

Official, No. 2.

INSTRUCTIONS

FOR

METEOROLOGICAL TELEGRAPHY.

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Issued under the Authority of the Meteorological Committee.  
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NEW AND ENTIRELY REVISED EDITION.

DRAWN UP IN ACCORDANCE WITH THE INTERNATIONAL CODE

ADOPTED AT

UTRECHT, SEPTEMBER 1874.



LONDON:

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE:

AND SOLD BY

J. D. POTTER, 31 POULTRY, AND 11 KING STREET, TOWER HILL;

AND

STANFORD, CHARING CROSS.

1875.

Price Sixpence.

Composition of the Daily Weather Telegrams, for the British Isles.

THE telegrams transmitted at 8 a.m. daily will consist of six groups, containing five figures each, the groups being arranged in accordance with the following rules.

Letters will not be used in the groups at any time. The time referred to is Greenwich time.

FIRST GROUP.

To contain the reading of the barometer, reduced to 32° F. and the mean sea level, for 6 p.m. on the previous day, and the direction of the wind (*true*, not magnetic) at the same hour.

Example I.

Barometer at 6 p.m. 29·76	} Group* 97622.
Wind direction, 6 p.m. W.S.W.	

Example II.

Barometer at 6 p.m. 30·44	} Group 04402.
Wind direction, 6 p.m. N.N.E.	

SECOND GROUP.

Force of the Wind at 6 p.m. on the previous day (by Beaufort scale†), the Weather, and Temperature of air at the same hour.

* The first figure of the barometrical reading and all decimal points are omitted, so that 29·26 is telegraphed as 926 and 30·48 as 048.

† The scale used for telegraphing Wind Direction will be found at p. 9.

† For the Beaufort scale of wind force, see p. 9.

Example I.

Force of wind at 6 p.m. = 9
 Weather* " " = Rain
 Temperature by dry bulb = 49° } Group 09549.

Example II.

Force of wind at 6 p.m. = 11
 Weather " " = Foggy
 Temperature, by dry bulb = 9° } Group 11809.

It will be observed that in all cases where on some occasions one, and at other times two, figures are required, spaces are given for two figures. When only one is needed, a cypher is to be inserted in the first place in order to maintain uniformity in the groups. Thus, it will be seen by the scale for the direction of wind on p. 9 that N.E. (true)=4; this will be reported "04" in the groups, while S=16, should be reported as 16. Again, force 2 is to be reported as "02," but force 11 as "11." The same principle runs through all the groups, but it does not apply to any remarks the observer may see fit to add to his message. In those cases it is better to write the words in full, thus: "Gale west-south-west, force ten, all night."

THIRD GROUP.

Reading of the barometer at 8 a.m., reduced to 32° F. and mean sea level.

Direction of wind at 8 a.m.

Example I.

Reading of the barometer = 29.62
 Direction of wind = N.W. } Group 96228.

Example II.

Reading of the barometer = 28.42
 Direction of the wind = N. } Group 84232.

FOURTH GROUP.

Wind force at 8 a.m.: Weather at the same hour.
 Temperature by dry bulb thermometer, at same hour.

* For notation for weather, see p. 10.

Example I.

Wind force = 6
 Weather = half clouded
 Temperature of air = 53° } Group 06253.

Example II.

Wind force = calm
 Weather = quite clear sky
 Temperature = 27° } Group 00027.

When a dead calm prevails it is evident that both the Direction and Force of the wind will be represented by cyphers.

FIFTH GROUP.

Reading of the Wet-bulb Thermometer at 8 a.m.

Amount of Rainfall in last 24 hours, in inches, tenths, and hundredths, omitting the decimal point.

Example I.

Reading of wet-bulb thermometer at 8 a.m. = 50°
 Rainfall in past 24 hours, measured at 8 a.m. = 0.46 in. } Group 50046.

Example II.

Reading of wet-bulb thermometer = 25°
 Rainfall in past 24 hours. = 2.36 ins. } Group 25236.

SIXTH GROUP.

Maximum and Minimum Temperatures in the past 24 hours.

Amount of Sea Disturbance at 8 a.m.*

Example 1.

Maximum temperature = 64°
 Minimum " = 48°
 Sea disturbance (rather rough) = 5 } Group 64485.

Example 2.

Maximum temperature = 38°
 Minimum " = 21°
 Sea disturbance (dead calm) = 0 } Group 38210.

* For inland stations the last figure is of course 0 (for uniformity).

FIRST GROUP.

Reading of the Barometer at 2 p.m., reduced to 32° F.
and mean sea level.
Direction of the Wind.

Example.

Reading of the barometer, 29.48 } Group 94812.
Direction of the wind = S.E.

SECOND GROUP.

Force of wind at 2 p.m.; Weather at the same hour;
Temperature by dry-bulb thermometer.

Force of wind - = 3
Weather - = hazy
Temperature of air = 62° } Group 03762.

THIRD GROUP.

Temperature by wet-bulb thermometer.
Sea disturbance.
Two cyphers (for uniformity).

Example.

Reading of wet bulb = 51°
 Sea disturbance = 4
 Cyphers - - - = 00 } Group 51400.

2 P.M. REPORTS.

Certain selected stations send additional reports at 2 p.m. daily, consisting of the readings of the Barometer, two Thermometers (dry and wet-bulbs), with the Wind, Weather, and Sea Disturbance. The observations must be made punctually at 2 o'clock, and the telegrams be sent off immediately, so that they may arrive at the Central Office in time to be of service the same afternoon.

