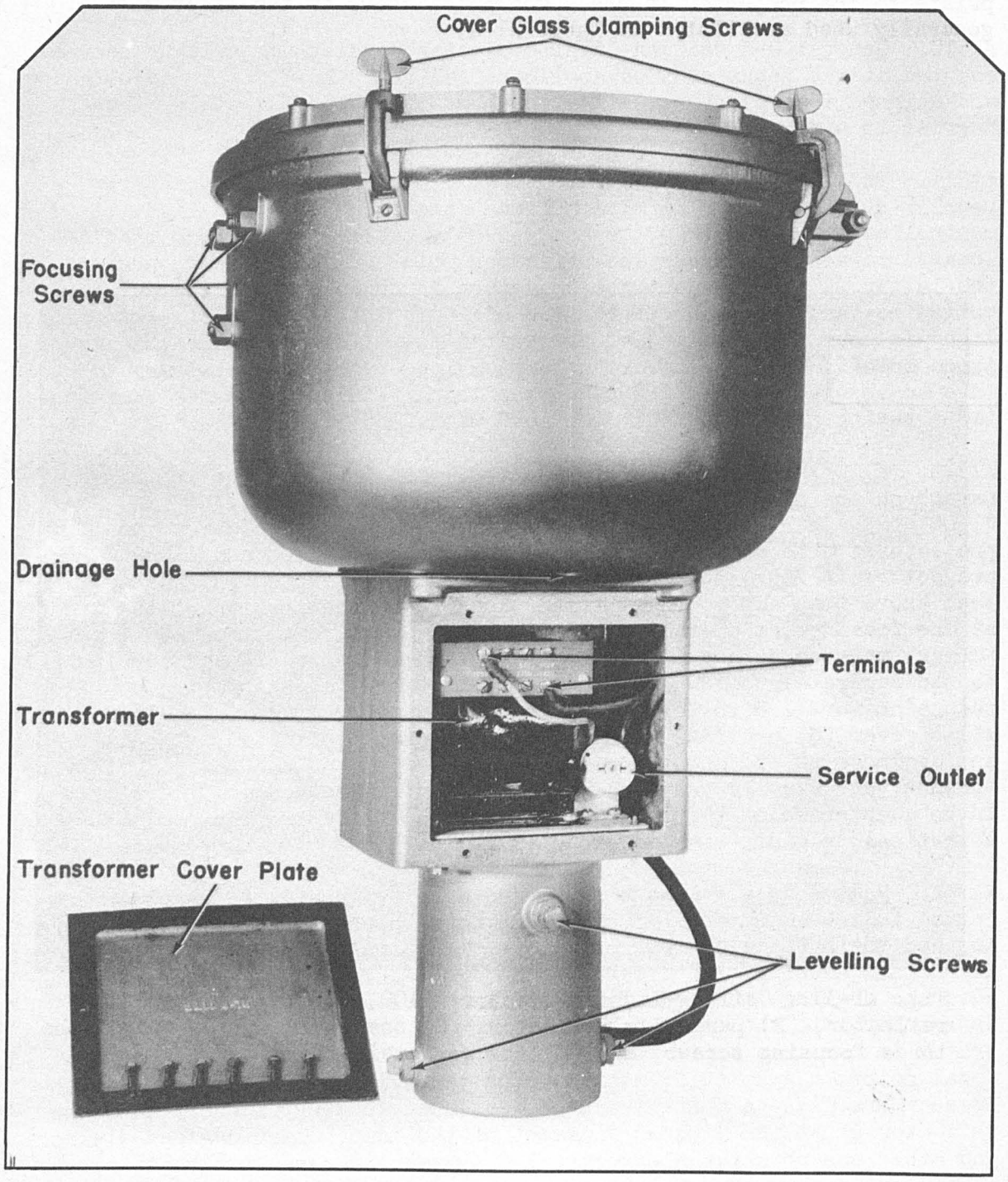


Fig. Al-38. Ceiling-light projector, K100.

A1321.1. Lamps.--Replace defective lamps promptly with the type appropriate to the projector in use. Characteristics of the lamps most generally used are listed in Table A1-4.

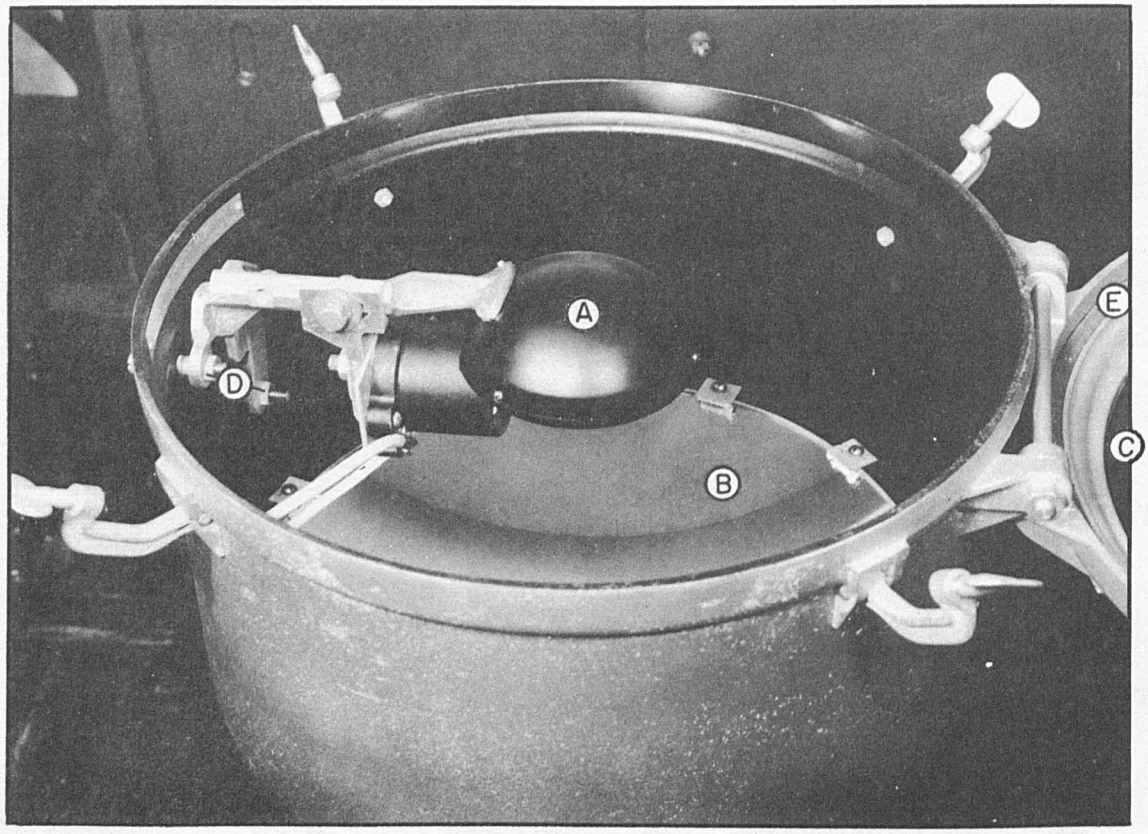


Fig. A1-39. Ceiling-light projector, K100, showing (A) secondary reflector, (B) parabolic reflector, (C) cover glass, (D) two of the three focusing screws, and (E) the gasket in the cover.

TABLE A1-4. Ceiling-Light Lamps

Lamp Type	Lamp Voltage (Nominal)	Watts	Base	Projector Identification
G-25	12	420	Mogul Prefocus	Crouse-Hinds or Westinghouse, serial numbers 481 and above.
G-30	105, 110, 115, or 120	250	Mogul Screw	
G-40	105, 110, 115, or 120	500 or 1000	Mogul Screw	
T-20	105, 110, 115, or 120	1000	Mogul Screw	

The efficiency of a ceiling light is reduced when:

(1) The lamp has begun to blacken.

(2) The operating voltage across an 11.8-volt lamp is less than 11.3 volts.

(3) The filament of the lamp sags to a noticeable extent.

(4) The lamp is out of focus, or the reflectors are in poor condition.

Whenever the intensity of the spot from a new lamp appears to be subnormal for existing conditions, try another new lamp and, if the condition persists, report the circumstances to the supervising station. Voltage fluctuations may cause variations in intensity. Whenever these variations noticeably affect the efficiency of the light, the circumstances, including the times and frequency of the variations, should be reported. Replace the lamp when it begins to blacken noticeably. The removal of mogul screw-base lamps may be facilitated by the application of a little powdered graphite to the threads before installing the lamp. Remove the lamp with care, since the leverage afforded by the size and shape of the bulbs makes it easy to break the seal between the glass and the metal base if much force is used to turn it in the socket.

A1330. K101-Type Projectors.--The K101 ceiling-light projector (see Fig. A1-39a) consists of a sealed-beam spotlight (100-watt, 6-volt, Mazda No. 4567 lamp or equivalent) and transformer mounted on a 2-inch pipe.

A1331. Transformer.--A transformer is required of at least 150-VA capacity that will reduce the line voltage to 6 volts. The normal operating voltage of the lamp (measured under nighttime operating conditions) should not exceed 6 volts, and should not drop below 5.5 volts. Higher voltages reduce the life of the lamps substantially; lower voltages reduce the intensity of the beam of light to an undesirable extent. Where steady 110 to 115 volt (nominal), 60-cycle power is available, a General Electric Catalog No. 71G78 transformer or equivalent is recommended. The transformer should have a primary rating equal to or not more than five volts above the normal nighttime operating voltage across the power supply cable at the transformer end of the cable. If a transformer with multiple taps on the primary winding is available (e.g., with taps for 90, 100, 105, 110, 115, and 120 volts input), the power supply should be connected to the winding that will give more than 5.5 volts but not more than 6.0 volts when the lamp is lighted at night. Where the nighttime voltage is subject to fluctuations of 5 volts or more, use an input voltage regulator if possible.

A1332. Wiring.--The wiring diagram for the projector is shown in Fig. A1-39b. The cable between the lamp and the transformer should be 2-conductor, 14 AWG RC (American Wire Gage - Rubber Covered) cable or heavier. Suitable 600-volt class cable should be used where the cable is to be laid underground in contact with the earth. The gage of the conductors depends on the length of cable required, as follows:

(1) For a run of less than 750 feet, use a 12 AWG, 2-conductor cable or heavier.

(2) For a run of 750 to 1000 feet, use size 10 AWG, 2-conductor cable or heavier.

A1333. Installation.--Install the 2-inch pipe support for the lamp vertically on a rigid concrete base. A spirit level or equivalent should be used for checking the verticality of the pipe and for leveling the bracket which holds the lamp. The top of the pipe should extend approximately three feet above the surrounding terrain. Place the bracket support for the lamp over the top of the pipe and adjust the combined aligning and retaining screws in the slip-fitter until the top surface of the bracket is secure and level. Mount the transformer in a water-tight junction box (Graybar No. 2124 or equivalent) and mount the box on the side of the pipe support. It may be mounted with metal straps as shown in Fig. A1-39a. Use Crouse-Hinds CGB 194 connectors or equivalent to provide for cable entrances in the junction box. Install the lamp in the bracket and, to insure the verticality of the lamp beam, center the lamp in the bracket so that the three glass bosses on the back of the lamp are resting on the ring of the bracket before tightening the three retaining clamps. Use the cable specified in par. A1332 to connect the lamp to the secondary winding of the transformer. Connect

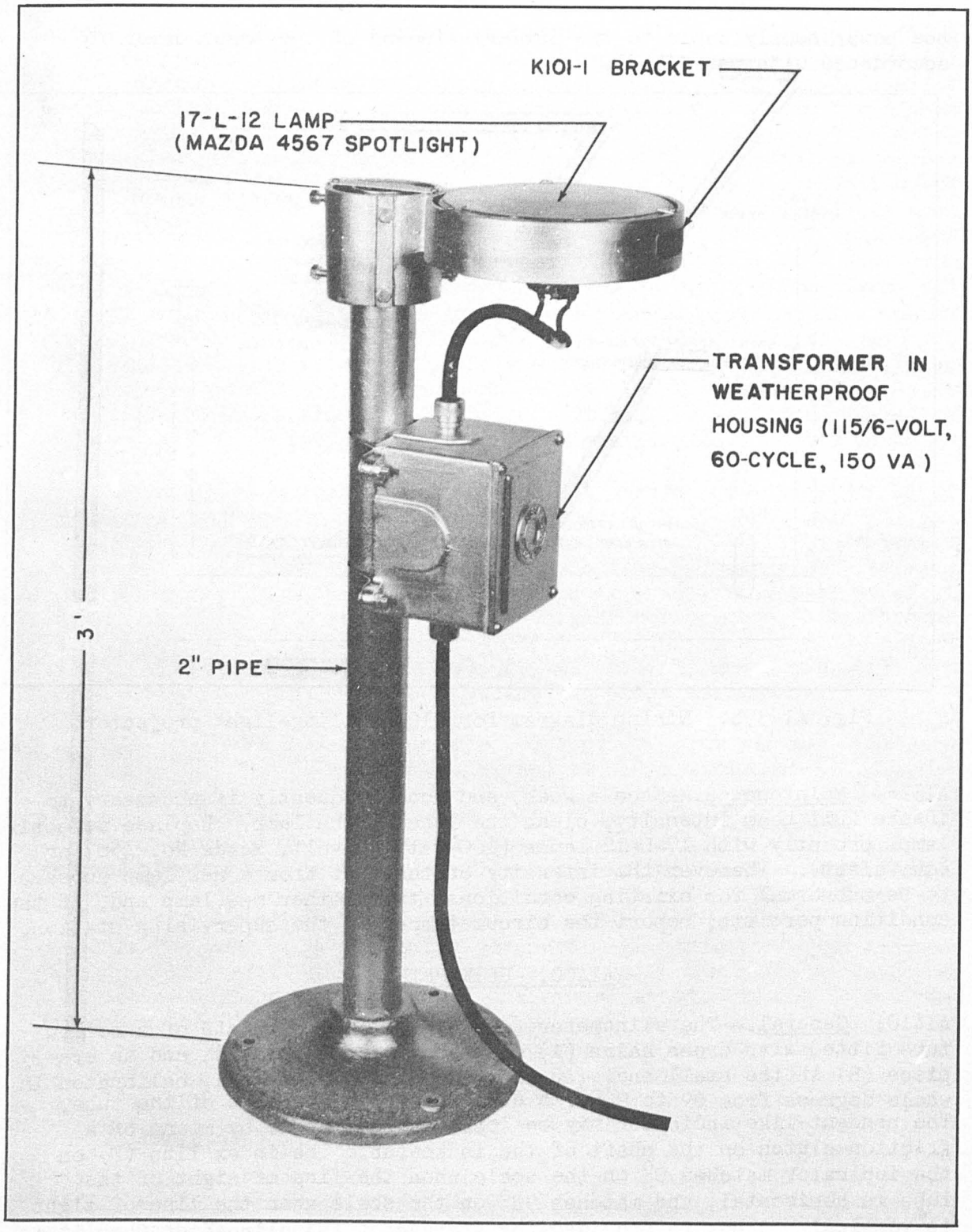


Fig. A1-39a. K101 ceiling-light projector.

the power supply cable to the primary winding of the transformer in accordance with par. A1331.

