

CHAPTER 18

ABSTRACT OF WIND

18.1 The types of wind measuring equipment most commonly used by the Atmospheric Environment Service are the analog U2A system with associated Munroe recorder, the digital 78D system, and the M.S.C. Anemometer Type 45B, with its associated M.S.C. Anemograph. These instruments are described in detail in Instrument Manual 50, Technical Manual TM 05-01-04, and Instrument Manual 51 respectively. The following instructions deal with the abstracting of wind data from the Anemograph Chart 100B (Type 45B System) and from the Recorder Chart Roll (U2A System). Included also are procedures for completing Form 0063-2306 – Abstract of the Wind.

Note: The instructions pertaining to the U2A Recorder Chart Rolls also apply to similar chart rolls from other wind recorders, e.g., Bendix-Friez.

18.2 ANEMOGRAPH CHART 100B – FORM 63-9605. The body of the chart is divided horizontally into two sections; one for the wind direction record and the other for the wind speed record. At the top of the chart are spaces provided for entering the station name and province, the normal daily time (LST) that the chart is put on the recorder drum, time zone, year, month and day.

18.2.1 The wind direction section is spaced horizontally to allow for the recording of the directions to 8 points of the compass and it is divided vertically by heavy lines for each hour and dotted lines for each half-hour. The directions of the four quadrants (N, S, E, W) are printed in order to facilitate the selection of the prevailing direction.

18.2.2 The wind speed section is divided horizontally by lines, each of which is spaced to allow for the recording of 2 miles of wind, and vertically by heavy lines for each hour. Between the heavy lines are intermediate light lines spaced at 10-minute intervals.

18.3 CHART CHANGING

18.3.1 The normal, daily time of chart change, or time of 'chart on' for the anemograph chart 100B shall be 0800 Local Standard Time, unless the station normally operates on a limited program, and is not staffed at 0800 LST. Under these conditions, an alternate time of normal chart changing shall be arranged through the appropriate channels. If an alternate 'normal time of chart on' must be selected due to hours of operation of the station, this change should occur at the beginning of a month. The normal time of chart on must not vary during a month. As long as an alternate normal time of chart on is established and maintained, all preprinted times along the top of each chart shall be changed in accordance with the revised time. For example, if the alternate 'chart on' time is 1000 LST, strike out 08, 09, 10, etc., and enter 10, 11, 12, etc.

	10	11	12	
Example:	08	09	10	etc.

18.3.1.1. Do not use Daylight Saving Time.

18.4 ENTRIES ON ANEMOGRAPH CHART 100B - FORM 63-9605

18.4.1 Before putting the new chart on the drum of the recorder, enter the station name, province, the normal daily time of 'chart on' (LST, two digits, hour only - see Example 4), time zone (a single letter preceding 'S.T.' in English, or following 'HN' in French), year, month and day in the spaces provided on the chart. Alter the preprinted times along the top of the chart if applicable. All entries shall be printed or written clearly. The drum shall then be installed such that when the pen is started, it will indicate to the closest five minutes the actual time that it was placed on the chart. (Thus the hour is obtained from the preprinted times along the top of the chart and the minutes from the start position of the pen.)

18.4.1.1 After the chart has been removed from the drum, entries of hourly prevailing wind directions and wind speeds, in the spaces provided, shall be made as follows:

- (a) Required at all stations which do not normally provide 24 Hourly Observations per day, throughout the year. (Note exception para. 18.8.4 (b)).
- (b) Required at any station if so requested to satisfy a Regional or local need.
- (c) Not required at stations which normally provide 24 Hourly Observations per day, throughout the year.

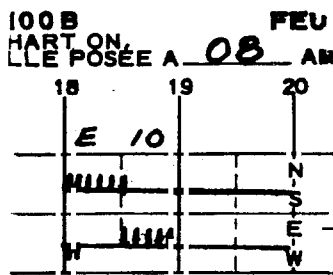
HOWEVER:

On occasions when the 24-hourly observation program has been temporarily interrupted due to staff shortage, staff sickness, etc., and there is no serviceable U2A recorder at the station, the hourly prevailing wind directions and wind speeds, converted to knots for the period of interrupted service, shall be determined from Anemograph Chart 100B and entered in Columns 36 and 37 of Form 63-2322. Also make a note of the fact, with the duration of the period, in column 1.

