CHAPTER 4

ATMOSPHERIC PRESSURE

4.1 GENERAL. Atmospheric pressure, also called barometric pressure, is the force per unit area exerted by the atmosphere as a consequence of its weight, and thus is equal to the weight of a vertical column of air of unit area, extending from the level in question to the outer limit of the atmosphere.

4.1.1 The standard instrument for the measurement of atmospheric pressure at staffed observing stations in Canada is the mercury barometer, in which the pressure is balanced against the weight of a column of mercury, the length of the column being measured on a scale graduated in units of pressure called hectopascals. Refer to Instrument Manual 10 – Pressure Measurements with Mercury Barometers.

4.1.2 The symbol for hectopascal is hPa.

4.1.3 The following procedures apply to to sites that have software that will calculate the hourly station pressure, the MSL pressure, the altimeter setting, and every three hours, the pressure tendency amount.

4.1.3.1 At stations equipped with a mercury barometer, read the attached thermometer and the barometer according to section 4.2 of MANOBS. Enter both readings on the computer data entry screen. It may be necessary, at times, for the observer to determine and enter the temperature from12 hours ago. See para. 4.3.3.2

4.1.3.2 At stations equipped with an electronic barometer or AWOS pressure sensor, transfer the pressure reading from the pressure sensor display to the data entry screen. (At some locations, the electronic barometer will interact directly with the computer so no transfer of data is required of the observer.)

4.1.3.3 The observer will operate the barograph according to section 4.6. The three hour pressure tendency amount will be calculated and displayed on the data entry screen. The observer shall determine the tendency characteristic from the barograph trace and enter the code figure (para. 4.7.2.2) on the data entry screen.

Amend. No.9
Sept. 1987

4.2 READING THE MERCURY BAROMETER

The following steps, in the order given, are to be taken in reading the mercury barometer:

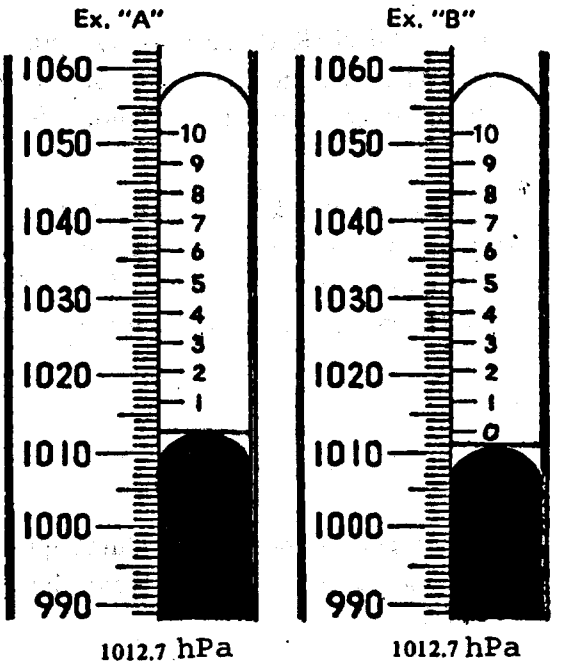
(a) read the attached thermometer, to the nearest whole degree Fahrenheit (half degree Celsius)

(b) tap the barometer lightly with the fingers at about the middle of the frame

(c) lower the vernier until it just appears to touch the top of the meniscus (curved surface at the top of the mercury column), being careful to keep the eye level with the bottom of the vernier (both the front and back edges)

(d) read the scale and the vernier to the nearest 0.1 hPa.

READING THE BAROMETER SCALE



Note: An observational practice always to be recommended is: read, write down the reading, recheck the reading. In thus checking the reading of the barometer the observer should bear in mind the possibility of a misreading by 5 or 10 units, an error which can quite easily be made.

4.2.1 Example "A" illustrates the scale reading and vernier setting for a barometer reading of 1012.7 hPa. The verniers on the older AES barometers have graduation marks "1 to 10".

4.2.2 Example "B" also illustrates the scale reading and vernier setting for a barometer reading of 1012.7 hPa. The verniers on the newer AES barometers have graduation marks "0 to 10". You will note in Example "A" that the bottom of the vernier coincides with the scale reading "1012.7," while in Example "B" it is the "0" mark on the vernier which coincides with the scale reading "1012.7".

4.2.3 Always keep the door of the barometer cabinet closed, except when reading, to protect the barometer from dust and damage.

Amendment nº 14
June 1996

4.3 BAROMETRIC PRESSURE COMPUTATIONS

4.3.1 Station Elevation*

4.3.1.1 The station elevation is the vertical distance in metres above Mean Sea Level (MSL) of the datum level to which barometer readings are corrected to give station pressure.