These reports are looked upon as extra intelligence, and the morning report of the following day should be compiled as though no such afternoon report had been sent.

Such reports will consist of three groups only, corresponding almost exactly with the third, fourth, and fifth groups in the 8 a.m. report.

SPECIMEN of COMPLETE REPORT for 2 p.m. with explanation.

Barometer reduced to 32° T. } 3 Figs. and mean sea level.	94812
Direction of Wind. 2 Figs.	
Force of Wind. 2 Figs. Weather. 1 Fig.	03762
Reading of dry bulb thermometer. 2 Figs.	
Reading of wet bulb thermometer. 2 Figs.	
Sea disturbance. 1 Fig.	514 00
Cyphers, to maintain uniformity. 2 Figs.	
Words added by observer.	Barometer beginning to fall, ugly appearance.

SPECIAL TELEGRAMS.

Special telegrams, whether sent at the discretion of the observer, or in accordance with the directions given in the next paragraph, or in reply to a telegraphic message from the Meteorological Office, should *always* be drawn up in the form given for 2 p.m. reports; but the observer should add any remarks which he may deem of importance.

Whenever the level of the mercury in the barometer has fallen one-tenth of an inch or thereabouts in any one hour; or the wind, being strong, has suddenly changed its direction, or has increased to a gale or serious squall; or the sea has suddenly become rough, although the wind has not increased, *an immediate report should be sent to London.*

SUNDAYS AND HOLIDAYS.

On Sundays and other holidays, of which latter *due notice will be sent whenever they occur*, observations should be taken *if possible* at the usual hours and the reports be precisely similar in form to those sent on week days. If any observations are not taken at the regular hour, the fact should be noted in the message.

Sunday reports should be distinctly dated "Sunday," and should be despatched by post from most stations in Great Britain, and by wire on Monday morning from those in Ireland and North Scotland, so as to reach London at latest by 10 a.m. on Monday. Holiday reports should be treated similarly.

REPETITIONS.

Whenever a repetition of any message is asked for, the observer is requested to look carefully at his register and his instruments, in order to see whether he might not have made any error in copying the report from his Register.

SCALES IN USE.

The following scales are used in drawing up the telegrams:—

WIND SCALES.

1. Direction.

The different points of the compass are supposed to be numbered beginning with 1 = N.byE., 2 = N.N.E. (*true bearings*), and so on, 8 corresponding with East, 16 with South, 24 with West, and 32 with North.

A Table of the approximate equivalents for the United Kingdom for compass bearings in true bearings, with the corresponding numbers, is here annexed.

Compass } bearings	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
True } bearings	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW
Figures -	30	32	2	4	6	8	10	12	14	16	18	20	22	24	26	28

2. Force.

This is estimated in accordance with the following scale, known ordinarily as the "Beaufort Scale," from its having been drawn up by Admiral Beaufort for use on board ship. The Scale has been altered so as to suit the present use of double topsails. Added to the Table is a list of the *average* values in miles per hour travelled by the wind during the prevalence of the different forces.

BEAUFORT SCALE OF WIND FORCE.				Miles per hour.
0. Calm	-	-	-	3
1. Light air	-	Or, just sufficient to give steerage way	-	8
2. Light breeze	-	Or, that in which a well-conditioned man-of-war, with all sail set, and clean full, would go in smooth water from	1 to 2 knots -	13
3. Gentle breeze	-		3 to 4 knots -	18
4. Moderate breeze	-		5 to 6 knots -	23
5. Fresh breeze	-		Royals, &c. -	28
6. Strong breeze	-		Topgallantsails	34
7. Moderate gale	-	Or, that to which she could just carry in chase, full and by -	Topsails, jib, &c. -	40
8. Fresh gale	-		Reefed upper topsails and courses.	48
9. Strong gale	-		Lower topsails and courses.	56
10. Whole gale	-	Or, that with which she could scarcely bear lower main-top-sail and reefed foresail.		65
11. Storm	-	Or, that which would reduce her to storm-staysails		75
12. Hurricane	-	Or, that which no canvas could withstand		90

Note.—The attention of observers is directed to the fact that storms in these islands are rarely, if ever, as violent as they are in tropical latitudes.

Accordingly, great caution should be used in the insertion of extreme figures in the telegraphic reports such as 12 for the wind and 9 for the sea.

WEATHER SCALE.*

0 = sky quite clear.	5 = rain falling.
1 = „ a quarter clouded.	6 = snow „
2 = „ half clouded.	7 = haze.
3 = „ three-quarters clouded.	8 = fog.
4 = „ entirely overcast.	9 = thunderstorm.

Any other phenomena must be reported in words after the groups of figures, such as “lightning last evening,” “thunder yesterday but no lightning,” “very heavy dew,” “Aurora,” &c., &c.

Observers are requested to pay special attention to this regulation, so that important features of weather, not included in the above scale, may be duly reported by wire.

SCALE FOR SEA DISTURBANCE.

0 = dead calm.	4 = moderate.	7 = high.
1 = very smooth.	5 = rather rough.	8 = very high.
2 = smooth.	6 = rough.	9 = tremendous.
3 = slight.		

* It will be observed that the scale for “amount of cloud” hitherto used has been dispensed with, while that for the weather has been modified as above.

Additional Instructions for Reporting.

1. General Instructions.

It is of the utmost importance that the observations be *punctually* taken, the reports made up and sent off immediately.