18.5 HOW TO ABSTRACT WIND DATA

18.5.1 Hourly Prevailing Wind Direction. Wind directions on the chart are indicated by vertical marks at right angles to the direction of travel of the chart and towards the directions indicated. The direction recorded is that in which the vane was pointing at the time the cups completed a run of one mile. The hourly prevailing wind direction is that direction, one of 8 possible directions, which has the greatest number of miles recorded during the hour, and is reported to 8 points of the compass, N, NE, E, SE, S, SW, W, or NW.

18.5.1.1 When the record indicates one direction only during the hour, the prevailing direction for the hour is obvious. However, more frequently, two or more directions are recorded. In this case, it will be necessary to count the number of vertical marks for each indicated direction, to determine which has the greatest mileage and, therefore, is prevailing. Example:



In this example the total mileage is 10

2 miles from the N W

3 miles from the N

1 mile from the NE

4 miles from the E

Prevailing Direction is East.

18.5.1.2 If the greatest mileage is represented by two or more directions, the last of the directions in question shall be the prevailing direction; see example 4, para. 18.5.5.4.

18.5.2 Hourly Wind Speed. Wind speed (miles per hour) is recorded on the chart by vertical steps; each step is made when one mile of wind passes the anemometer. The speed trace moves 50 steps up and 50 steps down. The wind speed (mph) is determined by counting the number of vertical steps in the wind speed record for each hour. If a vertical step coincides with an hour line, it should be counted in the preceding hour.

18.5.3 Entries of Hourly Wind Data. In the spaces provided on the chart, enter the hourly prevailing wind direction and the hourly wind speed in miles per hour. Examples: N2, NE5, E15, SW25. Enter C for calm.

18.5.4 Missing Data. If the anemograph is inoperative for short periods of time only, such as required for minor repairs or servicing, entries for the direction and speed should be obtained for the corresponding period from the following sources and in the priority listed here:

- (a) Surface weather Record Form 63-2322 (convert knots to mph)
- (b) Other operative surface wind recorder or indicator.
- (c) Observer's estimate.*

Note: Form 63-2306 allows for summarization of wind direction to 8 compass points only. Observations recorded to 16 points may be arbitrarily reduced to 8 points by turning the intermediate directions counter-clockwise, e.g.,

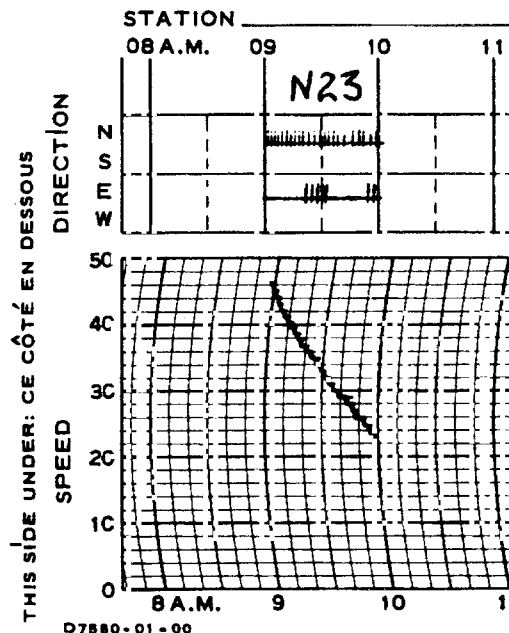
NNE is entered as N
ENE is entered as NE
ESE is entered as E
SSE is entered as SE

SSW is entered as S
WSW is entered as SW
WNW is entered as W
NNW is entered as NW

18.5.5 Typical Examples

Example 1

18.5.5.1 Example 1: During a one-hour period this anemograph chart shows that the wind was north for 10 miles, northeast 5 miles, then north again for 6 miles, then northeast for 2 miles, i.e., 16 miles of wind from the north and 7 miles from the northeast, and a total mileage for the hour of 23. The prevailing direction for this hour is NORTH since the greatest mileage is from the north. The entry in the appropriate space is N23.