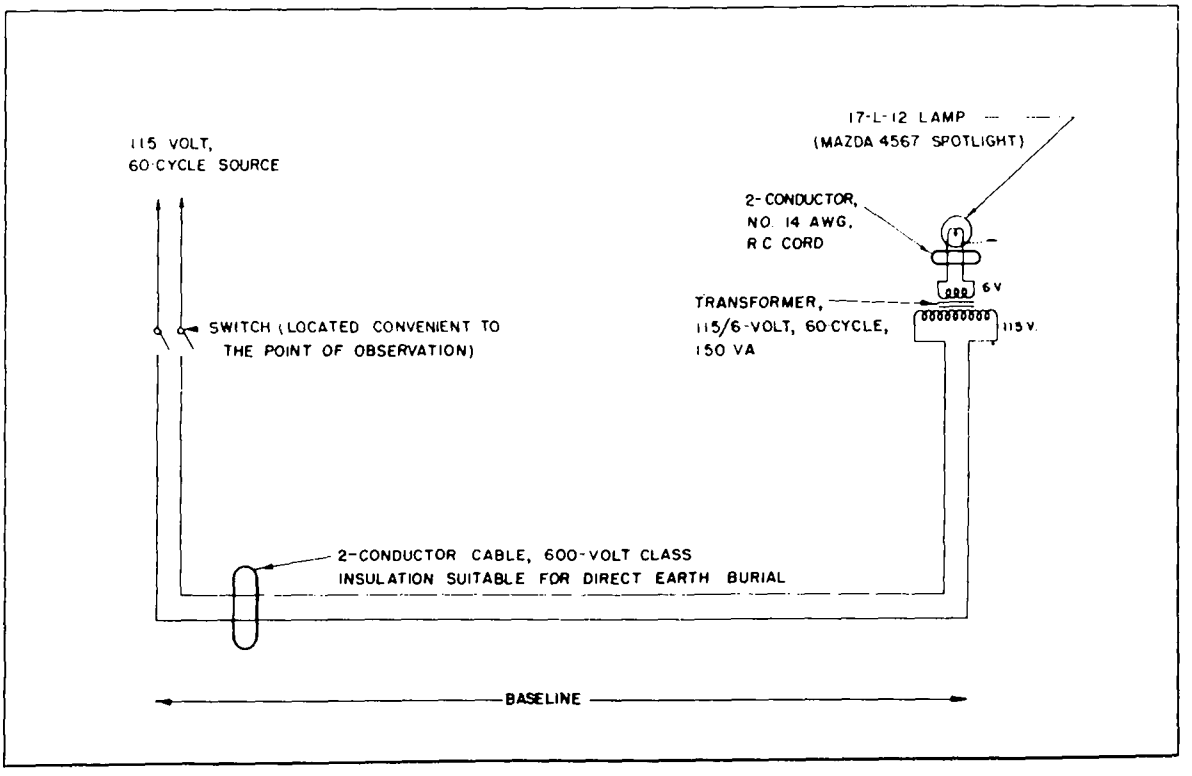


Fig. A1-39b. Wiring diagram for K101 ceiling-light projector.

A1334. Maintenance.--Once a week, and more frequently if necessary to insure full beam intensity, clean the lens of the lamp. Replace defective lamps promptly with 17-L-12 lamps (100-watt, 6-volt, Mazda No. 4567 or equivalent). Whenever the intensity of the spot from a new lamp appears to be subnormal for existing conditions, try another new lamp and, if the condition persists, report the circumstances to the supervising station.

A1400. CLINOMETERS

A1410. General.--The clinometer (see Fig. A1-40) consists of a hollow tube fitted with cross hairs (A) mounted in the large end, and an eye-piece (B) in the small end. An elevation-angle scale (C), calibrated in whole degrees from 0° to 90°, is attached to the outside of the tube. The pendant-like indicator may be locked at any angle by means of a friction clutch on the shaft of the indicator. The index line (D) on the indicator matches 0° on the scale when the line of sight of the tube is horizontal, and matches 90° on the scale when the line of sight is vertical. A box is provided for storage of the clinometer when it is not in use. The box should be mounted or placed in a dry protected

inside location, as convenient as possible to the observation point.

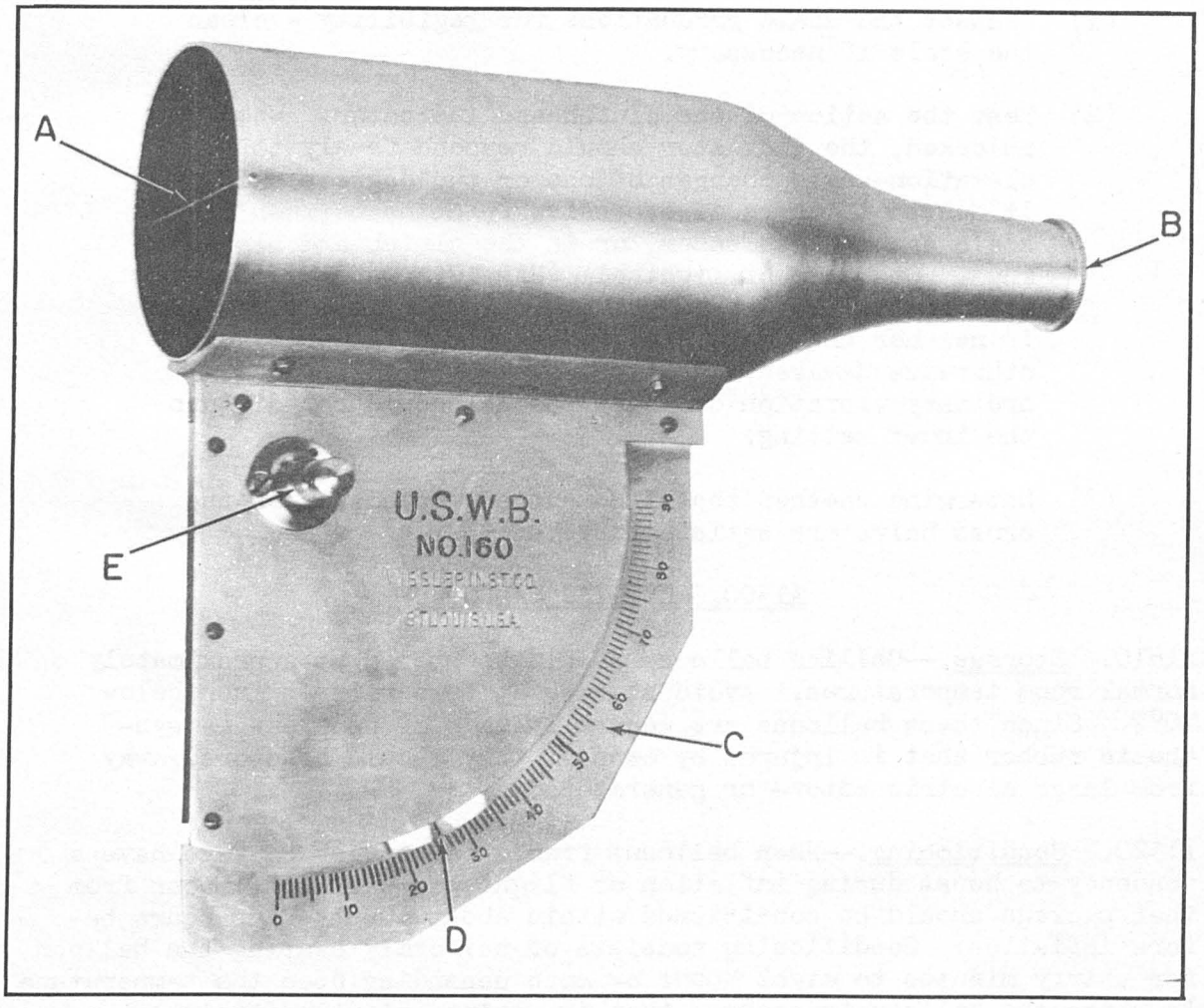


Fig. A1-40. Clinometer, K110, showing (A) cross hairs, (B) eyepiece, (C) elevation-angle scale, (D) index, and (E) clutch and locknut for the index.

A1420. Operation.--Unlock the friction clutch by unscrewing the knurled locknut (E) on the indicator. Make sure that the indicator responds freely to slight changes in the elevation of the line of sight through the clinometer before determining the cloud height (see par. 1441).

A1430. Maintenance.--The clinometer should be protected adequately to prevent denting of the tube or scale mechanism, or dislocation of the cross hairs or eyepiece. Whenever the operation is faulty and the

trouble cannot be corrected, inform the supervising station.

A1430.1. Examine the clinometer once a month as follows:

(1) Inspect the scale graduations for legibility - clean the scale if necessary.

(2) Test the action of the clutch and indicator. When unlocked, the indicator should respond freely to elevation-angle changes of one or two degrees. If it does not, there is excessive friction between the scale and the indicator, or in the clutch and bearings. One drop of light oil (SAE 10 or anemometer oil) on the bearings may improve the indicator action if neither the scale nor the indicator is dented or otherwise damaged. When the clutch is locked, ordinary vibration or light shocks should not disturb the index setting.

(3) Determine whether the alignment and condition of the cross hairs are satisfactory.

A1500. CEILING BALLOONS

A1510. Storage.—Ceiling balloons should be stored at approximately normal room temperatures. Avoid storage at temperatures much below 70°F. Since these balloons are generally made of neoprene (a synthetic rubber that is injured by ozone), they should be stored away from large electric motors or generators.

A1520. Conditioning.—When balloons from a particular package have a tendency to burst during inflation or flight, remaining balloons from that package should be conditioned within about twenty-four hours before inflation. Conditioning consists of uniformly heating the balloon for thirty minutes to eight hours or more depending upon the temperature to which the balloon is heated; that is, thirty minutes at air temperatures near the boiling point of water (approximately 212°F.), or eight hours at temperatures near 120°F. Temperatures under 120°F. will not condition the balloon; temperatures much above the boiling point of water are likely to scorch or harden the rubber.

A1521. Balloons may be heated by suspending them in a stream of hot air (above 120°F.) from a heating system, or by placing them on a hot-water or steam radiator, or on the reflector of a small incandescent lamp (not over 100 watts). When a balloon is heated through contact with a solid object, the balloon should be turned occasionally to insure uniform conditioning of the rubber. This precaution is more important at relatively high temperatures. The temperature of a surface may be tested quickly

with a few drops of water. If the water boils or evaporates rapidly, the surface is likely to be too hot for contact with the balloon.

A1522. A balloon may also be conditioned in boiling water. Insert a plug of cork, or wood, etc. in the neck of the balloon to keep the water out, and immerse all of the balloon except the plugged end in the water for about five minutes. Shake all free water from the balloon, and have it relatively dry before inflation.

A1530. Inflation.—The nozzle used to inflate balloons weighs 45 grams. It is usually identified by the letters "HE" stamped on the nozzle. If it is not, stamp or scratch the letters on it.

A1531. The balloon should be dry inside, and relatively dry outside, especially in freezing weather, to prevent the formation of a film of ice on the rubber. Remove any trapped air by folding and squeezing the balloon carefully in the hand, then stretch the neck sufficiently to insert the inflation nozzle. Place the nozzle so that the tubing connecting the nozzle to the regulator rests on a support and is not suspended from the nozzle. Inflate the balloon slowly (see par. A1531.1). Turn off the gas as soon as the balloon begins to lift the nozzle. Add or remove gas slowly from the balloon as necessary. The balloon is properly inflated when the nozzle is suspended about 1/4 inch above the inflation platform after any motion of the balloon has stopped. Listen for leaks in the balloon. Tie the neck of the balloon securely just above the nozzle, and remove it from the nozzle. Double the end of the neck over the tied portion, and either tie the doubled portion or secure it with a rubber band.

A1531.1. To inflate the balloon:

(1) Close the valve on the regulator by clockwise rotation of the control shown on the preset-type regulator in Fig. A1-41. Some dual-gage diaphram-type regulators require counterclockwise rotation.

(2) Open the cylinder valve fully by counterclockwise rotation of the handwheel (see par. 1621(6)); slowly open the regulator valve to an inflation pressure of five pounds or less as indicated on the low-pressure gage of dual-gage regulators. The high-pressure gage indicates the cylinder pressure, which serves as an approximate indication of the amount of helium in the cylinder.

(3) When the balloon is inflated (see par. A1531):

(a) Close the regulator and cylinder valves completely. (See par. 1621.)

(b) Remove the balloon from the nozzle.

(c) As a precaution against damaging the diaphram of the regulator open the regulator valve and listen for escaping gas. If gas is escaping, try to close the valve tighter (by hand only).

(d) Close the regulator valve, even when the cylinder valve cannot be closed completely. This condition should be encountered very infrequently; however, (c) above should be followed carefully to eliminate pressure on the regulator diaphram whenever possible.