The *time* referred to is always *Greenwich time*.

If from any cause telegraphic communication with London should be interrupted, so that the messages cannot arrive at the Meteorological Office by 4 p.m., they should be transmitted by the next post, *not* by wire.

While *too* much time should not be occupied in “reading” the instruments, especially the thermometers, anything like “hurry” should be still more discouraged. Any remarkable or unusual phenomena observed during the day, or any marked change of weather which has occurred, should be noted in words in the next report, and further details may be sent by an early post. Thunder and lightning, either together or separate, should always be reported in the first message after, or during their prevalence.

The official numbers of all the instruments used should be reported to London, and changes of any kind, such as the substitution of one instrument for another, or alteration in the position of the instruments, must be at once reported.

2. Barometrical Readings.

Whenever a reading of the barometer is taken the *attached* thermometer should be read also, and the reading be reduced to 32° F. and mean sea level. The reading of the attached thermometer should be taken before that of the barometer, in order that the reading of the former may not be affected by the proximity of the Observer.

The reading of the barometer should be taken, corrected, reduced, and *registered* to three places of decimals; but in reporting by wire the first two places only are requisite. Care must be taken, however, to report to the *nearest* hundredth, *i.e.* if the *third* decimal be *less* than “5” it is merely to be omitted: thus—

$$29.874 \text{ or } 29.871 = 29.87;$$

but should it be 5 or more than 5, the second figure is to be increased by 1: thus—

$$29.875 \text{ or } 29.877 = 29.88$$

“*Extreme*” Barometer Readings.—These may be

either higher or lower than that at 8 a.m.; thus, supposing that at 6 p.m. the reading reduced to 32° F. and mean sea level were 29.43, at 10 p.m. 29.24, and that at 8 a.m. the following day it had risen to 29.40; then after the groups of figures on this *latter* day the words "ten p.m. Bar. 924" should be added to the message. It would thus be evident that the barometer had fallen to an "extreme" of 29.24 at 10 p.m. and had since risen briskly. These figures are often of great value, especially in unsettled weather.

Again, suppose that on any day (say November 10th) the following readings were recorded in the register:—

Nov. 10th, 8 a.m.	-	-	30.193
" 2 p.m.	-	-	30.392
" 6 p.m.	-	-	30.241
" 10 p.m.	-	-	30.230
Nov. 11th, 8 a.m.	-	-	30.214

Then to the 8 a.m. report on the 11th add the words, "Two p.m. Bar. 039."

In fact it would materially add to the value of the reports if those observers who have the barometers near at hand would give regularly in their 8 a.m. reports a reading of the barometer taken at a late hour on the previous night; or if not practicable to do so always it might be done as frequently as possible, especially in unsettled weather. In the same way those who send up 2 p.m. reports might add a reading taken at noon: thus—"Noon 974."

The error to which observers are the most liable in reading a barometer is one of five hundredths (.050) of an inch; thus reading 29.924 for 29.974, and *vice versa*. Great care is requisite in counting the tenths also.

3. Thermometric Readings.

In reading a thermometer the principal liability to error is that of reading 5° too high or too low, as the case may be; and thus reporting, say, 57° for 52°, and *vice versa*.

4. Wind.

If there be no vane in sight the direction may be estimated best by observing drifting smoke from tall chimneys which are near the observer, or from chimneys in clear places, or from the motion of *very low* clouds, if there be any. Clouds, unless they are very low, frequently move in a direction different from that of the air at the

earth's surface, and are consequently not safe guides as to the direction of the surface wind.

Every possible care should be taken that the wind reported is the true wind which prevails in the observer's neighbourhood, and is not a mere local eddy caused by buildings or other obstructions to the general current.

If a vane be used to give the direction, care should be taken that it is set to true bearings and that it works freely.

A careful look out should be kept for the strongest wind occurring in the 24 hours, in order to report an accurate "extreme" in the next day's report.

Whenever a stronger wind occurs than that prevailing either at 6 p.m. or 8 a.m., which are both reported in the telegram, the direction, force, and hour of occurrence of such wind should be reported in words.

Whenever the force of the wind reaches 8 or upwards, the hour at which the gale (counted as Force 8 or more), commenced or ended should be reported.

5. Weather.

The Amount of Cloud is to be reported as a condition of Weather. It is that proportion of the sky which is covered with clouds, estimated in fourths.

When mist or fog is prevalent, so that the amount of actual cloud cannot be correctly ascertained, the *weather* must be reported by the figures for "fog" or "mist," as may be necessary; but when the haze is not sufficiently dense to obscure the sky, the state of the sky should be given as the *weather* in the groups, and the words "hazy" or "slightly hazy" be added to the report.

Whenever the observer notices that the clouds are moving in a direction different from that of the wind at the surface of the earth, or that the clouds are travelling at a rate *very* different from what might be expected by the wind at the time, or that the *upper* clouds are moving in a direction different from that of the *lower* clouds, he is to report the direction *from* which that motion takes place, and *whether it is fast or slow*.

When the weather is, or has been, squally, it should *always* be reported; and if the place for weather in the second or fourth group be already filled up, the word "squally" should be added.

All words relating to the weather given *before* the groups of figures will be understood as referring to weather which has occurred in the interval that has

elapsed since the previous morning, while words given *after* the groups will refer to the weather at the time of the report.

Although space is given in the groups for one feature only of the weather which may be prevailing at the time, it is evident that the observer can make any additional remarks which he may think fit, in *words*, adding them to the message after the groups.