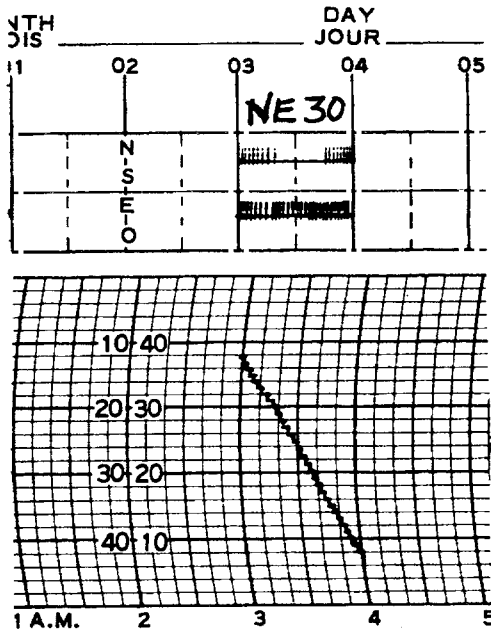


*Estimated values of wind direction and/or speed shall be entered on Chart 100B as follows:

- (i) Estimated direction shall be indicated by an asterisk above and to the left of the direction e.g., *NW
- (ii) Estimated speed shall be indicated by an asterisk above and to the right of the speed e.g., 15*
- (iii) *NW15* indicates that both direction and speed were estimated.

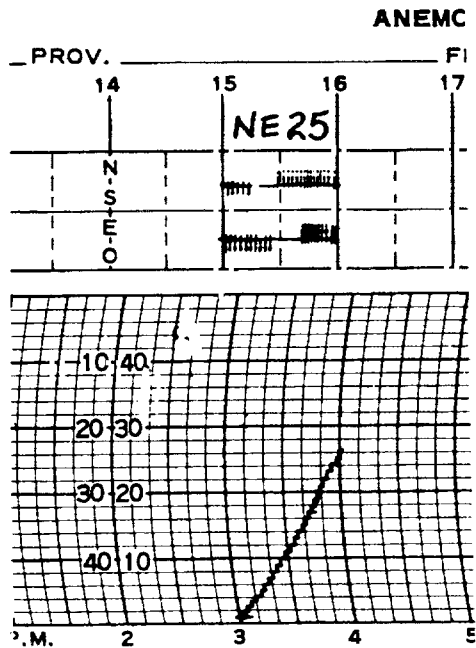
Example 2

18.5.5.2 Example 2: During a one-hour period this anemograph chart shows that the wind was northeast for 8 miles, east for 12 miles, and then northeast again for 10 miles, i.e., 18 miles from the northeast and 12 miles from the east, and a total mileage for the hour of 30. The prevailing direction for this hour is NORTHEAST and the entry in the appropriate space is NE 30.



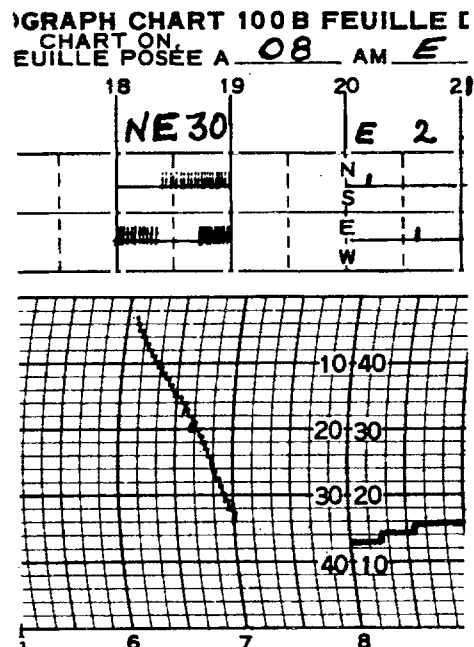
Example 3

18.5.5.3 Example 3: During a one hour period this anemograph chart shows that the wind was southwest for 5 miles, west for 4 miles, then north for 6 miles, then northeast for 10 miles, giving a total mileage for the hour of 25. The prevailing direction for the hour is NORTHEAST and the entry in the appropriate space is NE 25.



Example 4

18.5.5.4 Example 4 illustrates an anemograph chart showing the greatest mileage being represented by two or more directions. In such cases, the last of the directions in question shall be entered as the prevailing direction for that hour. In this example for hour ending 19 the wind has blown from the east for 10 miles, north for 10 miles, and northeast for 10 miles, thus the prevailing direction for this hour is NORTHEAST, and has been entered in the appropriate space as NE 30. Likewise, for hour ending 21, the prevailing direction is EAST.