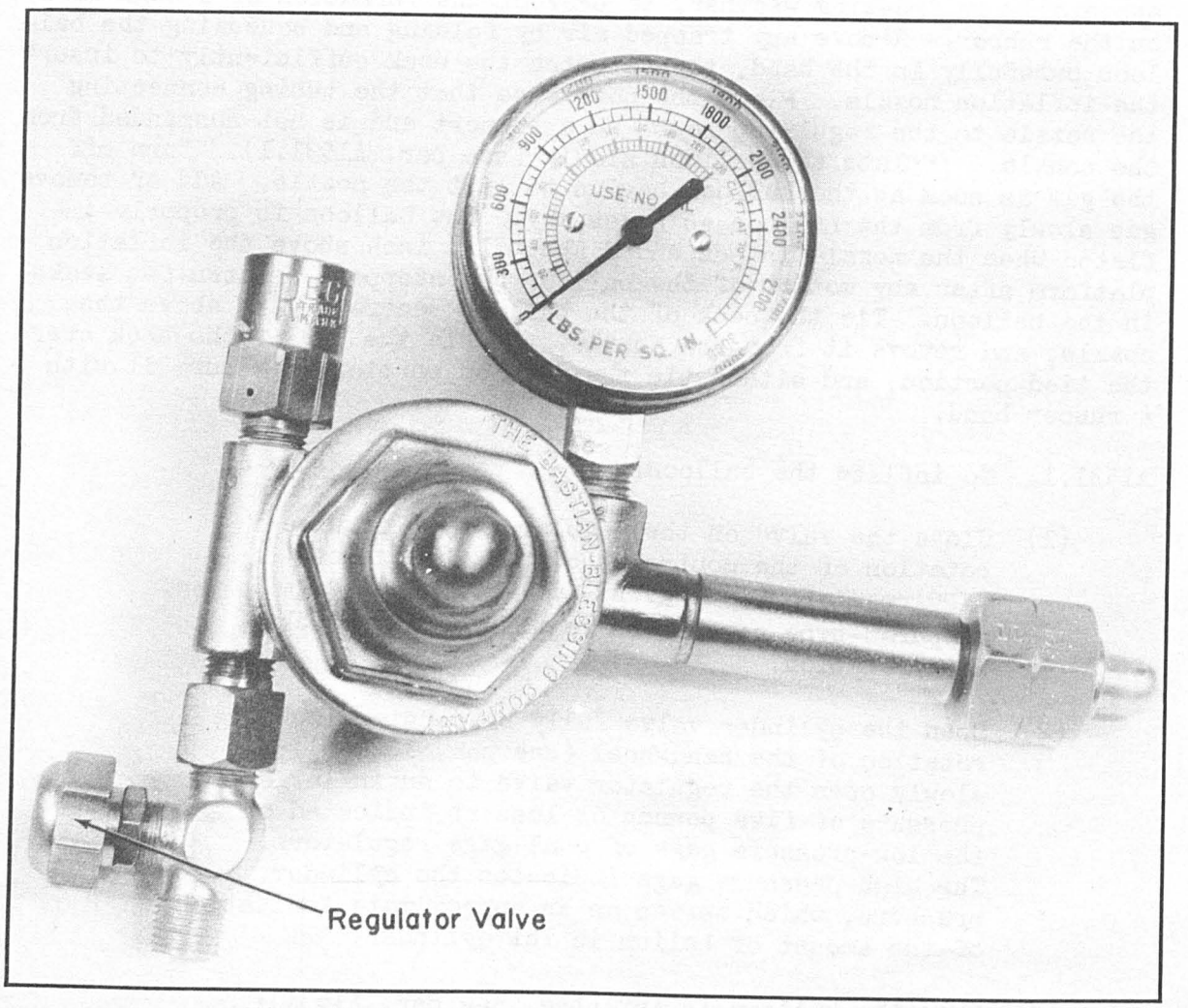


Fig. A1-41. Preset helium regulator, J412.

A1600. HELIUM CYLINDERS

A1610. Procurement.--Notify the supervising station promptly when the reserve cylinder of helium is placed in use.

A1620. Inspection of Shipment.--When a cylinder of helium is received, inspect it as follows:

(1) Check both shipping tags to make certain that the cylinder was intended for the station (notify the supervising station immediately of any error).

(2) Remove the cylinder-valve cap and turn the handwheel of the cylinder valve clockwise by hand to make sure that the valve is closed.

(3) Loosen the valve-protecting cap nut (turn clockwise) and remove it unless there is evidence of a leak, as evidenced by the sound of escaping gas or a build up of pressure at the outlet of the valve when the hand is held firmly over the outlet. If leakage continues after the handwheel has been tightened by hand, place the cylinder in use at once. Report receipt of partially filled and leaking cylinders to the supervising station and order another cylinder immediately.

(4) If the valve is not leaking, open the valve 1/ momentarily to determine whether the cylinder contains an appreciable charge of gas.

(5) If a cylinder is defective, mark both shipping tags "DEFECTIVE", report the circumstances to the supervising station, and order another cylinder immediately.

1/ A wrench made of steel rod is provided for opening the cylinder valve, but must not be used to close it.

A1621. Precautions.—The following list of precautions will be rigidly observed:

(1) Do not attempt to repair cylinder valves, or the regulators used with the cylinders.

(2) Do not attempt to stop leakage around the safety nut (the small nut on the side of the valve stem opposite the outlet).

(3) Whenever a leaking cylinder cannot be placed in use at once, replace the cap nut which protects the valve outlet.

(4) Never use a wrench to close the handwheel.

(5) Do not use a pipe wrench on the cap nut.

(6) Do not use the cylinder valve as a "throttling" valve; that is, do not use the valve partially opened as a means of controlling the flow of gas from the cylinder.

(7) When a cylinder is empty, first close the valve, then remove the regulator and replace the cap nut. Do not leave the valve open on an empty cylinder.

(8) When attaching or detaching the regulator from the cylinder, note that left-hand threads are used in the coupling, i.e., counterclockwise rotation of the nut is required to attach the regulator.

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. 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	7/8	
1/16	1	
1/8	1¼	
3/16	1½	
¼	1-3/4	
5/16	2	
3/8	2¼	
½	2½	
5/8	3	
3/4		

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 1½ 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^{o} 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 objects 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.

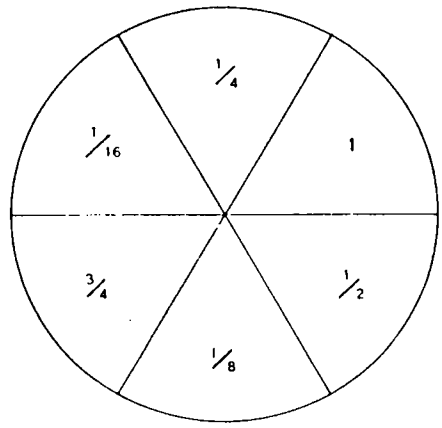


Fig. 2. Visibility in sectors of horizon circle.

2400. ENTRIES ON WBAN-10

2410. Visibility (Col. 4).--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.

2420. Remarks (Col. 13).--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) Variable visibility when prevailing visibility is less than three miles (see par. 2310): Enter range of variability separated by "V"; e.g., "VSBY 1V2".

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. Lightning, an igneous meteor is also observed. Hydrometeors other than precipitation, and lithometeors, are termed obstructions to vision. Observations of these phenomena are taken without the use of instruments, and from as many points as necessary to view the entire horizon.

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).

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 is based upon the appearance of the storm from the point of observation. All thunderstorms not classified as heavy in accordance with par. 3233 are classified moderate.

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. 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 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 par. 8450, because their observational criteria are exclusively wind.

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.

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. Estimate 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). Intensity of rain may also be estimated from the guides listed in Table 6.

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	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.

TABLE 6. Guides for approximating intensity of rain

Very Light	Scattered drops that do not completely wet an exposed surface, regardless of duration.
Light	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	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	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 criteria in pars. 3443.1 to 3443.7.

3443.1. Sleet.—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.—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.—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 par. 3432 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.

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.

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 dintinguish 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.

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

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.

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 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 column 5 whenever the visibility recorded in column 4 is seven miles or more. If the visibility is less than seven miles, weather or obstructions to vision must be reported either in column 5 or column 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		

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 MIS W DCA MOVG N 1600E

Observed	Instructions for Entry
(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 1/	
(a) Hail	Enter diameter in inches of largest hailstones, e.g., HLSTO 1 1/4

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 CAA contractions (SNW, SNW SHWRS, etc.).

(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+
(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
(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., "PATCH 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.

CHAPTER 4. MEASUREMENT OF PRECIPITATION

Precipitation measurements are not usually required at SAWRS and A-type, second-order stations. If these measurements are authorized, reference should be made to Chapters 4 and A4 of the unabridged edition.

CHAPTER 5. TEMPERATURE

5000. GENERAL

5010. Scale.--Temperatures as used in these instructions refer to the Fahrenheit scale.

5020. Types of Thermometers.--Nonrecording mercurial or spirit-filled Fahrenheit thermometers - either a dry-bulb thermometer or a psychrometer (dry- and wet-bulb thermometers mounted on a common back) - are furnished SAWRS and A-type, second-order stations.

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.--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 crank of the psychrometer fan or the crank of the 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.

5500. ENTRIES ON WBAN-10

5510. Temperature (Col. 7).--Enter the dry-bulb temperature to the nearest whole degree. Prefix a minus sign to temperatures below zero.

5530. Dry Bulb (Col. 14A).--Enter the dry-bulb temperature to the nearest degree and tenth, prefixing minus signs as required.

5540. Wet Bulb (Col. 14B).--Enter the temperature of the wet bulb to the nearest degree and tenth, prefixing minus signs as required.

A5000. DESCRIPTION AND MAINTENANCE OF THERMOMETERS

A5010. General.--The range of thermometers in use at a station should exceed any expected maximum and minimum temperatures. During periods when temperatures below -38°F. may be expected, substitute an alcohol-filled (spirit-filled) dry-bulb thermometer for the mercury-filled dry-bulb thermometer (see par. 5130).

A5020. Psychrometers.--Psychrometers are ventilated with a hand-powered fan (H030) mounted in a shelter (see Fig. A5-1). They are suspended, bulb end down, with both bulbs in front of the fan and about midway between the center of the fan and its periphery. When used in a medium-sized shelter (P300), the fan and its supporting frame are installed with the crank-shaft housing projecting through the louvered side. The bottom of the supporting frame in front of the fan should be approximately 2-1/2 inches above the bottom of the shelter. A hook to hold the psychrometer is screwed into the face of the instrument-mounting board about seven inches from the right end of the board, and at a height such that the wet bulb of the suspended psychrometer is five inches above the bottom of the shelter.

A5020.1. The single-back psychrometer is suspended in the small shelter (P320) from a bracket at the top of the shelter. The ventilating fan is attached to the lower right slat following modification of the slat as shown in Fig. A5-17a. Before installing the fan, remove the wire-net-covered shield, and then the mounting board to which the gear box of the fan is attached. Insert the fan shaft, bearing portion of the gear box into the shelter through a 7/8-inch hole in the slat. Replace the fan on its shaft; then install the shield over the fan in the position indicated by the four small holes in the slat. Countersink the holes slightly, if necessary, in order to place the washers and nuts on the four studs of the shield. Secure the gear box to the outside of the slat with wood screws. The mounting board supplied with the fan may be discarded.

A5021. Maintenance.--Once a week, check the condition of the thermometers, change the wick on the wet bulb, and clean the thermometers if foreign matter (crystalline mineral deposits on wet bulb, etc.) has accumulated. Deposits of foreign matter on the wick will cause erroneous wet-bulb readings. In some localities, it may be necessary to replace wicks more frequently than once a week to prevent their becoming badly soiled. A solution of vinegar and water will usually prove effective in removing mineral deposits on the glass bulbs.

A5021.2. Oil the bearings of psychrometer fans (H030) at least once a month with one or two drops of light oil, such as anemometer oil if the bearings are only slightly worn, and SAE 10 or 20 if the bearings are

A5500. INSTRUMENT SHELTERS

A5510. Types of Shelters.--Two types of shelters are in use at SAWRS and A-type second-order stations: the P320, small shelters (see Fig. A5-17a), and the P300, medium shelter (see Fig. A5-17).

A5520. Exposures.-- (See Fig. A5-17.) Whenever possible, shelters will be installed over earth or sod at least 100 feet from any concrete or other hard-surfaced area, and not closer to any other object than four times the height of the object above the floor of the instrument shelter. Avoid roof installations if practicable. However, if it is necessary to locate the shelter on a roof, it should not be closer than 30 feet to any large, vertical reflecting surface (walls, etc.), exhaust fans, or cooling towers. The floor of the shelter should be approximately four feet above the ground or roof, except that, if the shelter is mounted above a roof, the height may be greater than four feet in order to minimize radiation effects from the roof. To afford the interior of the shelter the greatest protection from direct solar radiation while the door is open, locate the shelter where the door will face north (in the Northern Hemisphere). Keep the shelter door closed when the instruments are not being read.

A5521. Illumination.--Use an electric lamp of not more than 25 watts in the medium-type shelter. Keep the lamp as far as practicable (at least ten inches) from any temperature-sensing element. Do not leave the lamp turned on any longer than is necessary to read the instruments. Use flashlights for illumination in the small shelter.

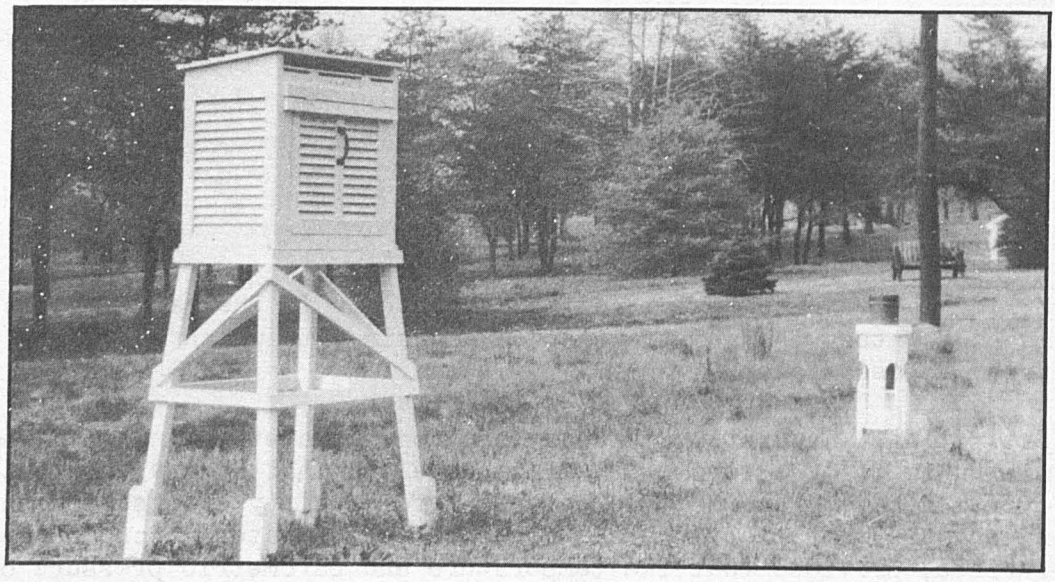


Fig. A5-17. Medium shelter (P300).