6. *Notes added to the Reports.*

It may be well to say a word or two on this subject as many observers never add a single word of any kind to their reports, and their value is thereby much decreased. Notes may be added with great advantage when,—

1. In cases where the barometer has been rising but has just begun to fall again, especially if accompanied by the formation of cirrus clouds (mares' tails); or if the barometer has been falling and is just beginning to rise, especially if accompanied by a shift of wind and rain.

2. If the barometer begins to fall rapidly after having done so slowly or at a moderate rate.

3. If the wind should be shifting its direction while blowing strongly, let it be stated which way it is shifting, and what weather accompanies the change.

4. If the general appearance of the sky be threatening, either for wind or heavy rain, or if the sea be turbulent and rising.

5. If any very unusual extreme reading has been registered by any of the instruments a note should be added in addition to the figures of the reading, in order that, supposing the occurrence to have been local, it may not be mistaken at the Central Office for a telegraphic error. This is especially necessary in the case of *very* heavy falls of rain.

6. If the minimum temperature has been very low in the night, but the thermometer has since risen very suddenly, the change should be referred to, especially in winter time, and in such cases great care should be used in estimating the wind direction at 8 a.m.

7. Lunar halos should be carefully noted; so also should coronæ (coloured rings), which must be carefully distinguished from halos. Auroræ, *unusually* heavy dews, hail storms, &c. should be reported whenever they have occurred.

Directions for using the Instruments.

BAROMETER.

In handling barometers it should always be remembered that they are delicate and expensive instruments. The result of rough treatment is breakage; and for scientific purposes, observations from an instrument improperly repaired and not verified are useless.

The barometer should be fixed in a good light for observing, but out of the reach of sunshine or the occasional heat of a fire or lamp. The ill effects of artificial heat are, however, nearly completely obviated by taking a careful reading of the attached thermometer at the time of observation of the barometer. It should hang where it can swing freely, and be out of the reach of persons passing near it, so as to be carefully protected from injury. The height of the cistern of the barometer above *high-water mark spring tides* should be ascertained, noted, and reported to London.

INSTRUCTIONS FOR HANDLING THE BAROMETER.

A bracket and screws for suspending the barometer Fixing up. are in its box. Screw up the bracket where the barometer is to be hung. Then lift the instrument carefully out of its box, bend back the hinged part of the suspension arm, and slip it into the bracket. (The holding screws should not be driven quite home until the instrument is in position.) The mercury will then fall gradually, and the instrument will usually be ready for observation in about an hour; but as local temperature affects the instrument slowly, it may be well not to record observations from it for some hours after first fixing it. In a well-boiled tube, the mercury hangs adhesively sometimes, and will not quit the top of the tube. If, after an hour or so, the mercury has not descended to its proper level, tap the cistern end rather sharply with the finger, or make the instrument swing a little in its gimbals. This difficulty very rarely happens, and no precise mode of treatment can be laid down: the remedy lies much at the judgment of the observer, who should use such means as his discretion may lead him to deem best to cause the mercury to fall. The box should be safely stowed away.

Taking it
down.

Whenever it may be necessary to take down a barometer and stow it in its box, *the vernier should be brought down to the bottom of the scale*. Then, having lifted the instrument out of the bracket, place or hold it in an *inclined* position for a few minutes, so as to allow the mercury to flow *very gently* up to the top of the glass tube. It should then be taken lengthwise and laid in its box. It is now portable, without any other adjustment whatever; and may be carried with the *cistern end upwards* or *lying flat*, but it must not be subjected to jars or concussions.

Packing it.

Experience shows that it is advisable to give some directions as to packing barometers. The instrument having been taken down and placed in its box as directed, if it is to be sent by rail or other conveyance, and will probably have to be handled by persons unacquainted with its delicate and peculiar construction, should be placed in a packing case with two or three inches of soft elastic packing all round it, as hay, straw, shavings, tow, or paper-cuttings. The lid of the case should *never be nailed down*, but always fastened with screws. The address label should be *pasted* (not nailed) on the end of the case which is next the cistern, or lower end of the barometer, and it should be marked "Glass and fragile instruments. Keep flat, or carry it this end upwards."

Of course, if two or more barometers are packed together, the cisterns should all be placed at this mark end of the case. Barometers should be transmitted by passenger train, and, in short, always by whatever route or conveyance affords the most easy transit. Transshipment or change of conveyance should be avoided if possible.

BAROMETER VERNIER.

Principle of the
vernier.

In order to facilitate the taking of accurate readings of the height of the barometer, a small moveable scale, called a vernier, is attached to the instrument.

The general principle of this moveable dividing scale is that the total number of the smallest spaces or subdivisions of the vernier are made equal, taken together, to one less or more than that number of the smallest spaces in an equal length of the fixed scale. In standard barometers the twenty-five spaces in the vernier are equal to any twenty-four spaces of the scale, which are each half a tenth or five hundredths of an inch; there-

fore a space on the scale is larger than a space on the vernier by the twenty-fifth part of .05, which is .002 inch, consequently the vernier exhibits differences of .002 of an inch.

The vernier is moved by a rack and pinion. Turn the milled-head of the pinion so as to bring the *lower* edge of the vernier exactly on a level with the top of the mercurial column. When set properly, the front edge of the vernier, the top of the mercury, and the back edge of the vernier should be in the line of sight, which line will thus just touch the *middle* and *uppermost* point of the column. Great care should be taken to acquire the habit of reading with the eye exactly on a level with the top of the mercury, that is with the line of sight at right angles to the scale.