4.3.1.2 At surface weather observing sites on airports the station elevation is equal to the aerodrome elevation as determined by Transport Canada and reported in the Canada Flight Supplement.

4.3.1.3 At surface weather observing sites off airports the station elevation is equal to the elevation of the barometer cistern (in the case of a mercury barometer) or the sensor elevation of the electronic barometer.

4.3.1.4 The only time that the station elevation shall be revised is when the following occurs:

(a) At surface weather observing sites on airports whenever there is a change in the aerodrome elevation;

(b) At surface weather observing sites off airports whenever there is a change in the elevation of the pressure sensor.

(c) When a new, more accurate survey indicates the need for a change.

*Note: Prior to Jan 1, 1977 the term "established elevation" was used. It referred to the elevation of the barometer cistern when a barometer was initially installed at a weather station, and no distinction was made between observing sites on airports and off airports. Also, an established elevation of zero metres (MSL) was assigned to all stations where the cistern elevation was less than 15 metres. As a consequence the station pressure and MSL pressure were identical at these stations.

Amendment n° 14
June 1996

4.3.2 Determination of Station Pressure

4.3.2.1 Station pressure is the atmospheric pressure at the station elevation.

4.3.2.2 Station pressure is determined by applying to the barometer reading a reduction figure obtained from the "Reduction of Barometer Readings to Station Pressure" table. This table incorporates corrections for barometer calibration, departures from standard conditions of temperature and gravity and an additional correction to account for the difference in height between station elevation and the actual barometer cistern elevation. This latter correction, called a removal correction, is usually a small constant. it is therefore necessary, at most stations, to use only the correction supplied on the "Reduction of Barometer Readings to Station Pressure" table to obtain the station pressure from the barometer reading. See Example I on the computation of station pressure.

4.3.2.3 Procedures when two tables are required: Where the difference in height between the station elevation and the actual barometer cistern elevation is large (approximately 10 m or more), two reduction tables are required to determine station pressure. First the pressure at the level of the cistern is computed and then the station pressure at station elevation is computed.

4.3.2.3.1 The "Reduction of Barometer Readings to Pressure at the Cistern" table is used to determine the atmospheric pressure at the level of the barometer cistern. This table includes the calibration, gravity and temperature corrections.

4.3.2.3.2 The "Reduction of Pressure at Cistern to Station Pressure" table is used to determine the station pressure. This table contains removal corrections (reduction values) to reduce the pressure at cistern level to pressure at station elevation. The removal correction depends upon the temperature of the air column between cistern elevation and station elevation in addition to the pressure at the level of the cistern. The outdoor dry bulb temperature is sufficiently representative of the average temperature of the air column. The pressure at the cistern and the current outdoor dry bulb temperature are used to obtain the removal correction from the table. This removal correction added algebraically to the pressure at the cistern gives the station pressure. If the station elevation is lower than the cistern elevation, the removal correction is positive and the station pressure is greater than the pressure at the cistern. If the station elevation is higher than the cistern elevation, the removal correction is negative and the station pressure is lower than the pressure at the cistern. See Example II for the computation of station pressure at stations where two reduction tables are used.

Amendment nº 14
June 1996

EXAMPLE 1: HOW TO CALCULATE STATION PRESSURE USING THE "REDUCTION OF BAROMETER READINGS"

1995-Nov-15 15:39 CRANBROOK A

Use Nearest Barometer Reading

REDUCTION OF BAROMETER READINGS TO STATION PRESSURE/A LA PRESSION DE LA STATION

ELEVATIONS : STATION 939.4 M. CISTERN / CUVETTE 933.2 M.