CHAPTER 6. HUMIDITY MEASUREMENT

6000. DEFINITIONS

6010. General.--These instructions are concerned with the expression of humidity in terms of 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. Dew-point data can be expressed with respect to ice or water. The psychrometric calculator expresses dew point with respect to water at all temperatures. Psychrometric tables numbered WB 235 express values 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 Table 9 is 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.

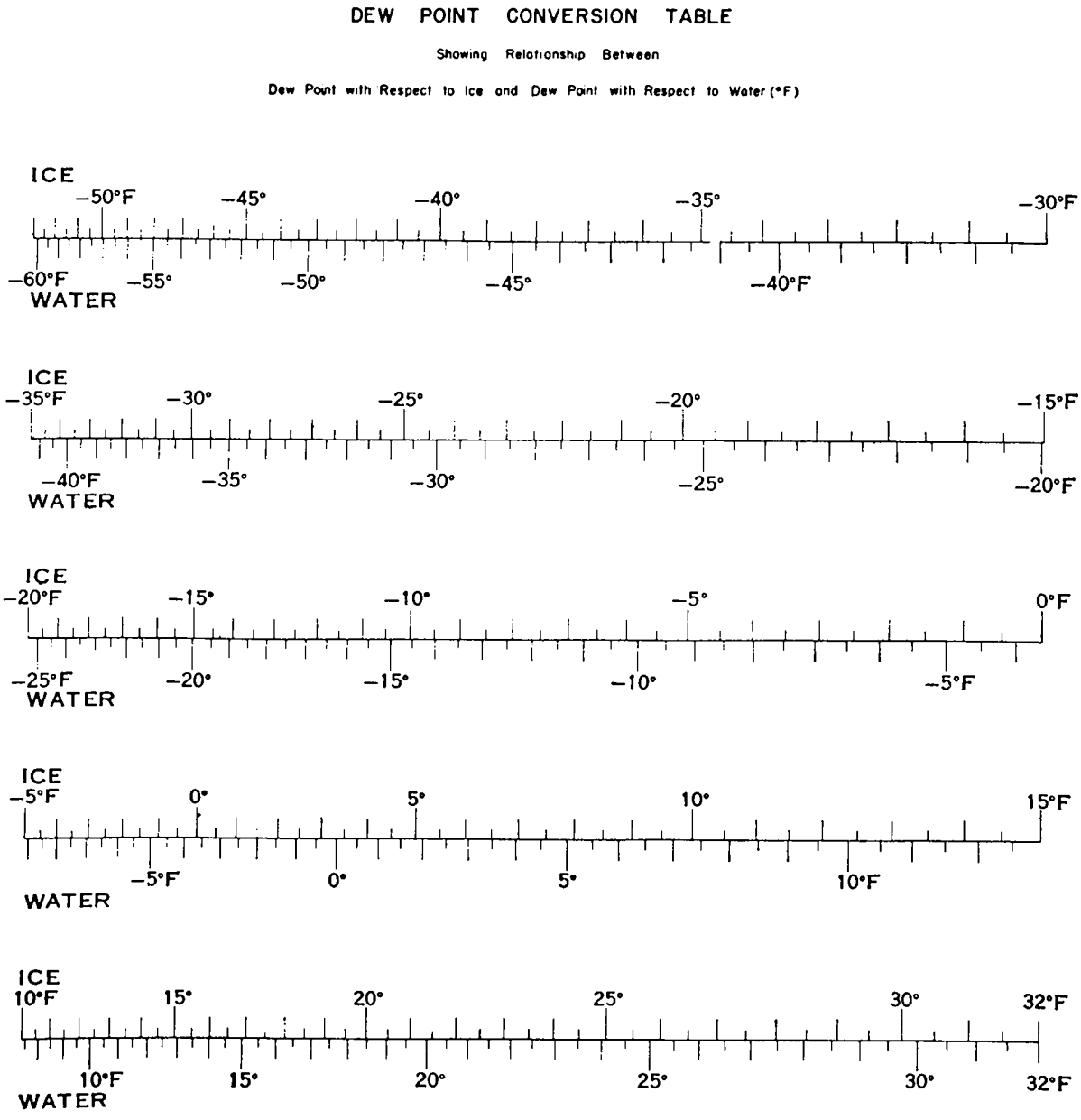
6100. PSYCHROMETRIC COMPUTATIONS

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 computations.

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 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.

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



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 temperature of the dew point is the same as that of the wet bulb. If the wet bulb is covered with ice and a depression cannot be obtained, the dew point will be converted to its water equivalent (see par. 6131.1).

6120. Psychrometric Calculator.--Use the calculator based on the barometric pressure nearest the normal station pressure (see par. 6010). 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.--Use the tables based on the barometric pressure nearest the normal station pressure (see par. 6010). 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 data are given as tabular values on correspondingly captioned pages.

6131. The dew point is 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 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 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.

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

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°

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

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.

A6100. USE AND MAINTENANCE OF PSYCHROMETRIC CALCULATORS

A6121. Psychrometric Calculator.--(See Fig. A6-1.) When the wet-bulb temperature is 32° or higher, use the high-temperature range (Form 1183) of the calculator; when the wet-bulb temperature is less than 32°, use the low-temperature range (Form 1184). In the latter case, disregard instruction 1(a) on the calculator, since the wick will be brought to a frozen state as indicated in par. 5151.3. The dew point is always read from the T_W,DP scale. On the high-temperature range (Form 1183), note that the T_W,DP scale from -10° to 32° is near the outer edge of the calculator.

A6122. Psychrometric Calculator - Maintenance.--When not in use, the calculator must be kept in an envelope or drawer, or otherwise protected. Keep it out of direct sunlight and away from radiators or other objects with relatively high temperatures.

A6122.1. Clean the calculator monthly with a damp blotter. If a more thorough cleaning is necessary, take it apart and wash it with soap and water, then rinse and dry it. Do not use acetone, benzene, lacquer thinners or other solvents. Care should be taken to reassemble the calculator with spacing washers between each moving part, and with the rotor disks on the proper faces of the base. Do not lubricate the pivot assembly, since oil may cause discoloration of the vinylite.

A6122.2. Four sets of reference marks are printed near the extremities of two mutually perpendicular diameters of the calculator. On the base, each reference mark consists of three short parallel lines, while on the disk, each reference mark consists of a single line. To check the centering of the disks, align a reference mark on one of the disks with the center line of a reference mark on the base. The other reference marks on the disk should then lie within the limits of the outer lines of corresponding reference marks on the base. Repeat this test for the four positions of the disk's reference marks with relation to the marks on the base. If each position does not satisfy the conditions of the test, notify the supervising station, and do not use the calculator. This check is required (a) upon receipt of the calculator, (b) after reassembling the device, and (c) periodically to prevent misalignment due to pivot wear.

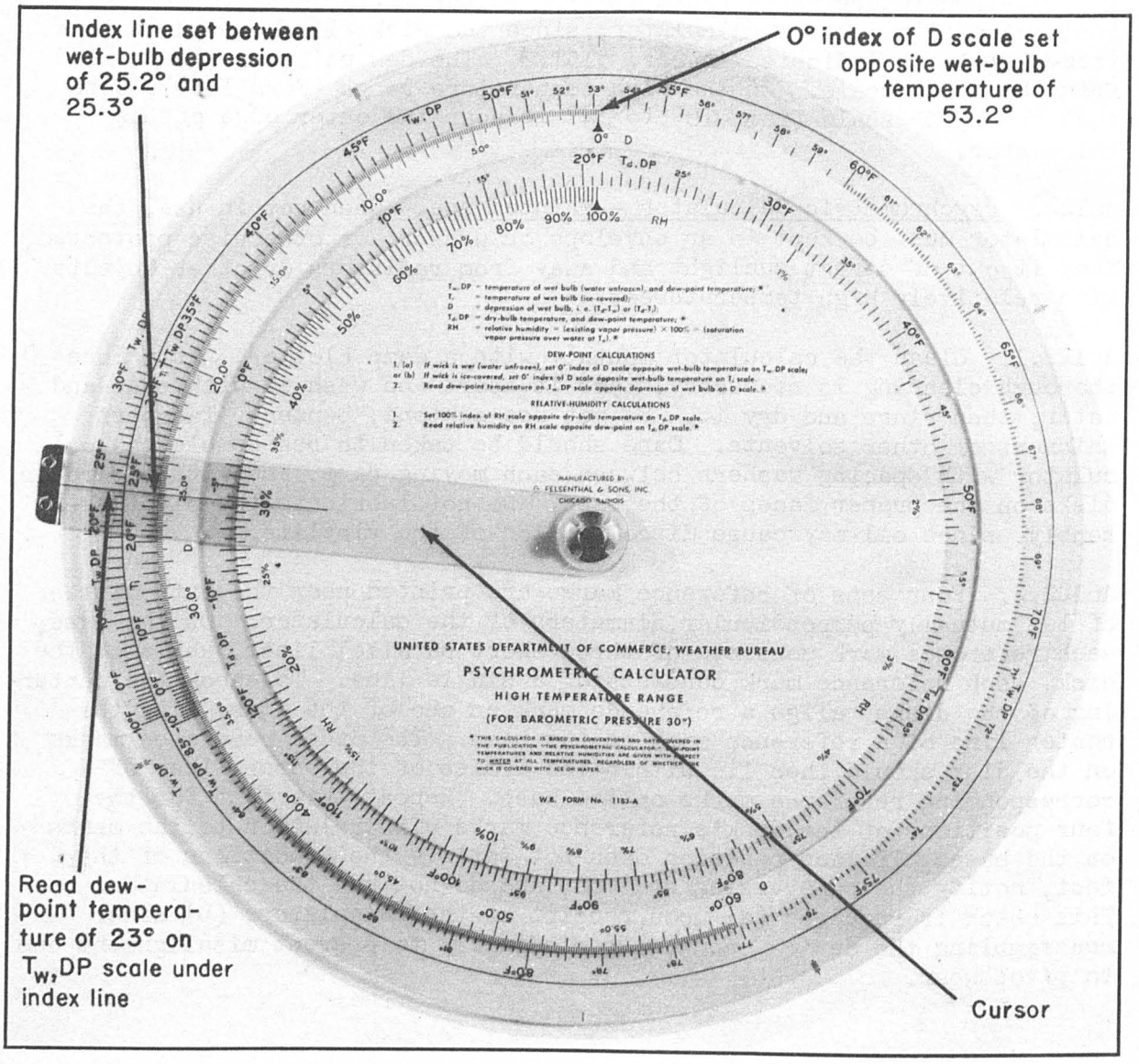


Fig. A6-1. Psychrometric calculator.

CHAPTER 7. PRESSURE

Unless otherwise specified, altimeter settings will be reported from SAWRS or A-type second-order stations only if needed for local operational purposes. They will be determined in accordance with instructions issued by the operational interest requiring them. If these data are recorded on WBAN-10A, they will be entered in column 12 as three figures representing units, tenths, and hundredths. Prefix an "E" to these values, e.g., enter 29.94 as E994.

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, and character 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 ten 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 9-light (8-point) wind-direction indicators, or from direct-reading dials by observing the indicator for a one-minute interval in accordance with the following instructions for the type of indicator in use.

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 one-minute interval.

8200. DETERMINATION OF SPEED

8210. General.—Speed of the surface wind will be determined to the nearest statute mile per hour. So far as possible average wind speed observations will not be taken during periods of extreme wind speeds - either high or low.

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.--One-minute-average wind speeds may be obtained from 1/60-mile indicators (such as 9-light indicators) in accordance with par. 8231, or from direct-reading indicators in accordance with par. 8233.

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

8233. Direct-reading indicators usually indicate almost instantaneous values. Observe the indicator for a one-minute period and determine an average value. Apply to the average value the correction furnished for the particular instrument.

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.

TABLE 14a. Corrections to indicated wind speeds

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

*Movement of anemometer cups observed.

8300. CHARACTER OF WIND

8310. Gustiness.—Gustiness is characterized by sudden, intermittent increases in speed, with at least ten miles per hour variation (corrected) between peaks and lulls. The peak speed must reach at least 19 m.p.h. 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.

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 statute miles per hour. If the wind speed is estimated, enter the letter E immediately following the speed. Wind speeds determined with equipment that is not approved by the Weather Bureau will be considered estimated. Enter C for calm.

8430. Gustiness (Col. 11).—Report gusts by the symbol "4" 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).

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).

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. All scheduled observations will be started just sufficiently in advance of the time of transmission to permit of 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 1/

(2) Visibility 1/

(3) Atmospheric phenomena

(4) Temperature

(5) Altimeter setting } When required for operational purposes.

(6) Wind

9100. AVIATION OBSERVATIONS

9110. General.--The observations taken at SAWRS and A-type, second-order stations (for aviation purposes) are classified as record, special, or as record-special when the two coincide, except for supplementary observations taken in accordance with par. 9143. The time and conditions under which the observations are taken, and the elements observed, are specified in the following paragraphs. When a record and a special observation coincide, all the elements observed for a record observation will be included in the record-special observation. The weather will be observed and the various elements evaluated between observations as often as the condition of the weather requires. Changing weather situations that might require a special 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.

1/ These items should be reviewed if practicable before filing the message to insure that current data are being transmitted.