A piece of white paper placed behind the tube, so as to reflect the light, assists in setting the vernier accurately. A small bull's-eye lamp held behind the instrument enables the observer to get a correct setting at night. When observing the barometer, it should hang *freely*, not being inclined by holding, or even by a touch; because any inclination will cause the column to rise in the tube.

Every long line	{ cut on the barometer scale }	a tenth	(.100) of an inch.
" short "	{ corresponds to - }	five hundredths (.050)	"
Every long line	{ cut on the vernier scale }	one hundredth (.010)	"
" short "	{ corresponds to - }	two thousandths (.002)	"

The mode of reading off may be learned from a study of the following diagrams, in which A B represents part of the scale, and C D the vernier, the lower edge D denoting the top of the mercurial column. The scale is readily understood; B is 29.000 inches; the first line above B is 29.050; the second line 29.100, and so on. The first thing is to note the scale line just below D, and the next is to find out the line of the vernier which is in one and the same direction with a line of the scale. In figure 1 (p. 18), the lower edge of the vernier, D, is represented in exact coincidence with scale line 29.5; the barometer therefore reads 29.500 inches. Studying it attentively in this position it will be perceived that the vernier line *a* is .002 inch below the next line of the scale. If, therefore, the vernier be moved so as to place *a* in a line with *z*, the edge D would read 29.502. In like manner it is seen that *b* is .004 inch away from the line next above it *on the scale*; *c*, .006 inch apart from

Reading the
barometer.

that next above it; d , $\cdot 008$ inch from that next above it; and l , on the vernier, is $\cdot 010$ below y . Hence, if l be moved into line with y , D would read $29\cdot 510$. Thus the numbers 1, 2, 3, 4, 5, on the vernier, indicate hundredths, and the intermediate lines the even thousandths of an inch. Referring now to figure 2,

Fig. 1.

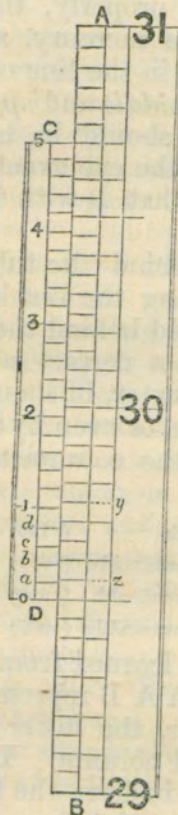
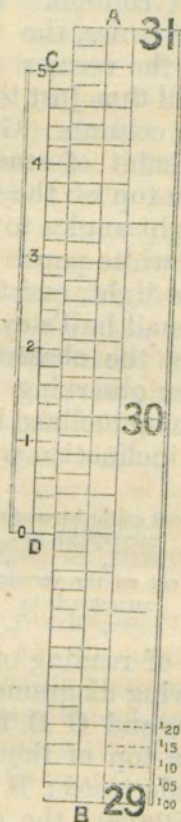


Fig. 2.



the scale line just below D is $29\cdot 650$. Looking carefully up the vernier, the third line above the figure 3 is seen to lie evenly with a line on the scale. The number 3 indicates $\cdot 030$, and the third subdivision $\cdot 006$; and thus we get—

Reading on scale	-	29.650
Reading on vernier	- {	.030
		.006
Actual reading	-	29.686 inches.

Sometimes two pairs of lines will appear to be coincident; in which case the intermediate thousandth of an inch should be set down as the reading. Thus, suppose the reading appears to be $29\cdot 684$ or $29\cdot 686$, the mean $29\cdot 685$ should be adopted.

MANAGEMENT OF THERMOMETERS.

It is not at all an easy matter to obtain a record of temperature which shall be altogether unexceptionable. If an open exposure is available, a double-louvre-boarded case, or screen, should be set up to contain the thermometers. There is a great difference of opinion among meteorologists as to the best form and size for such a screen. It would seem to be suitable for its purpose, if it afford perfect shelter from the sun's rays falling directly upon the instruments and allow free circulation of the air about them, keeping them at least three or four inches from the wall and from the sides and front of the screen itself. All thermometer stands which are entirely open on one side have two serious disadvantages; the thermometers are not sheltered from rain and snow, and constant care is required to turn the stand so as to keep the instruments always in the shade. This is more particularly necessary in high latitudes, as the sun rises and sets more on the polar side of the east and west points of the horizon than in the low latitudes.