18.5.6 Irregular Cases. If wind data are missing and not available from another source and cannot be estimated, a dash (-) shall be entered in the appropriate box on the chart, whether the missing data are wind directions and/or speeds. One dash is used for each missing element, i.e., each missing direction and/or speed. If data are missing for a complete day, the chart heading should be completed, but the word MISSING may be written on the body of the chart, rather than filling in a dash for each missing piece of data.

18.5.6.1 If the pen overruns the chart, resulting in data being recorded on the unlined portion of the chart or in two sets of data being superimposed on the same portion of the chart, these data should be abstracted if possible and entered in the relevant boxes of the appropriate chart. This procedure is necessary because 24 hours of data only can appear on any one chart. The normal time of CHART ON should then be entered in the heading of the new chart and the pen should be placed in the proper position, i.e., indicating the actual time of day on the chart. If it is impossible to abstract the data, dashes should be entered in all the relevant boxes.

18.5.6.2 If the pen overwrites the previous day's data, it will likely be impossible to abstract the wind direction, although it may be possible to determine the wind speed. In such a case enter a dash (-) for the wind direction and enter the wind speed as abstracted.

18.6 DISPOSAL OF ANEMOGRAPH CHART 100B - FORM 63-9605. At the end of each month, the completed set of anemograph charts shall be forwarded promptly through appropriate channels to AES Downsview. However, if the wind data are normally derived from a U2A (or other) system and recorded on Form 63-2322, and a type 45B is also installed at the site, the anemograph charts should be disposed of in accordance with Regional instructions and not sent to AES Downsview.

18.6.1 Stations shall ensure that the set of charts is complete for the month and shall include the chart for the last day of the month. The charts should be in correct order, with the chart for the first day of the month on top and succeeding days underneath, with the last day of the month on the bottom.

18.6.2 Stations completing Form 63-2306 shall abstract the new month data from the chart for the last day of the month (mid-night to 08 a.m.), before forwarding that chart along with the rest of the charts for the month.

18.6.3 Stations having a local need for anemograph charts should advise the ADMA, through appropriate channels. The charts will then be returned to the station as soon as possible after processing.

18.7 ABSTRACT OF THE WIND - FORM 63-2306. This form is used in preparing a monthly climatological report of wind data as abstracted from Anemograph Chart 100B, U2A dials or recorder, or other wind equipment operated for climatological purposes.

18.7.1 Form 63-2306 shall be completed to satisfy a Regional or local need. Stations required to complete this form will be advised accordingly by the Region.

18.7.2 Entries on Form 63-2306

18.7.2.1 In the spaces provided at the top of the form, enter the station name, province, month, year and Standard Time Zone. In the boxes provided, check off the units used for wind run, and the type of anemometer in use. (See example, para. 18.7.2.8.)

18.7.2.2 In the main body of Form 63-2306, opposite the appropriate dates in the hour-ending columns, record the hourly wind directions and speed values (in miles per hour) as entered on Anemograph Chart 100B. For example, an entry of NW30, on the Anemograph Chart 100B, for the hour ending 0900 (space between 08 and 09) would be entered on Form 63-2306, in the column for hour ending 9.

18.7.2.2.1 At stations equipped with U2A or similar wind equipment, and required to complete Form 63-2306, entries become two minute mean winds, with directions in tens of degrees. For example:

Observed Two Minute Mean 63-2306 Entry

<u>Wind, On the Hour</u>	
360 degrees, 8 knots	3608
045 degrees, 10 knots	0510
184 degrees, 29 knots	1829
Calm	0000

Note: Ensure that the wind speed units and anemometer type are noted in the heading of Form 63-2306.

18.7.2.3 Footings to the Main Body of the Form. These rows and columns are used only at those stations where data are abstracted from Anemograph Chart 100B.

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18.7.2.3.1 Sums. In the row designated 'sums', enter the monthly totals of wind run for each hour of the day.

18.7.2.3.2 Means. In the row designated 'means' enter the average wind speeds to the nearest tenth of a unit for each hour of the day. The 'mean' is determined by dividing the 'sum' in the row above, by the number of days in the month. If the record is incomplete, the divisor shall be the total number of days on which a wind record was obtained at that hour.