9120. Record Observations.--A record observation is taken at scheduled intervals as required for flight operations or as specified by the Weather Bureau Regional Offoce. These observations will contain the following elements:

(1) Ceiling
(2) Sky
(3) Visibility
(4) Weather
(5) Obstructions to vision
(6) Temperature
(7) Dew Point
(8) Wind direction, speed and character *
(9) Altimeter setting
(10) Remarks

*When required for operational purposes.

9130. Special Observations.--Special observations are taken to provide information on significant developments in meteorological conditions occurring at other than scheduled times. These observations will contain the following elements:

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

*When required for operational purposes.

9132. Criteria for Taking Special Observations.--A special observation will be taken at SAWRS whenever one or more of the elements listed below have changed in the amount specified (with reference to the preceding observation). At SAWRS where less than twenty-four scheduled hourly observations are taken daily, special observations will be taken if required while personnel are on duty between the first and last scheduled observations of the day. Only conditions specified in the following paragraphs require that special observations be taken.

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 for the airport. 1/

(6) The ceiling increases to or above the highest instrument minimum for the airport. 1/

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. 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/

1/ Effective only at stations having scheduled air-carrier operations.

9132.4. Tornado.

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

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.

9132.8. 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.

9143. An observation will be taken immediately following any aircraft accident or report of an aircraft in distress in the vicinity of the observing station. It will include all elements normally reported in a record observation, but need not be disseminated. The note "ACFT ACCIDENT" will be entered in column 13. 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 13 whenever this observation has been delayed.

9160. Grouping of Elements.--Record and special 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 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) time (space) ceiling, sky visibility, weather, obstructions to vision (space) temperature 1/ (slant) dew point 1/, wind direction and speed 1/ (slant) altimeter setting 1/ (slant) and remarks.

EXAMPLE: KNE 1227E E18V⊕12/CIG 16V20

9162. Special Reports.--Data pertaining to special reports are grouped similarly to hourly observations insofar as the same data are transmitted (see par. 9130). Spaces will be used following type of report which is sent for all special observations (including record-specials - see par. 9172).

9163. Corrected Reports.--A corrected report will be filed only if another observation has not been filed subsequent to the erroneous report. A report correcting a previous report will be identified by the letters "COR" immediately following the station identification. The report will include station identifier and time of the uncorrected report. When the observation to be corrected is a special or a record special, the correcting report will also include type of report following "COR" (see par. 9172); e.g., KNE COR S5 1832E etc.

9163.1. A correction message may consist of one or more elements properly identified (e.g., COR 1306P VSBY5), whenever this procedure is shorter than the complete corrected observation.

9170. Coding.--Instructions in Chapters 1 - 8 will be observed in coding individual elements of observations. 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(2)).

1/ See par. 9120.

9173. Time.—The local standard time of each observation will be included in coding the report. The time, in four figures, is followed by the correct time-zone indicator selected from Table 17.

9180. Dissemination.—All record and special (including record-special) observations will be transmitted to the station designated by the regional office. 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 9132.6, enter in remarks of the next succeeding transmitted observation: (a) the time of the observation not transmitted, (b) weather and obstructions to vision 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@2ZR (FIBI)

S6 1448E M20@8/1437E ZR

CHAPTER 10. PILOTS' REPORTS

10000. GENERAL

10010. Pilots' reports of meteorological phenomena encountered in flight will be transmitted in plain language to the station to which scheduled observations are sent, where they will be encoded, recorded, and further disseminated. No record of pilots' reports need be maintained at SAWRS and A-type, second-order stations.

CHAPTER 11. FORM WBAN-10

11000. GENERAL

11001. Form WBAN-10A will constitute the primary original record form for surface aviation observations taken at SAWRS and A-type, second-order stations. It will be prepared in duplicate. 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.

11001.1. WBAN-10B will be used at stations provided with a mercurial barometer. Pressure data normally determined at the station will be entered on the form in accordance with the applicable instructions in the unabridged manual.

11001.2. WBAN-10D will be prepared for SAWRS and A-type, second-order stations by the supervising stations, in accordance with instructions in the unabridged manual or on the form.

11002. Instructions in this chapter relate primarily to entry of non-meteorological 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 3H or equivalent). Sufficient pressure should be used to insure legible copies and ample contrast for photographic reproduction. At stations where the form is used by the communications operator directly, slants may be used to separate the coded aviation data, as specified in Chapter 9.

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

11005. On or before the second work day of each month, send the original copies of WBAN-10A (and WBAN-10B where prepared) for the preceding month to the Weather Bureau station designated by the regional office. After Form 5066 (Corrections to Weather Records - Memorandum) has been received, correct the carbon copies of WBAN-10 in red and retain them for ninety days, after which they may be destroyed.

11005.1. First-order verifying stations will forward WBAN-10 forms from SAWRS and A-type, second-order stations to the National Weather Records Center, Ashville, N. C., at quarterly intervals for the quarters: January - March, April - June, July - September, and October - December. Identify the shipment on the outer wrapper e.g., "SAWRS Records", and list the contents of the shipment in an accompanying letter. Forward a copy of the letter to the Central Office, Attention: O-2.

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 13.

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 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/

(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.

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.)

1/ When an observation is taken following an aircraft accident in accordance with par. 9143, leave this column blank.

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. Contractions pertaining to nonmeteorological data, such as notices to airmen, may also be entered in the column if desired.

U S DEPARTMENT OF COMMERCE, WEATHER BUREAU — WBAN 10A

SURFACE WEATHER OBSERVATIONS

STATION SAWRS, City, State DATE Jan 5, 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 (ins)	REMARKS AND SUPPLEMENTAL CODED DATA	OBSERVERS INITIALS
						1/	1/	1/	1/		1/	2/ 3/ 3/	
R	0343	-X	4	GF		42	42	→↘	11E		E990	[Table 1a] 42.2 42.0	ALO
S1	0355	W2X	1/2	F				→↘	10E			[9132.1, .3]	ALO
S2	0406	W2X	3/8	F				→↘	10E			[9132.3]	ALO
RS3	0540	-X	3/4	F		43	42	→↘	10E		E990	VSBY N½E½W1 42.8 42.2	ALO
												[2420(1); 9132.1, .3]	
RS4	0645	-X	1/2	F		42	41	↘	10E		E991	CNDS RPDLY VRBL [9132.1, .3] 42.3 41.9	ALO
RS5	0742	M7VⓄ	2	F		42	41	↘	10E		E991	CIG 5V8 [1520(8); 9132.1, .3] 42.2 41.8	ALO
RS6	0846	6Ⓞ	3	F		43	41	↘	14E		E993	[9132.1, .3] 42.8 42.0	ALO
R	0945	30Ⓞ 90Ⓞ 220Ⓞ	5	F		46	43	↘	24E	Q38	E995	VSBY NW1½BD 45.6 44.1	ALO
												[2420(1); 8450]	
R	1242	35Ⓞ 220-⊕	10			56	41	→↘	17E		E993	56.0 48.5	RB
R	1541	M34Ⓞ 120⊕	7	RW-		51	40	→↘	21E	+30E	994	[8310, 8430] 50.6 45.4	RB
RS7	1845	15Ⓞ M38⊕	7	ZR-		32	26	↘	14E		E980	[9132.6] 31.5 29.6	RB
RS8	1947	12Ⓞ M35⊕	6	ZR--		30	25	↓↘	13E		E980	[9132.6] 29.8 28.3	RB
				Jan. 6									
												[11001]	
R	0040	25Ⓞ	10			25	22	↓↘	8E		E990	25.2 24.1	ALO
R	0345	18Ⓞ 150Ⓞ	12			22	19	↓↘	11E		E998	18ⓄV⊕ [1520(7)] 22.2 21.2	ALO
R	0447	20Ⓞ	12			22	18	↓↘	10E		E000	21.8 20.6	ALO
R	0740	O	15+			19	16	↘	10E		E004	[2410] 18.6 17.9	ALO
R	1546	150Ⓞ	6	BS		25	16	↘	25E	+33	E012	[3911; 8310; 8430] 24.9 22.2	MS
R	1842	150Ⓞ	8			25	16	↘	18E		E014	25.2 22.4	MS
R	1945	O	12			24	17	↘	15E		E013	24.3 22.0	MS
				Jan 7 etc.									

1/ These data are entered when required for operational purposes.
2/ The paragraph references in this column refer to pertinent instructions illustrated by the observation.
3/ These data are entered whenever related entries are made in columns 7 and 8.

Fig. 6. Entries on WBAN-10A.

Change No. → 1 *FOR OFFICIAL USE ONLY*

UNITED STATES DEPARTMENT OF COMMERCE • Charles Sawyer, Secretary
WEATHER BUREAU • F. W. Reichelderfer, Chief

MANUAL OF SURFACE OBSERVATIONS

ABRIDGED

(For SAWRS and A-Type Second-Order Stations)

FROM

CIRCULAR N

Sixth Edition

(Revised)

JULY 1952

WASHINGTON, D. C.

Table

1a	Sky-
1	Sky
2	Sky
2a	Cej
3	Hej
4	He
A1-4	Cε
4c	R
5	C
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8b	
9	
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*Revised
Eff. 7-1-52.

INTRODUCTION

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. Observations of clouds and obscuring phenomena 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 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).
○ 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 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 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.

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.

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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 (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 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.

*1451. At stations where hourly observations for scheduled transmission are taken, balloons will be used as follows during daylight hours 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

1/ These minimums are with reference to instrument minimum exclusive of ILS, GCA, or alternate minimum.

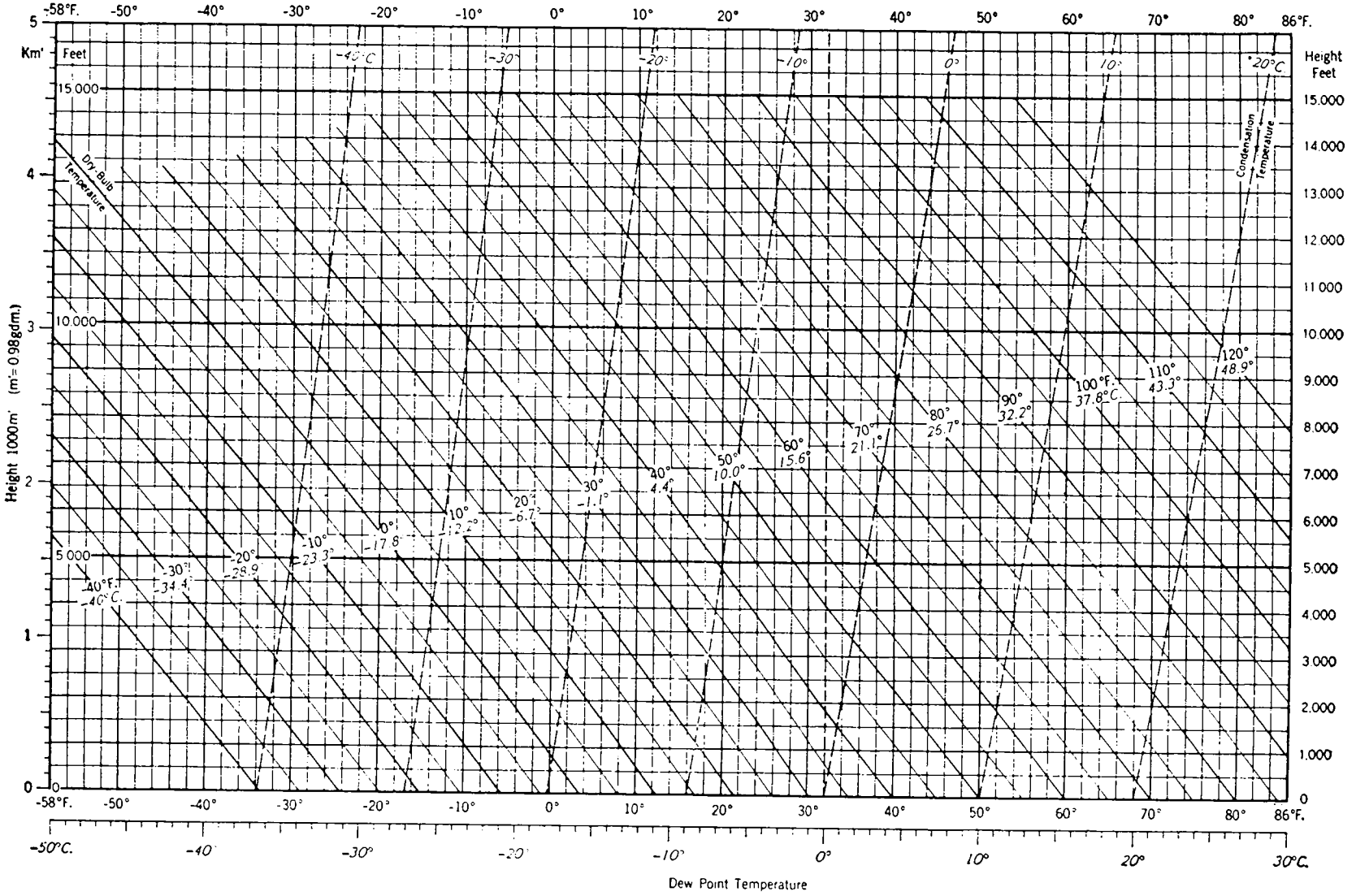

FIGURE 1. Diagram for determining height of convective-type clouds.

(Convert sub-freezing dew-point temperatures from a water to ice basis by means of Table 9 before using this diagram)

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 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)

Opaque sky cover (cont'd.)

	Layers	Summation	Sky-Cover Symbol
(4)	0.1 sky cover at 1000' (Smoke aloft)	0.1	10⊙..(with remark: KLYR 10⊙)
	0.3 sky cover at 5000'	0.4	5⊙
	0.1 sky cover at 10,000'	0.5	10⊙
(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".

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with a few drops of water. If the water boils or evaporates rapidly, the surface is likely to be too hot for contact with the balloon.

A1522. A balloon may also be conditioned in boiling water. Insert a plug of cork, or wood, etc. in the neck of the balloon to keep the water out, and immerse all of the balloon except the plugged end in the water for about five minutes. Shake all free water from the balloon, and have it relatively dry before inflation.