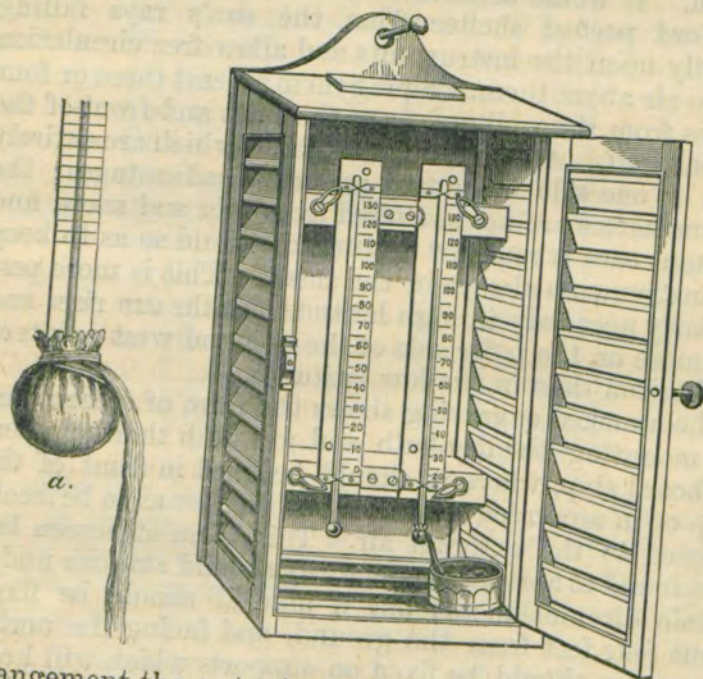
The annexed engraving shows the form of screen used for mounting the dry-bulb and wet-bulb thermometers on board ship, where it should be fixed in front of the poop or in any other available position, so as to be freely exposed to the external air. This form of screen has been found to answer satisfactorily at land stations under certain circumstances; but if used it should be fixed about four feet from the ground, and facing the north. The screen should be fixed on supports which will keep it at least four inches from the wall into which they are driven, and great care must be taken that the sun shall not shine on it at all during *any part* of the day. The greatest care should be taken that the screen is firmly fixed. If the maximum or minimum thermometers are shaken, the index of either may be moved and the readings set astray.

Thermometer
screens.

Two thermometers should be fitted up in the vertical position in the screen, one to give the temperature of the air, and the other that of evaporation. They should be without cases or guards, near each other, but not within a less distance than two or three inches, and as free as possible from radiation from walls, heated ground or stones, and from draughts near windows of warm rooms and kitchen areas; and, on board ship, from cabins and engine rooms.

A piece of the finest muslin or cambric should be tied round the bulb of one thermometer, and a few threads of cotton wick passed round the glass stem close to the bulb (see *a*, fig. 3), touching the muslin, and long enough to reach two or three inches below the lowest part of the bulb, should be carried down so as to dip into and remain in a small vessel of water. By this

Fig. 3.



arrangement the water is slowly conducted, by capillary attraction, to the bulb and evaporated there. See fig. 3. The cup, glass, or other small holder of water ought not to be under or too near the dry thermometer. This little reservoir should be on the off side of the wet thermometer, that is, as far as possible from the dry

thermometer, which of course should not receive any moisture either from rain or otherwise. The water should be either distilled or rain water, or, if this be not procurable, the softest pure water that can be had, to avoid the inconvenience of the deposit of lime, &c. on the bulb. The water vessel should be replenished *after*, or some time *before*, observing; because observations are incorrect if made while the water is warmer or colder than the air.

The muslin and wick should be well washed before being applied, and occasionally while in use. They should be changed once or twice a month or even oftener, according to the quality of the muslin, &c., and the exposure to *dust* or *blacks*. Accuracy depends much on the care taken for cleanliness, and for a proper supply of fresh water. The temperature of evaporation is a very important observation, and therefore especial care should be taken to make it correctly.

In our climate the usual difference between the readings of the dry and wet bulb thermometers ranges from 0 to 12 degrees in *outer* air.

When the wet bulb is frozen it should be wetted by means of a camel-hair brush or a feather with some cold water taken from under ice, care being taken to raise its temperature as little as possible. After waiting a few minutes, the moisture will first freeze, then cool down to the temperature of the air, and finally the thermometer will fall a trifle lower than the dry one, and then the reading may be noted. It is only when there is absolutely no water or ice upon the bulb that it fails to act; and, allowing for the error of the instrument, it can only read higher than the dry bulb when the water is warmer than the air, which it never should be for the purpose of a correct observation.

Maximum Thermometer.

Suspend the instrument in a horizontal position. On an increase of temperature the mercury will extend itself along the stem and remain with its extremity showing the highest degree reached. On a decrease of temperature the mercury cannot recede into the bulb until it is reset for a future observation, owing to a restriction placed in the bend of the tube. To set the instrument, hold it, bulb *downward*, and give it one or two jerks, or swing it to and fro. This will send some

of the mercury into the bulb, and this treatment should be continued until the temperature existing at the time is shown by the upper end.

Minimum Thermometer.

Suspend the instrument in a horizontal position, below the maximum thermometer, in the same screen. To set the index, hold the thermometer bulb uppermost until it descends to the end of the spirit. With a decrease of temperature the alcohol will draw the index towards the bulb; but on an increase of temperature the fluid will advance beyond the index, leaving it so that the end remote from the bulb will show whatever extreme of cold may have occurred. If the spirit becomes separated, hold the thermometer bulb downward, and give it one or two good swings with the arm. This will cause the detached portions to flow towards the bulb and unite.

Owing to the volatility of alcohol, with which spirit this thermometer is made, a little will in course of time be carried away from the column and condensed at the sealed end of the tube. Hence it is necessary to compare a spirit thermometer from time to time with a mercurial thermometer of known accuracy. Should they not read alike, the upper end of the spirit thermometer should be examined closely, and if any spirit be apparent there it should be shaken down.

RAIN GAUGE.

The funnel of this rain gauge is made to lift on and off the cylinder. A can for receiving the rain from the funnel is placed inside the cylinder.

When rain is to be measured, remove the funnel, take out the can, and pour the rain collected into the glass measure, which is graduated to hundredths of an (artificial) inch, up to 0.50, or half an inch. Place the glass upon a table or other horizontal surface for support and steadiness, and read off with the eye on a level with the surface of the water.