18.7.2.3.3 Directions. In the 9 rows designated by compass directions and 'calm', enter the number of occurrences of each direction in the hour concerned. For example, for the first space, count the number of occurrences of north in the hour ending 0100 local time, and enter the number in the row designated 'N'; then count the number of occurrences of northeast in the hour ending 0100 local time, and enter the number in the row designated NE, etc.

18.7.2.3.4 Sums. Enter the sum of the direction entries and calms for each of the hours. The sum of occurrences of north, northeast, etc., for each hour should be the same as the number of days in the month, provided the record was complete for the appropriate hour.

18.7.2.3.5 At the extreme right-hand end of the rows the total for each row shall be entered. These totals show the number of hours during the month when the wind blew from each of the directions concerned.

WIND DIRECTION CONVERSION TABLE

Compass Points	Degrees (Nearest)	Degrees (Range)
North	360	349-011
North-northeast	023	012-033
Northeast	045	034-056
East-northeast	068	057-078
East	090	079-101
East-southeast	113	102-123
Southeast	135	124-146
South-southeast	158	147-168
South	180	169-191
South-southwest	203	192-213
Southwest	225	214-236
West-southwest	248	237-258
West	270	259-281
West-northwest	293	282-303
Northwest	315	304-326
North-northwest	338	327-348

18.7.2.4 Side Columns. These columns and rows are used only at those stations where data are abstracted from Anemograph Chart 100B.

18.7.2.4.1 Total Wind Run. In the total wind run column enter the total number of units (e.g., miles) of wind run each day. This will be the sum of the 24-hourly values, e.g., 438. At the bottom of this column enter the sum and the mean of the daily wind run.

18.7.2.4.2 Mean Hourly Speed. Divide the total wind run for each day by 24 and determine the mean hourly speed to the nearest tenth of a unit per hour. Enter these values in the appropriate spaces in the mean hourly speed column, e.g., 18.3. At the bottom of this column enter the mean hourly speed for the month. (Divide total wind run for the month by total hours).

18.7.2.4.3 Maximum Hourly Velocity. Determine the greatest wind run recorded for any hour of the day and enter the prevailing direction and speed for that hour, Example NW 36.

18.7.2.4.4 Wind Run from Each Direction. Determine the total wind run for each day from each of the eight compass points and enter these values in the appropriate spaces.

18.7.2.4.5 Sums and Means. Determine the total wind run from each of the 8 compass points and enter these values in the spaces reserved for sums. Determine the means by dividing the total wind run by the number of hours during which the wind blew from the corresponding direction. Enter these values in the spaces reserved for means. For example, if the total wind run from north for the month was 3174, and north was the prevailing direction for 276 hours (taken from the direction footings, para. 18.7.2.3.3), the mean speed from north would be:

$$\frac{3174}{276} = 11.5 \text{ units (e.g., m.p.h.)}$$

18.7.2.5 Checks. As a check on the accuracy of the additions the following values should be identical:

- (a) The total wind run for the month as obtained from the 24-hour totals.
- (b) The sum of the total wind run for each day.
- (c) The sum total of the wind run from the eight points of the compass.

18.7.2.6 General Summary. A general summary for the month is required in the lower right-hand corner of the form at those stations where data are abstracted from Anemograph Chart 100B.

18.7.2.6.1 Maximum Velocities. Spaces are provided for entering the number of days when maximum hourly winds occurred within specified limits. These data shall be determined from entries in the maximum hourly velocity column.

18.7.2.6.2 Total Wind Run for Month. Enter the total wind run for the month as obtained from the total wind run column.

18.7.2.6.3 Greatest Wind Run in 24 Hours. Determine the greatest daily wind run from the total wind run column and enter it in the space provided.

18.7.2.6.4 Greatest Wind Run and Prevailing Direction for 1 Hour. Determine this value from the maximum hourly velocity column and enter it in the space provided.

18.7.2.6.5 Date of Greatest Wind Run for 1 Hour. Determine the date of the greatest wind run for 1 hour and enter it in the space provided.

18.7.2.6.6 Maximum Speed and Direction for 10 Minutes. This value may be obtained by examining the anemograms and noting the maximum wind run in any ten-minute period. The speed, direction, date and hour of the maximum wind shall be entered in the space provided.

18.7.2.6.7 Average Speed for Month. Obtain the average speed for the month from the mean hourly speed column (para. 18.7.2.3.2) and enter it in the space provided.