A1530. Inflation.--The nozzle used to inflate balloons weighs 45 grams. It is usually identified by the letters "HE" stamped on the nozzle. If it is not, stamp or scratch the letters on it.

A1531. The balloon should be dry inside, and relatively dry outside, especially in freezing weather, to prevent the formation of a film of ice on the rubber. Remove any trapped air by folding and squeezing the balloon carefully in the hand, then stretch the neck sufficiently to insert the inflation nozzle. Place the nozzle so that the tubing connecting the nozzle to the regulator rests on a support and is not suspended from the nozzle. Inflate the balloon slowly (see par. A1531.1). Turn off the gas as soon as the balloon begins to lift the nozzle. Add or remove gas slowly from the balloon as necessary. The balloon is properly inflated when the nozzle is suspended about 1/4 inch above the inflation platform after any motion of the balloon has stopped. Listen for leaks in the balloon. Tie the neck of the balloon securely just above the nozzle, and remove it from the nozzle. Double the end of the neck over the tied portion, and either tie the doubled portion or secure it with a rubber band.

*A1531.1. To inflate the balloon:

(1) Close the valve on the regulator by clockwise rotation of the control shown on the preset-type regulator in Fig. A1-41. Some dual-gage diaphram-type regulators require counterclockwise rotation.

(2) Open the cylinder valve fully by counterclockwise rotation of the handwheel (see ¶ A1621(6)), and slowly open the regulator valve:

(a) Sufficiently to inflate the balloon in approximately one minute (two minutes in cold weather), where a single gage (cylinder-pressure indicating gage) regulator is used.

(b) To an inflation pressure of five pounds or less as indicated on the low-pressure gage of dual-gage regulators 1/.

1/ The high-pressure gage indicates the cylinder pressure, which serves as an approximate indication of the amount of helium in the cylinder.

(3) When the balloon is inflated (see ¶ A1531):

(a) Close the regulator and cylinder valves completely. (See ¶ A1621.)

(b) Remove the balloon from the nozzle.

(c) Open the regulator valve and listen for escaping gas. If gas is escaping, try to close the cylinder valve tighter (by hand only).

(d) Although the cylinder valve should be checked in the foregoing manner to eliminate unnecessary pressure on the regulator diaphram, the regulator valve should be closed in the event that leakage of gas through the cylinder valve cannot be stopped completely, especially in the case of cylinders that are nearly full of helium.

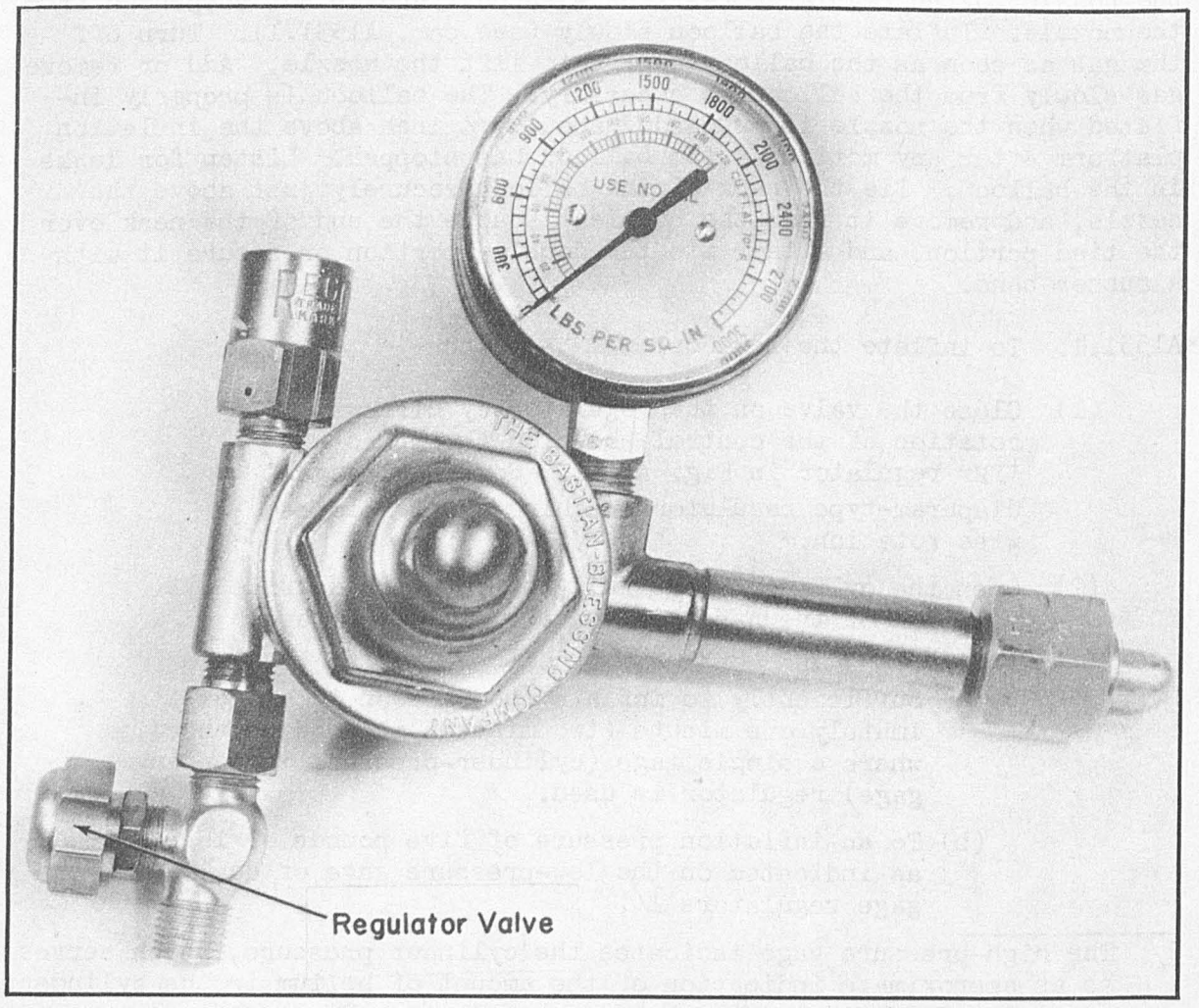

Fig. A1-41. Preset helium regulator, J412.

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*TABLE 8. I

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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 33° (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.

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.

*3512. Blowing Spray.--Spray lifted from the 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.

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

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.

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 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

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3920. Re
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(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+
(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
(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., "PATCH GF W".

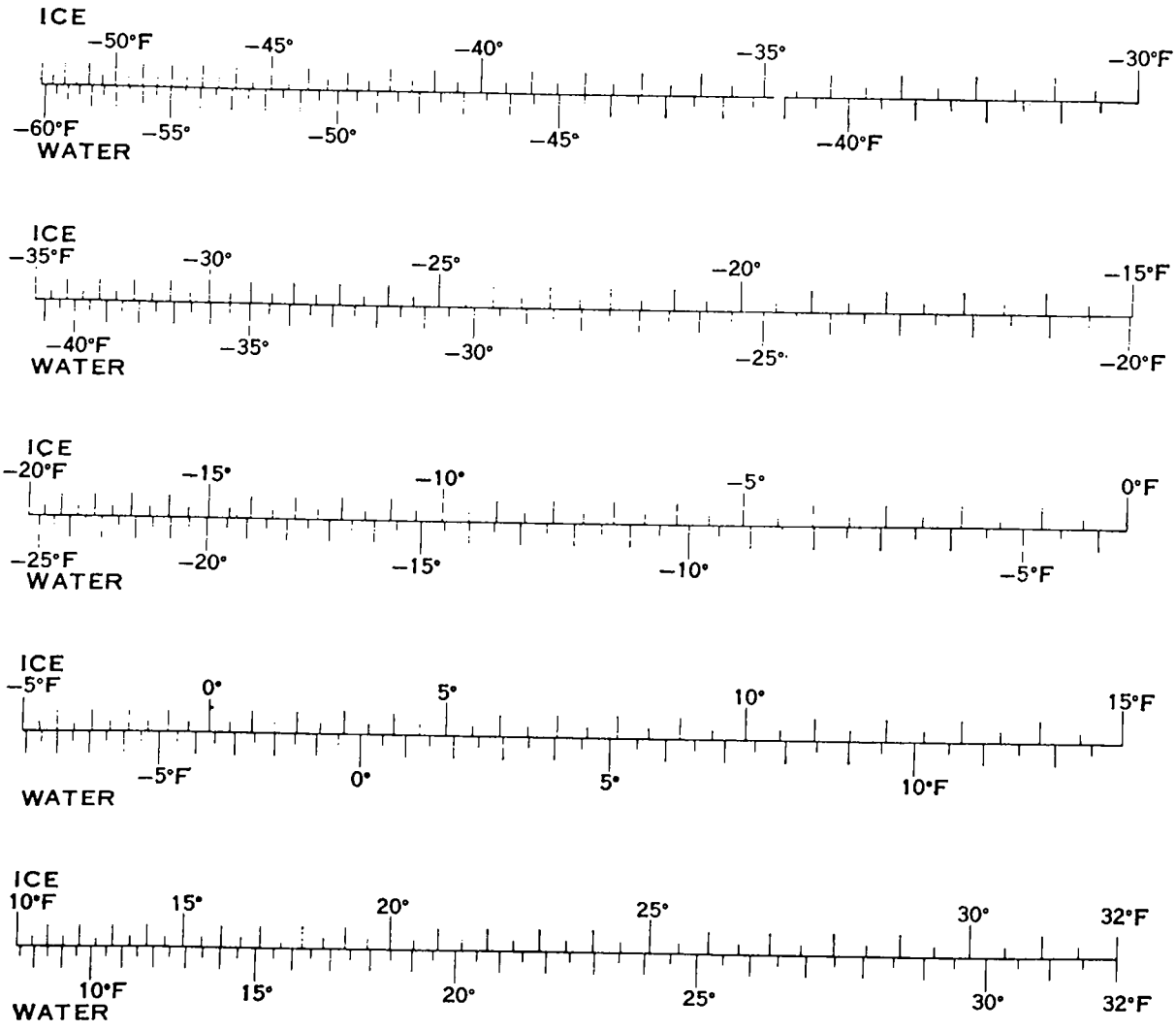
*NOTE: Report in remarks obstructions to vision for which symbols have not been established, by means of authorized contractions or plain language.

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)



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 temperature of the dew point is the same as that of the wet bulb. If the wet bulb is covered with ice and a depression cannot be obtained, the dew point will be converted to its water equivalent (see ¶ 6131.1) unless liquid fog is present at the station. In this latter instance, the dew point will be regarded as the same as the dry-bulb temperature.

6120. Psychrometric Calculator.--Use the calculator based on the barometric pressure nearest the normal station pressure (see par. 6010). 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.--Use the tables based on the barometric pressure nearest the normal station pressure (see par. 6010). 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 data are given as tabular values on correspondingly captioned pages.

6131. The dew point is 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 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,

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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. All scheduled observations will be started just sufficiently in advance of the time of transmission to permit of 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 1/

(2) Visibility 1/

(3) Atmospheric phenomena

(4) Temperature

(5) Altimeter setting } When required for operational purposes.

(6) Wind

9100. AVIATION OBSERVATIONS

9110. General.--The observations taken at SAWRS and A-type, second-order stations (for aviation purposes) are classified as record, special, or as record-special when the two coincide, except for supplementary observations taken in accordance with par. 9143. The time and conditions under which the observations are taken, and the elements observed, are specified in the following paragraphs. When a record and a special observation coincide, all the elements observed for a record observation will be included in the record-special observation. The weather will be observed and the various elements evaluated between observations as often as the condition of the weather requires. Changing weather situations that might require a special 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.

1/ These items should be reviewed if practicable before filing the message to insure that current data are being transmitted.

9120. Record Observations.--A record observation is taken at scheduled intervals as required for flight operations or as specified by the Weather Bureau Regional Office. These observations will contain the following elements:

(1) Ceiling
(2) Sky
(3) Visibility
(4) Weather
(5) Obstructions to vision
(6) Temperature
(7) Dew Point
(8) Wind direction, speed and character ø
(9) Altimeter setting
(10) Remarks

øWhen required for operational purposes.

*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 even though there are no impending aircraft operations. These observations will contain the following elements:

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

øWhen required for operational purposes.

*9132. Criteria for Taking Special Observations.--A special observation will be taken at SAWRS whenever one or more of the elements listed below have changed in the amount specified (with reference to the preceding observation). At SAWRS where less than twenty-four scheduled hourly observations are taken daily, special observations will be taken while personnel are on duty following the first scheduled observation of the day, in accordance with the following paragraphs.

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CHAPTER 10. PILOTS' REPORTS

10000. GENERAL

10010. Pilots' reports of meteorological phenomena encountered in flight will be transmitted in plain language to the station to which scheduled observations are sent, where they will be encoded, recorded, and further disseminated. No record of pilots' reports need be maintained at SAWRS and A-type, second-order stations.

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CHAPTER 11. FORM WBAN-10

11000. GENERAL

11001. Form WBAN-10A will constitute the primary original record form for surface aviation observations taken at SAWRS and A-type, second-order stations. It will be prepared in duplicate. 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.

11001.1. WBAN-10B will be used at stations provided with a mercurial barometer. Pressure data normally determined at the station will be entered on the form in accordance with the applicable instructions in the unabridged manual.

11001.2. WBAN-10D will be prepared for SAWRS and A-type, second-order stations by the supervising stations, in accordance with instructions in the unabridged manual or on the form.

11002. Instructions in this chapter relate primarily to entry of non-meteorological 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). Sufficient pressure should be used to insure legible copies and ample contrast for photographic reproduction. At stations where the form is used by the communications operator directly, slants may be used to separate the coded aviation data, as specified in Chapter 9.

*11004. The name of the station and the date will be entered in the spaces provided. If stamps are used, use black ink.

11005. On or before the second work day of each month, send the original copies of WBAN-10A (and WBAN-10B where prepared) for the preceding month to the Weather Bureau station designated by the regional office. After Form 5066 (Corrections to Weather Records - Memorandum) has been received, correct the carbon copies of WBAN-10 in red and retain them for ninety days, after which they may be destroyed.