Should more than half an inch of rain have been collected, successive measurements will be necessary. For instance, having measured half an inch or 0.50, empty

the glass, fill up again from the collecting can, and add the result of this second measurement to the half inch measured previously; should the second reading be 0.34, the two readings added together will give for the total rainfall 0.84 of an inch.

Rain gauges should be placed on the ground, or the lower part of the gauge should be sunk below the level of the ground, so that the upper rim of the gauge may be about 1 ft. above the level of the ground; this will prevent the gauge from being upset. They must be in a position exposed to a free fall of rain, snow, or hail, where no houses, walls, or trees shelter them from the wind or cause eddies. Should it be absolutely necessary to place them on a building or other elevated position they should be supported by a frame or other means, admitting of their being emptied daily, but preventing their being blown down, care being taken that the receiving aperture is horizontal. Generally, a position on or near the ground is far preferable to an artificial elevation; but if so raised, the height above ground should be registered and officially reported.

From day to day, in the morning, the quantity of water from rain, snow, or hail (melted), should be measured very carefully and recorded.

The gauge should not be opened more than once a day. The glass measure should be used with great care, because, if broken, some delay may occur in replacing it. It should not be left in the gauge, especially in winter, when it would be liable to be broken by frost.

THE GAUGE SHOULD BE EXAMINED EVERY DAY, EVEN IN FINE WEATHER, SO THAT NO SHOWER, HOWEVER SLIGHT, MAY ESCAPE NOTICE.

The accuracy of rain gauges depends upon the correct graduation of the glass and the perfect form of the circular opening of the funnel. In the gauge supplied by this office the diameter of the receiver is eight inches; it is tested, and the glass verified before issue. If the circular opening gets bent or knocked out of shape, the indications of the gauge are no longer correct. Such defects should be reported as soon as they are discovered. The funnel should be kept clean and free from the accumulation of dust, leaves, &c.

Telegraphic Weather Intelligence.

The Meteorological Office issues (free of charge) to ports and fishing stations approved of by the Board of Trade, notices of atmospherical disturbances on or near the coasts of the British Islands.

SIGNALS.

The fact that such a notice has been received at any station is made known by a signal, which is hoisted on the receipt of the message, and remains hoisted, but only during the daytime, for the space of 48 hours and no longer, counted from the time the message is sent out.

The signals are made by means of two canvas shapes, a CONE and a DRUM.

The CONE is three feet high and three feet wide at base, and appears as a triangle when hoisted.

The DRUM (or cylinder) is three feet high and three feet wide, and appears as a square when hoisted.

SOUTHERLY GALE.

The CONE *point downwards* means that strong winds are probable, at first from the Southward (from S.E. round by S. to N.W.).

NORTHERLY GALE.

The CONE *point upwards* means that strong winds are probable, at first from the Northward (from N.W. round by N. to S.E.).

VERY HEAVY GALES.

The DRUM will be hoisted with the Cone whenever a very heavy gale, either southerly or northerly, as the case may be, is probable.

The Drum will not be used without the Cone.

SUDDEN SHIFTS OF WIND.

No signal is employed to indicate a wind which is likely to shift suddenly, but it must be remembered, that a Southerly wind is much more likely to veer to a point North of West than a Northerly wind is to veer to a point South of East.

Accordingly, when the South Cone is hoisted and the

anchorage or harbour is exposed to the North-West, it is advisable to make preparations for a North-West gale.

ON HOISTING THE SIGNALS.

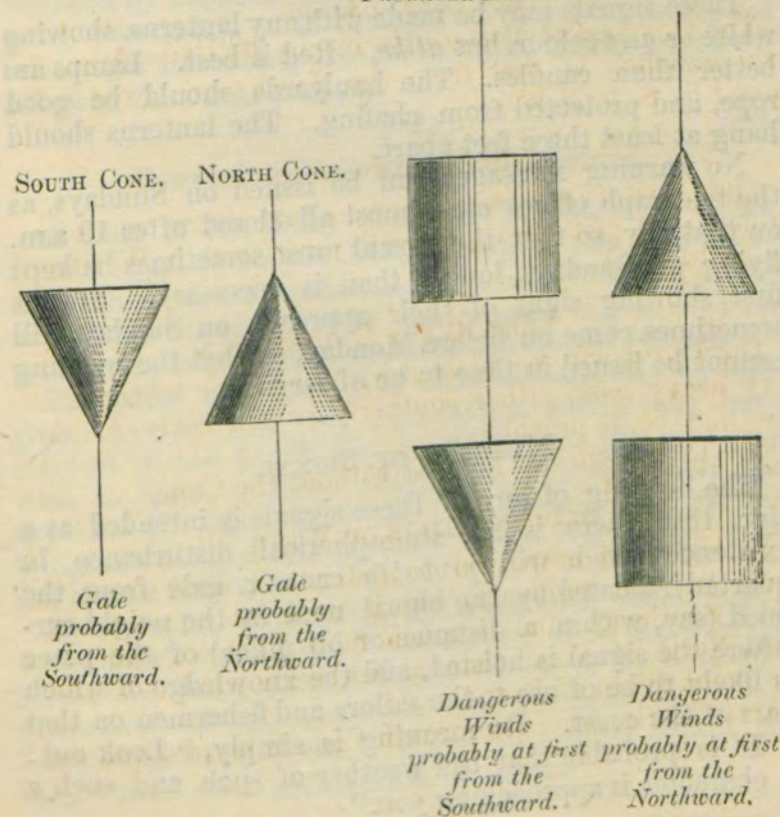
The signal is to be kept flying until dusk, and then lowered, and hoisted again next morning; and so on until the end of 48 hours from the time the message has been issued from London (which is always marked on the telegram), unless orders are received previously to lower the signal.