18.7.2.6.8 Longest Continued Direction. This is determined from examination of the hourly data. Enter the direction from which the wind blew continuously for the greatest number of hours. Enter also the number of continuous hours.

18.7.2.6.9 Prevailing Direction.

- (a) By Wind Run. From the "Wind run from each direction" columns select the direction from which the greatest wind run occurred and enter it in the space provided.
- (b) By Total Hours. From the rows designated by "compass directions", check the totals for each row and select the direction from which the wind blew for the greatest number of hours. Enter this direction in the space provided.

18.7.2.7 Disposal of Form 63-2306. Disposal of Form 63-2306 shall be in accordance with Regional or local instructions. However, stations which have been designated to complete this form shall also send a copy to AES Downsvew. In the event that the wind data are normally derived from a U2A (or other) system and recorded on Form 63-2322, and a type 45B is also installed at the site, a copy of Form 63-2306 should not be sent to AES Downsvew.

18.7.2.8 Typical Entries - Form 63-2306

Station: TEGGAY LAKE
Province: ONTARIO
Month/Year: NOVEMBER 19 83

ABSTRACT OF THE WIND / SOMMAIRE DES VENTS

Environment Canada / Environnement Canada
Standard time used: C.S.T.

Table with columns for DATE, HOURE/DIRECTION/SE, and various wind speed and direction data points. Includes summary statistics at the bottom.

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1992

18.8 U2A WIND RECORDER CHART ROLLS

18.8.1 Chart Speed. Instrument Manual 50 recommends that the chart drive speed of the U2A Wind Recorder be three inches per hour, however the speed may be altered to meet local needs. In fact, for most stations, a chart drive speed of one inch per hour should meet all requirements. Alteration of chart drive speed is explained in Instrument manual 50. The time standard used in the operation of the U2A wind recorder is coordinated universal time (UTC).

18.8.2 Identification Data. To assist the user and to facilitate abstracting and filing, certain identification data are required on wind recorder chart rolls. In making entries, care should be taken not to tear or puncture the chart, or obliterate the ink traces. Entries should be made on that portion of the chart which has a chart backing plate underneath it. The following identification data shall be entered:

- (a) Chart Beginning. At the beginning of each chart roll, record on the chart the station name and province, (as in METSTAT), the date and time (UTC) when the roll began, the type of recorder and chart speed.

Example: Victoria Int'l A, B.C.

Time On: August 1, 1986. 0915 UTC

U2A, 1" per hour

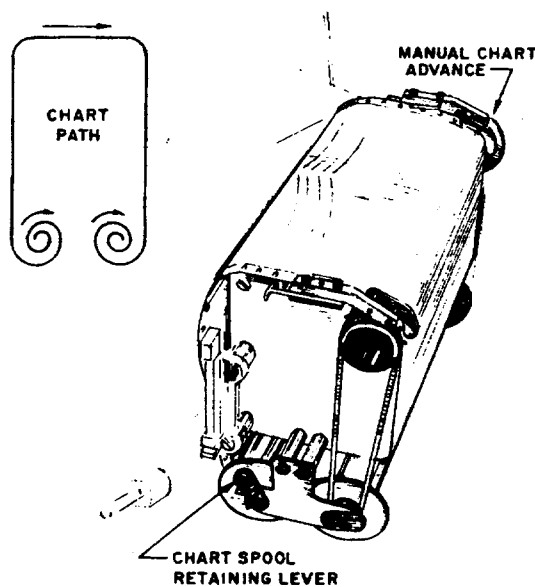
- (b) Retain Carton. When a new chart is put on the recorder:
 - (1) Retain the carton for storage of the completed chart roll.
 - (2) Record on the carton the date and time (UTC) of chart beginning.
- (c) Station Name and Date. Each day enter the station name (as in METSTAT) and the date, on the wind speed half of the chart. A suitable name stamp and dater may be used. Stations staffed on a 24-hourly basis shall enter the station name and date at or about midnight, UTC. Other stations should select a convenient time to make these entries, preferably at or around noon, UTC.

(d) **Time Check.** Time checks are recorded on the chart by drawing a short line in soft pencil on the chart, beside the speed trace. Near this short line enter the time of the check, using Coordinated Universal Time, e.g., 0015 UTC. Time checks are required as follows:

(1) Stations staffed on a 24-hourly basis shall record two time checks each day, one at or near midnight, UTC, the other at or around noon, UTC.