11005.1. First-order verifying stations will forward WBAN-10 forms from SAWRS and A-type, second-order stations to the National Weather Records Center, Ashville, N. C., at quarterly intervals for the quarters: January - March, April - June, July - September, and October - December. Identify the shipment on the outer wrapper e.g., "SAWRS Records", and list the contents of the shipment in an accompanying letter. Forward a copy of the letter to the Central Office, Attention: O-2.

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2		25.2 22.4	MS
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nd 8. (See ¶ 5530 and 5540.)			

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 field elevation; if the field elevation has not been established, add the height of the point of release above ground. 1/

1442.1. Limitations.--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.

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 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 filed in accordance with ¶ 10010.

1/ 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 Minutes and Seconds	10 gm. Spherical Nozzle lift - 45 gm.	30 gm. Nozzle lift - 139 gm.
0:10	80	120
0:20	170	230
0:30	250	350
0:40	330	470
0:50	420	590
1:00	500	710
1:10	580	820
1:20	650	920
1:30	730	1030
1:40	810	1140
1:50	880	1250
2:00	960	1360
2:30	1190	1680
3:00	1420	2010
3:30	1650	2320
4:00	1880	2630
4:30	2090	2940
5:00	2300	3250
5:30	2510	3540
6:00	2720	3840
6:30	2930	4130
7:00	3140	4430
7:30	3350	4720
8:00	3560	5020

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 layers overhead.

Observed	Instructions for Entry
(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"
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 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 the abbreviation "CIG" to the entire remark; 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. 13).--At each record hourly observation, enter tenths of total sky cover as whole numbers in column 13 adjacent to column 14A. (See ¶ 1110.)

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

SURFACE WEATHER OBSERVATIONS

STATION _____ DATE _____

SKY and CLOUDS (Height in hundreds of feet)	VISIBILITY (Miles)	WEATHER and OBSTRUCTIONS to VISION	SEA LEVEL PRESS (mbs)	TEMP °F	DEW PT °F	WIND DIR (True)	WIND SPEED (MPH)	WIND CHARACTERISTICS and GUSTS	ALTIMETER SETTING (In.)	REMARKS AND SUPPLEMENTAL CODE
Obscuring Phenomena Aloft:										
15-Ø										KLYR 15-Ø
M8Ø										KLYR 8Ø
Obscuring Phenomena At Surface:										
P25X 2 TRWA										
WØX 0 L-F										
-X 2 F										
Clouds and Obscuring Phenomena:										
1ØØ1ØØØ										KLYR 1ØØ
4ØØ6ØØE2ØØ⊕										KLYR 6ØØ
M5ØØ25⊕										KLYR 5Ø
4Ø1ØØE2Ø⊕										KLYR 2Ø⊕
V5Ø3Ø-Ø										KLYR 3Ø-Ø
-XE15Ø 5 H										
M21Ø5Ø-⊕										HLYR 5Ø-⊕
Multiple Overcast Layers:										
5-⊕2Ø-⊕E5Ø⊕										HIR CLDS VSB

OBSERVED SKY CONDITION SERVING AS A BASIS FOR ENTRIES ON WBAN-10A

Layer of smoke covering 0.4 sky at measured (by ceiling light) height of 1500 feet. Ratio opaque to total sky cover 1/4.

Layer of smoke covering 0.9 sky at measured (by ceiling light soon after dark) height of 800 feet; 0.7 of layer opaque. Ratio opaque to total sky cover 7/9.

All of sky obscured by rain. Vertical visibility estimated 2500 feet on basis of ceiling light observation. Ratio opaque to total sky cover 10/10.

All of sky obscured by fog. Vertical visibility zero. Ratio opaque to total sky cover 10/10.

Fog obscures 0.8 sky; 0.2 sky visible overhead; therefore, vertical visibility unlimited, and obscuration is termed partial (see par.1510).

Layer of smoke (0.2 opaque) covering 0.4 sky at height of 1000 feet. Layer of clouds (0.2 opaque) covering 0.2 sky at 10,000 feet. Total sky cover 0.5. Ratio opaque to total sky cover 4/5.

Layer of clouds covering 0.2 sky at height of 4000 feet. Layer of smoke (0.2 opaque) covering 0.3 sky at 6000 feet; summation total at this level 0.5. Layer of clouds covering 0.6 sky at estimated height of 20,000 feet. Total sky cover 1.0. Ratio opaque to total sky cover 10/10.

Layer of smoke (0.5 opaque) covering 0.6 sky at measured height of 500 feet. Layer of clouds (0.6 opaque) covering 0.6 sky at 2500 feet. Total sky cover 1.0. Ratio opaque to total sky cover 10/10.

Layer of clouds (0.2 opaque) covering 0.2 sky at 400 feet. Layer of clouds (0.1 opaque) covering 0.1 sky at 1000 feet; summation total at this level 0.3. Layer of smoke (0.7 opaque) covering 0.7 sky at estimated height of 2000 feet. Total sky cover 9 . Ratio opaque to total sky cover 9+/9+.

Layer of clouds (0.2 opaque) covering 0.2 sky at 1500 feet. Layer of smoke (0.1 opaque) covering 0.6 sky at 3000 feet. Total sky cover 0.8. Ratio opaque to total sky cover 3/8.

Layer of haze obscuring 0.6 sky at surface. Layer of clouds (0.3 opaque) covering 0.3 sky at estimated height of 1500 feet. Total sky cover 0.8. Ratio opaque to total sky cover 8/8.

Layer of clouds (0.4 opaque) covering 0.6 sky at measured height of 2100 feet. Layer of haze (completely transparent) covering all of sky at 5000 feet. Total sky cover 1.0. Ratio opaque to total sky cover 4/10.

Layer of clouds (0.2 opaque) covering 1.0 sky at 500 feet. Layer of clouds (0.2 opaque) covering 0.2 sky at 2000 feet; summation total at this level 1.0; ratio opaque to summation-total sky cover at this level 4/10. Layer of clouds (0.4 opaque) covering 0.6 sky at estimated height of 5000 feet; summation total at this level 1.0; ratio opaque to summation-total sky cover at this level 8/10. Layer of clouds (0.1 opaque) covering 0.2 sky at 25,000 feet. Total sky cover 1.0. Ratio opaque to total sky cover 9/10.

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

A1300. CEILING LIGHTS

A1310. General.--A ceiling-light projector consists of a light source mounted at the focus of a parabolic reflector. The light is adjusted and aligned to project a vertical beam of light approximately three degrees in width.

A1311. The lights are rigidly mounted on a pipe support, which is usually set in or on a firmly-anchored concrete base. The light is controlled by a switch in the power-supply cable. The switch should be located conveniently near the office or point of observation, preferably the latter so that the observer may turn it on and off during an observation to facilitate identification of indistinct light spots. A pilot light is usually installed at the switch to indicate whether the light is on or off. Do not leave the lamp on longer than is necessary to take an observation. This precaution is particularly important at stations having projectors that use 1000 watt, 105-120 volt lamps.

A1320. K100- and K100B-Type Projectors.--The instructions in this paragraph are applicable to K100 (see Figs. A1-38 and A1-39) and K100B projectors,and are also generally applicable to older style projectors. The effectiveness of the lamp in the K100 and K100B projectors is increased by the use of a small reflector (A) mounted just above the lamp so that it increases the concentration of the light at the focal point of the parabolic reflector (B). A step-down transformer, mounted either in the lower portion of the reflector housing or housed separately below the light, provides the necessary line-voltage reduction for 11.8 volt lights (12-volt nominal voltage). A hinged glass cover (C) provides access to the lamp and reflector. Ventilation and drainage holes, about one-half inch in diameter and fitted with wire screens, are usually provided in the bottom of the housing. Setscrews in an adapter below the transformer are used to fasten the projector to a vertical, rigidly-mounted, four-inch pipe.

A1321. Maintenance.--Once a week, and more frequently if necessary to insure full beam intensity, clean the cover glass on the projector housing and the surface of the reflectors. Inspect the drainage holes in the mirror and housing, and clean them as frequently as is necessary to insure adequate drainage and ventilation of the enclosure. When bright sunlight is shining into the projector, the intensity of heat and light concentrated in the area above the parabolic reflector, especially near its focal point, may be sufficient to burn the skin or seriously injure the eyes. Dark glasses must always be worn when looking directly into the reflector or at the lighted filament of the lamp. Liquid glass-cleaner and other non-abrasive cleaners (e.g., Bon-Ami), used with soft, clean cloths are recommended for cleaning the cover glass and reflectors. Avoid scratching or otherwise damaging the reflectors. Repair or replace the cover-glass gasket (E) whenever it appears that water is leaking into the housing.

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.

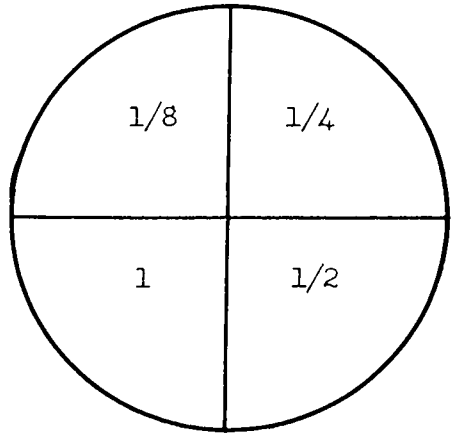

Fig. 2. Visibility in sectors of horizon circle.

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 par. 2310). Enter "15+" when the visibility is more than 15 miles but suitable distant markers for more precise determination are lacking.

2420. Remarks (Col. 13).--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) Variable visibility when prevailing visibility is less than three miles (see par. 2310): Enter range of variability separated by "V"; e.g., "VSBY 1V2".

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	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 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 criteria in pars. 3443.1 to 3443.7.

3443.1. Sleet.—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.--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.—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 par. 3432 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

(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 column 5 whenever the visibility recorded in column 4 is seven miles or more. If the visibility is less than seven miles, weather or obstructions to vision must be reported either in column 5 or column 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.

Observed	Instructions for Entry
* (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)
(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

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 CAA contractions (SNW, SNW SHWRS, etc.).

TABLE 14a. Corrections to indicated wind speeds

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

*Movement of anemometer cups observed.

8300. CHARACTER OF WIND

8310. Gustiness.--Gustiness is characterized by sudden, intermittent increases in speed, with at least 10 mph (nine knots) variation (corrected) between peaks and lulls. The peak speed must reach at least 19 mph (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.

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 statute miles per hour. If the wind speed is estimated, enter the letter E immediately following the speed. Wind speeds determined with equipment that is not approved by the Weather Bureau will be considered estimated. 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 fifteen 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.

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).

*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) 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/

1/ Effective only at stations having scheduled air-carrier operations.

2/ These minimums are with reference to instrument minimums exclusive of ILS, GCA, or alternate minimums.

9132.4. Tornado.

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

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.

9132.8. 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.

9143. An observation will be taken immediately following any aircraft accident or report of an aircraft in distress in the vicinity of the observing station. It will include all elements normally reported in a record observation, but need not be disseminated. The note "ACFT ACCIDENT" will be entered in column 13. 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 13 whenever this observation has been delayed.

9160. Grouping of Elements.--Record and special 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 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) time (space) ceiling, sky visibility, weather, obstructions to vision (space) temperature 1/ (slant) dew point 1/, wind direction and speed 1/ (slant) altimeter setting 1/ (slant) and remarks.

EXAMPLE: KNE 1227E E18V∅12/CIG 16V20

9162. Special Reports.--Data pertaining to special reports are grouped similarly to hourly observations insofar as the same data are transmitted (see par. 9130). Spaces will be used following type of report which is sent for all special observations (including record-specials - see par. 9172).

9163. Corrected Reports.--A corrected report will be filed only if another observation has not been filed subsequent to the erroneous report. A report correcting a previous report will be identified by the letters "COR" immediately following the station identification. The report will include station identifier and time of the uncorrected report. When the observation to be corrected is a special or a record special, the correcting report will also include type of report following "COR" (see par. 9172); e.g., KNE COR S5 1832E etc.

9163.1. A correction message may consist of one or more elements properly identified (e.g., COR 1306P VSBY5), whenever this procedure is shorter than the complete corrected observation.

9170. Coding.--Instructions in Chapters 1 - 8 will be observed in coding individual elements of observations. 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(2)).

1/ See par. 9120.

9173. Time.--The local standard time of each observation will be included in coding the report. The time, in four figures, is followed by the correct time-zone indicator selected from Table 17.

9180. Dissemination.--All record and special (including record-special) observations will be transmitted to the station designated by the regional office. 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 9132.6, enter in remarks of the next succeeding transmitted observation: (a) the time of the observation not transmitted, (b) weather and obstructions to vision 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 ¶ 3920.)

*EXAMPLES

S5	1437E	M15⊕2ZR	(FIBI)
S6	1447E	M20⊕8/1437E	ZR

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 13.

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 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/

(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.

11102. Time Entries (Col. 2).--The time ascribed to an observation is that of the last entry on WBAN-1C. 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.)

1/ When an observation is taken following an aircraft accident in accordance with par. 9143, leave this column blank.

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. Contractions pertaining to nonmeteorological data, such as notices to airmen, may also be entered in the column if desired.