At dusk, whenever a signal ought to be flying if it were daylight, a night signal may be hoisted in place of the Cone, consisting of three lanterns hung on a triangular frame, point downwards, or point upwards, as the case may be. It is not considered necessary to hoist lanterns to represent the Drum. They should be kept burning until late in the evening, say 9 or 10 o'clock.

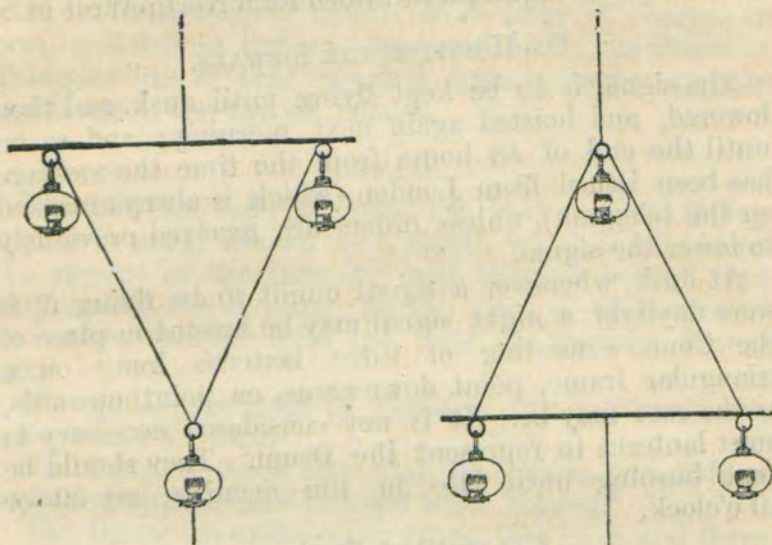
CAUTIONARY SIGNALS.

DAY SIGNALS.

PROBABLE HEAVY GALE OR STORM.



NIGHT SIGNALS (instead of the above), Lights in triangle.



Three lanterns and one yard 4 ft. long, will be sufficient.

These signals may be made with any lanterns, showing white or any colour, but *alike*. Red is best. Lamps are better than candles. The haulyards should be good rope, and protected from chafing. The lanterns should hang at least three feet apart.

No warning messages can be issued on Sundays, as the telegraph offices are almost all closed after 10 a.m. on that day, so that the signal must sometimes be kept flying on Sundays longer than is necessary. Storms first showing signs of their approach on Sunday, will sometimes come on before Monday, so that the warning cannot be issued in time to be of service.

MEANING OF SIGNAL.

The hoisting of any of these signals is intended as a sign that there is an atmospherical disturbance in existence which will *probably* cause a gale from the quarter indicated by the signal used in the neighbourhood (say, within a distance of 50 miles) of the place where the signal is hoisted, and the knowledge of which is likely to be of use to the sailors and fishermen on that part of the coast. Its meaning is simply, "Look out!" "It is probable that bad weather of such and such a character is approaching you."

Hitherto it has been found that at least *three* out of *five* signals of approaching storms (Force upwards of 8 Beaufort scale, a "Fresh Gale"), and *four* out of *five* signals of approaching strong winds (Force upwards of 6 Beaufort scale, a "Strong Breeze"), have been fully justified.

In every case some of the principal reasons which have led to the hoisting of the signal are explained in the telegram, *which should always be kept posted up for public inspection while the signal is flying*.

It must be remembered that only the greater and more general disturbances of the atmosphere can be made known by this method. Local changes of less extent may be indicated to observers by their own instruments and by local signs of weather, &c.

A regular study of the Daily Weather Report will be found very useful, as showing what weather has lately been prevalent generally.

The signal will sometimes be kept flying after the gale is over; this is the case because often one gale is followed by another before the 48 hours are out. In every case when it is thought at the Meteorological Office that immediate danger is over, orders are issued to lower the signal at once.

SUPPLY OF WEATHER INTELLIGENCE.

A copy of the Daily Weather Report, with Chart, will be supplied by post free of cost, to any port where the authorities will undertake to exhibit it to the public as soon as received. The subscription for a copy for private use is 1*l.* a year, to cover the cost of postage.

The office is prepared to send occasionally by telegraph to any port, any information which may have reached it, and which the authorities at the port may wish to have, if these authorities will bear half the expense of transmission of the messages. This intelligence is quite independent of the Warnings; these are transmitted free.

As examples of the kind of information which might be supplied, may be cited, statements as to the weather at certain points of the coast, whenever there is any disturbance of consequence of the atmosphere, but not amounting to a storm. These statements might be telegraphed when necessary to the ports.

Such messages ought to reach the port, at latest, at about noon on any day that they are issued. The system, wherever tried, has been found to be useful.

Information as to the laws of weather will be found in the "Board of Trade Barometer Manual," ed. 1871 (price 1s.), or in the "Board of Trade Fishery Barometer Manual," ed. 1869 (price 6d.)

By order of the Meteorological Committee,

ROBERT H. SCOTT,
Director.

LONDON:

Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE

Printers to the Queen's most Excellent Majesty.

For Her Majesty's Stationery Office.

[P. 2623.—125.—2/75.]