(2) Stations not staffed on a 24-hourly basis shall record one time check each day at a convenient time preferably at or around noon, UTC.

(3) Additional time checks (UTC) shall also be made on the chart as soon as possible after incidents such as aircraft accidents, wind damage, equipment and power failure, etc. No reference to the type of incident shall be entered on the chart. After a power or instrument failure, the chart shall be re-set. To reset, move the chart forward by rotating the knurled wheel as illustrated below.



(FIGURE 31 from Instrument Manual 50)

(e) **Chart Ending.** At the end of each chart roll, enter the station name and province, the date and time the roll began, the date and time the roll ended, type of recorder and chart speed.

Example: Ottawa Int'l A, Ont.

Time On: July 1, 1986 0015 UTC

Time Off: July 10, 1986 1000 UTC

U2A, 1" per hour.

18.8.3 Interpretation of Recorder Chart Trace. The following are general guidance instructions for interpreting the direction and speed traces on wind recorder chart rolls:

18.8.3.1 Mean Wind Direction. The mean wind direction for any period (2 minutes, 10 minutes, 1 hour, etc.) shall be estimated by visual inspection of the direction trace of the recorder chart, to determine the direction occurring most frequently during the period. When two or more mean wind directions appear to be equally valid for the period, the last shall be reported.

18.8.3.2 Mean Wind Speed. The mean wind speed for any period (2 minutes, 10 minutes, 1 hour, etc.) shall be determined from the speed trace of the recorder chart. A transparent straight-edge may be used as an aid in determining the mean speed. The straight-edge should be placed on the speed trace for the period, parallel to the horizontal edge of the chart, and in such a position that the edge of the ruler divides the speed trace for that period into equal areas, above and below this edge. The edge of the ruler, so positioned, now indicates the mean wind speed.

18.8.4 Use of Wind Data From Wind Recorder Chart Rolls. Wind data as obtained or abstracted from the chart rolls shall be used for the following purposes:

- (a) When Hourly Observations are Taken: The mean wind direction and speed (in knots) for a two-minute period at the time of observation shall be determined from the recorder chart. Wind shift, gust and squall data (in knots) as appropriate, shall also be obtained from the recorder chart.
- (b) When Hourly Observations Are NOT Taken: For each hour of the day that an Hourly Observation is not taken, record on Form 63-2322 the following data:
 - (1) In Col. 36, the mean wind direction (to the nearest ten degrees) for the two-minute period preceding the time of observation (refer to para. 10.2.14).
 - (2) In Col. 37 the mean wind speed (in knots) for the two-minute period preceding the time of observation (refer to para. 10.2.15).
 - (3) In Col. 38 the maximum gust or squall (in knots) which occurred in the 10-minute period preceding the time of observation (refer to para. 10.2.16).

Note: When data are not available due to inoperative wind equipment, no entries are required in Cols. 36, 37 and 38 for those hours when no Hourly Observations are taken, however a note regarding the unserviceability should be made in column 1.

Amendment n° 13 October 1994

- (c) Synoptic Observations: The mean wind direction and speed (in knots) for a 10-minute period preceding the observation shall be obtained from the recorder chart.
- (d) Summary for the Climatological Day:
 - (1) At all stations where Wind Recorder Chart Rolls are available, mean wind speeds and peak or gust data in knots shall be entered in "Summary for the Climatological Day", Cols. 64, 65, 66, 67 and 68 of Form 63-2322 (refer to para. 10.5.13.1 or 10.5.13.5).
 - (2) At the end of each month, through the appropriate channels, forward Forms 63-2322 to AES Downsvew.
 - (3) When equipment is inoperative, "M" should be entered. ■

18.8.5 Disposition of Wind Recorder Chart Rolls. Completed U2A and or Bendix-Friez recorder chart rolls shall be stored, on site, as directed by the Regional Office, for a period of five years. Requests for destruction shall be sought from CCDG attention CCID through channels.

18.8.5.1 Data on stored chart rolls are often more readily accessible if the following information is put on one end of the carton:

- (1) Station name and province
- (2) Date/time (UTC) of Chart On
- (3) Date/time (UTC) of Chart Off.