W B FORM 1150 A Revised 1-51 — U S DEPARTMENT OF COMMERCE, WEATHER BUREAU — WBAN 10A

SURFACE WEATHER OBSERVATIONS

STATION SAWRS, City, State DATE Aug 7, 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 (ins)	REMARKS AND SUPPLEMENTAL CODED DATA				OBSERVERS INITIALS
							1/	1/	1/	1/		1/		4/	3/	3/	
Table Ia	R	0343	-X	4	GF		42	42	→↘	11E		E990		6	42.2	42.0	ALO
9132.1,.3	S1	0355	W2X	1/2	F				→↘	10E				10			ALO
9132.3	S2	0406	W2X	3/8	F				→↘	10E				10			ALO
2420(1), 9132.1,.3	RS3	0540	-X	3/4	F		43	42	→↘	10E		E990	VSBY N½ E½ W1	8	42.8	42.2	ALO
9132.3, 9143	RS4	0645	-X	1/2	F		42	41	↘	10E		E991	CNDS RPDLY VRBL	4	42.3	41.9	ALO
1520(8), 9132.1,.3	RS5	0742	M7VⒹ	2	F		42	41	↘	10E		E991	CIG 5V8	8	42.2	41.8	ALO
9132.1,.3	RS6	0846	6Ⓓ	3	F		43	41	↘	14E		E993			42.8	42.0	ALO
2420(1), 8450	R	0945	30Ⓓ90Ⓓ220Ⓓ	5	F		46	43	↘	24E	Q38E	E995	VSBY NW1½ BD	4	45.6	44.1	ALO
	R	1242	350220-Ⓞ	10			56	41	→↘	17E		E993		10	56.0	48.5	RB
8310, 8430	R	1541	M34Ⓓ120Ⓞ	7	RW-		51	40	→↘	21E	+30E	E984		10	50.6	45.4	RB
9132.6	RS7	1845	150M38Ⓞ	7	ZR-		32	26	↘	14E		E980		10	31.5	29.6	RB
9132.6	RS8	1947	120M35Ⓞ	6	ZR--		30	25	↓↘	13E		E980		10	29.8	28.3	RB
11001					Aug 8												
	R	0040	250	10			25	22	↓↘	8E		E990		5	25.2	24.1	ALO
1520(7)	R	0345	18Ⓓ150Ⓓ	12			22	19	↓↘	11E		E998	18ⒹVⒹ	5	22.2	21.2	ALO
	R	0447	20Ⓓ	12			22	18	↓↘	10E		E000		3	21.8	20.6	ALO
2410	R	0740	O	15+			19	16	↘	10E		E004		0	18.6	17.9	ALO
3911, 8310, 8430	R	1546	150Ⓓ	6	BS		25	16	↘	25E	+33	E012		3	24.9	22.2	MS
	R	1842	150Ⓓ	8			25	16	↘	18E		E014		2	25.2	22.4	MS
	R	1945	O	12			24	17	↘	15E		E013		0	24.3	22.0	MS
					Aug 9 etc.												

2/ Table Ia

1/ These data are entered when required for operational purposes.
2/ The paragraph references in this column refer to pertinent instructions illustrated by the observation.
3/ These data are entered whenever related entries are made in columns 7 and 8. (See ¶ 5530 and 5540.)
4/ Total sky cover (see ¶ 1530).

* Fig. 6. Entries on WBAN-10A.

Change No. → 2 *FOR OFFICIAL USE ONLY*

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

MANUAL OF SURFACE OBSERVATIONS

ABRIDGED

(For SAWRS and A-Type Second-Order Stations)

FROM

CIRCULAR N

Sixth Edition

(Revised)

May 1953

WASHINGTON, D. C.

Instructions pertaining to Change 2, Circular N, 6th Edition (Revised July 1951), Abridged for SAWR & A-type 2nd-order stations:

(1) Page 18: Change par. "A1320" to read "A1330," and par. "A1321" to read "A1331."

(2) Page 20: Change par. "A1321.1" to read "A1331.1."

(3) Page 21: Change par. "A1330" to read "A1340."

(4) Page 22: Change par. "A1331" to read "A1341," par. "A1332" to read "A1342", and par. "A1333" to read "A1343."

(5) Page 24: Change "A1334" to read "A1344."

(6) Page 30, par. A1621(5): Insert "or pliers" between "wrench" and "on."

(7) Page 55, par. A5521: Insert "or two lamps not exceeding a total of 30 watts" at end of first sentence.

THIS PAGE MAY BE DISCARDED WHEN THE FOREGOING CHANGES HAVE BEEN MADE.

Commerce-Weather Bureau, Washington, D. C.

*Revised
Eff. 5-1-53

INTRODUCTION

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 SAWR stations weather-observing duties are secondary with respect to primary functions, such as communications, flight assistance, etc. Weather observations will be taken and transmitted as primary duties permit. (See also Par. A9120.2(3)).

*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.

Observed	Instructions for Entry
(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"
* 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 the abbreviation "CIG" to the entire remark; 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.

	Observed	Instructions for Entry
* (10)	Condensation trails if observed from the ground and still forming at time of observation--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. 13).--At each record hourly observation, enter tenths of total sky cover as whole numbers in column 13 adjacent to column 14A. (See ¶ 1110.)

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. 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).

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 objects 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

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. All scheduled observations will be started just sufficiently in advance of the time of transmission to permit of 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 1/

(2) Visibility 1/

(3) Atmospheric phenomena

(4) Temperature

(5) Altimeter setting } When required for operational purposes.

(6) Wind

9100. AVIATION OBSERVATIONS

9110. General.--The observations taken at SAWRS and A-type, second-order stations (for aviation purposes) are classified as record, special, or as record-special when the two coincide, except for supplementary observations taken in accordance with par. 9143. The time and conditions under which the observations are taken, and the elements observed, are specified in the following paragraphs. When a record and a special observation coincide, all the elements observed for a record observation will be included in the record-special observation. The weather will be observed and the various elements evaluated between observations as often as the condition of the weather requires. Changing weather situations that might require a special 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.

1/ These items should be reviewed if practicable before filing the message to insure that current data are being transmitted.

9120. Record Observations.--A record observation is taken at scheduled intervals as required for flight operations or as specified by the Weather Bureau Regional Office. These observations will contain the following elements:

(1) Ceiling
(2) Sky
(3) Visibility
(4) Weather
(5) Obstructions to vision
(6) Temperature ø
(7) Dew Point ø
(8) Wind direction, speed and character ø
(9) Altimeter setting ø
(10) Remarks

øWhen required for operational purposes.

*A9120.2. Omission of Observations. Contractions will be transmitted as follows to indicate the expected or actual omission of a scheduled observation:

(3) FINO. When primary duties prevent taking an observation as scheduled (see Introduction), record and transmit "FINO" at the scheduled time. On WBAN-10, record type and scheduled time of omitted observations in columns 1 and 2, "FINO" in column 13, and observer's initials in column 15.

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 even though there are no impending aircraft operations. These observations will contain the following elements:

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

øWhen required for operational purposes.

9132. Criteria for Taking Special Observations.--A special observation will be taken at SAWRS whenever one or more of the elements listed below have changed in the amount specified (with reference to the preceding observation). At SAWRS where less than twenty-four scheduled hourly observations are taken daily, special observations will be taken while personnel are on duty following the first scheduled observation of the day, in accordance with the following paragraphs.

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) 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.

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.

9132.9. 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. Observations taken for local distribution only are termed local extra observations; they are taken under the circumstances specified in par. 9142-43. (Note that when a local extra observation reveals a change in conditions that requires a special observation, the observation will be classified as a special (see par. 9132) and treated accordingly.)

*9142. 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 observation1/. In this case, the name of the agency requesting the local extra observation will be noted under "Remarks."

9143. An observation will be taken immediately following any aircraft accident or report of an aircraft in distress in the vicinity of the observing station. It will include all elements normally reported in a record observation, but need not be disseminated. The note "ACFT ACCIDENT" will be entered in column 13. 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 13 whenever this observation has been delayed.

9160. Grouping of Elements.--Record and special 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 pertaining to an element normally included in a report. Elements regularly omitted are

1/ If a special observation is also required, distribute the local extra observation of the elements requested, after which the other elements required for the special will be evaluated, and the special filed.

CHAPTER 10. PILOTS' REPORTS

10000. GENERAL

10010. Pilots' reports of meteorological phenomena encountered in flight will be transmitted in plain language to the station to which scheduled observations are sent, where they will be encoded, recorded, and further disseminated. No record of pilots' reports need be maintained at SAWRS and A-type, second-order stations.

*Revised
Eff. 5-1-53

CHAPTER 11. FORM WBAN-10

11000. GENERAL

*11001. Form WBAN-10 will constitute the basic original record form for surface aviation observations taken at SAWR and A-type second-order stations.

*11001.1. WBAN-10A will be used at all of these stations. It will be prepared in duplicate. 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.

*11001.11. WBAN-10B will be used at stations provided with a mercurial barometer. Pressure data normally determined at the station will be entered on the form in accordance with the applicable instructions in the unabridged manual.

11001.2. WBAN-10D will be prepared for SAWRS and A-type, second-order stations by the supervising stations, in accordance with instructions in the unabridged manual or on the form.

11002. Instructions in this chapter relate primarily to entry of non-meteorological 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). Sufficient pressure should be used to insure legible copies and ample contrast for photographic reproduction. At stations where the form is used by the communications operator directly, slants may be used to separate the coded aviation data, as specified in Chapter 9.

11004. The name of the station and the date will be entered in the spaces provided. If stamps are used, use black ink.

11005. On or before the second work day of each month, send the original copies of WBAN-10A (and WBAN-10B where prepared) for the preceding month to the Weather Bureau station designated by the regional office. After Form 5066 (Corrections to Weather Records - Memorandum) has been received, correct the carbon copies of WBAN-10 in red and retain them for ninety days, after which they may be destroyed.

11005.1. First-order verifying stations will forward WBAN-10 forms from SAWRS and A-type, second-order stations to the National Weather Records Center, Ashville, N. C., at quarterly intervals for the quarters: January - March, April - June, July - September, and October - December. Identify the shipment on the outer wrapper e.g., "SAWRS Records", and list the contents of the shipment in an accompanying letter. Forward a copy of the letter to the Central Office, Attention: O-2.

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 13.

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 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.

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. Contractions pertaining to non-meteorological data, such as notices to airmen, may also be entered in the column if desired.

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU — WBAN 10-A

SURFACE WEATHER OBSERVATIONS

STATION SAWRS, City, State DATE Aug 7, 1953

	TYPE	TIME (L.S.T.)	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 (ins)	REMARKS AND SUPPLEMENTAL CODED DATA				OBSERVERS INITIALS
2/							1/	1/	1/	1/		1/		4/	3/	3/	
Table 1a	R	0343	-X	4	GF		42	42	→ ↘	11E		E990		6	42	420	ALO
9132.1, .3	S1	0355	W2X	½	F				→ ↘	10E				10			ALO
9132.3	S2	0406	W2X	3/8	F				→ ↘	10E				10			ALO
2010, 2420(1), 9132.1, .3	RS3	0540	-X	⅞	F		43	42	→ ↘	10E		E990	VSBY N½ E½ W1	8	428	422	ALO
9132.3, 9143	RS4	0645	-X	½	F		42	41	↘	10E		E991	CNDS RPDLY VRBL	4	423	419	ALO
1520(8), 9132.1, .3	RS5	0742	M7VⒹ	2¼	F		42	41	↘	10E		E991	CIG 5V8	8	422	418	ALO
9132.1, .3	RS6	0846	6Ⓓ	3	F		43	41	↘	14E		E993			428	420	ALO
2420(1), 8450	R	0945	30Ⓓ 90Ⓓ 220Ⓓ	5	F		46	43	↘	24E	Q 38	E995	VSBY NW1½ BD	4	456	441	ALO
	R	1242	35Ⓓ 220 -Ⓒ	10			56	41	→ ↘	17E		E993		10	560	485	RB
8310, 8430	R	1541	M34Ⓓ 120Ⓒ	7	RW-		51	40	→ ↘	21E	+30E	E994		10	506	454	RB
9132.6	RS7	1845	15Ⓓ M38Ⓒ	7	ZR-		32	26	↘	14E		E980		10	315	296	RB
9132.6	RS8	1947	12Ⓓ M35Ⓒ	6	ZR--		30	25	↓↘	13E		E980		10	298	283	RB
11001					Aug 8												
	R	0040	25Ⓓ	10			25	22	↓↘	8E		E990		5	252	241	ALO
1520(7)	R	0345	18Ⓓ 150Ⓓ	12			22	19	↓↘	11E		E998	18ⒹVⒹ	5	222	212	ALO
	R	0447	20Ⓓ	12			22	18	↓↘	10E		E000		3	218	206	ALO
1520(10), 2410	R	0740	Ⓞ	15+			19	16	↘	10E		E004	CONTRAILS 160 MSL	0	186	179	ALO
3911, 8310, 8430	R	1546	150Ⓓ	6	BS		25	16	↘	25E	+33	E012		3	249	222	MS
	R	1842	150Ⓓ	8			25	16	↘	18E		E014		2	252	224	MS
	R	1945	Ⓞ	12			24	12	↘	15E		E013		0	243	220	MS
					Aug 9 etc.												

1/ These data are entered when required for operational purposes.
2/ The paragraph references in this column refer to pertinent instructions illustrated by the observation.
3/ These data are entered whenever related entries are made in columns 7 and 8. (See ¶ 5530 and 5540.)
4/ Total sky cover (see ¶ 1530).

* Fig. 6. Entries on WBAN-10A.

Change No. → 3

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UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

MANUAL OF
SURFACE OBSERVATIONS
ABRIDGED

(For SAWRS and A-Type Second-Order Stations)

FROM

CIRCULAR N
Sixth Edition

(Revised)

October 1, 1954

WASHINGTON, D. C.

Change No. 3 consists of the following:

Pen-and-ink changes:

1. Change "statute miles" or "miles" to read "nautical miles" in the following places:

   a. Page 5, par. 1431(2), line 2. (Change item (2) to read "(3).")

   b. Page 5, par. 1432, line 3.

   c. Page 6, par. 1436(3), line 3.

   d. Page 9, par. 1444, line 5.

   e. Page 10, par. 1446, line 6.

   f. Page 15, par. 1520(6,b), under the column captioned "Instructions for Entry."

2. Pages 43-44, par. 3920(1), under the caption "Instructions for Entry," in item (b), line 3, following "gusts," add "in knots," and in item (c), add the sentence "Distances other than visibility will be reported in nautical miles."

3. Page 68, par. 8420, 1st line, change "statute miles per hour" to "knots," and add "(see par. 11004)."

4. Page 68, par. 8430, 2nd line, following "Enter the peak speed," insert "in knots."

5. Page 76, par. 11004, add "In the caption to column 10, delete "(m.p.h.)" and add "(kts)."

6. Page 78, par. 11103, add the sentence, "Enter all distances in nautical miles except visibility."

7. Page 78, Figure 6, add the note "During the period Oct. 1 through Dec. 31, 1954, enter wind speeds in accordance with Par. 8420."

THIS PAGE MAY BE DISCARDED WHEN THE FOREGOING CHANGES HAVE BEEN MADE.