APPLIQUER A LA LECTURE DU BAROMETRE / APPLY TO BAROMETER READING

ATT. SERIAL NO: D573

THERM INT. DEG F	LECTURES DU BAROMETRE / BAROMETER READINGS 860	870	880	890	900	910	920	930	940	TEMP DEG F
51.0	-2.1	-2.1	-2.1	-2.2	-2.2	-2.2	-2.2	-2.3	-2.3	51.0
52.0	-2.2	-2.2	-2.2	-2.3	-2.3	-2.3	-2.3	-2.4	-2.4	52.0
53.0	-2.3	-2.3	-2.3	-2.3	-2.4	-2.4	-2.4	-2.4	-2.5	53.0
54.0	-2.3	-2.4	-2.4	-2.4	-2.4	-2.5	-2.5	-2.5	-2.6	54.0
55.0	-2.4	-2.4	-2.5	-2.5	-2.5	-2.6	-2.6	-2.6	-2.6	55.0
56.0	-2.5	-2.5	-2.6	-2.6	-2.6	-2.6	-2.7	-2.7	-2.7	56.0
57.0	-2.6	-2.6	-2.6	-2.7	-2.7	-2.7	-2.8	-2.8	-2.8	57.0
58.0	-2.7	-2.7	-2.7	-2.7	-2.8	-2.8	-2.8	-2.9	-2.9	58.0
59.0	-2.7	-2.8	-2.8	-2.8	-2.9	-2.9	-2.9	-3.0	-3.0	59.0
60.0	-2.8	-2.8	-2.9	-2.9	-2.9	-3.0	-3.0	-3.0	-3.1	60.0
61.0	-2.9	-2.9	-3.0	-3.0	-3.0	-3.1	-3.1	-3.1	-3.2	61.0
62.0	-3.0	-3.0	-3.0	-3.1	-3.1	-3.1	-3.2	-3.2	-3.2	62.0
63.0	-3.0	-3.1	-3.1	-3.2	-3.2	-3.2	-3.3	-3.3	-3.3	63.0
64.0	-3.1	-3.2	-3.2	-3.2	-3.3	-3.3	-3.3	-3.4	-3.4	64.0
65.0	-3.2	-3.2	-3.3	-3.3	-3.4	-3.4	-3.4	-3.5	-3.5	65.0
66.0	-3.3	-3.3	-3.4	-3.4	-3.4	-3.5	-3.5	-3.6	-3.6	66.0
67.0	-3.4	-3.4	-3.4	-3.5	-3.5	-3.6	-3.6	-3.6	-3.7	67.0
68.0	-3.4	-3.5	-3.5	-3.6	-3.6	-3.6	-3.7	-3.7	-3.8	68.0
69.0	-3.5	-3.6	-3.6	-3.6	-3.7	-3.7	-3.8	-3.8	-3.8	69.0
70.0	-3.6	-3.6	-3.7	-3.7	-3.8	-3.8	-3.8	-3.9	-3.9	70.0
71.0	-3.7	-3.7	-3.8	-3.8	-3.8	-3.9	-3.9	-4.0	-4.0	71.0
72.0	-3.8	-3.8	-3.8	-3.9	-3.9	-4.0	-4.0	-4.1	-4.1	72.0
73.0	-3.8	-3.9	-3.9	-4.0	-4.0	-4.1	-4.1	-4.1	-4.2	73.0
74.0	-3.9	-4.0	-4.0	-4.1	-4.1	-4.1	-4.2	-4.2	-4.3	74.0
75.0	-4.0	-4.0	-4.1	-4.1	-4.2	-4.2	-4.3	-4.3	-4.4	75.0

Use Nearest Temperature

Total Correction

TIME (UTC)	0900	1200	1500	1800	2100	0000
15 Sum (T_w + T_d)						
16 Mean (Sum ÷ 2)						
17 Attached Thermometer	75	63				
18 Barometer as read	908.4	915.0				
19 Total Correction	-4.2	-3.3				
20 Station Pressure	904.2	911.7				
21 Reduction to Sea Level						
22 Sea Level Pressure						

Note 1: If the barometer reading is exactly half way between listed values, select the "correction" for the higher value. See computation at 1200Z.

Note 2: If the attached thermometer values are not listed by their appropriate increments (1 for F scale or 0.5 for the C scale), obtain corrections through interpolation.

Amendment n° 14
June 1996

EXAMPLE II: HOW TO CALCULATE STATION PRESSURE USING THE REDUCTION OF BAROMETER READINGS TO PRESSURE AT THE CISTERN" AND "REDUCTION OF PRESSURE AT CISTERN TO STATION PRESSURE" TABLES.

Step 1: Determine Atmospheric Pressure at the Cistern Level

1995-Oct-05 11:39 2400572 YVM BROUGHTON ISLAND A NWT Q

REDUCTION OF BAROMETER READINGS TO CISTERN PRESSURE/A LA PRESSION DE LA CUVETTE

ELEVATIONS : STATION 6.4 M. CISTERN / CUVETTE 111.0 M.

APPLIQUER A LA LECTURE DU BAROMETRE / APPLY TO BAROMETER READING

ATT. SERIAL NO: BE70-706

THERM INT. DEG C	LECTURES DU BAROMETRE / BAROMETER READINGS 940	950	960	970	980	990	1000	1010	1020	1030	TEMP DEG C
15.5	- 0.9	- 0.8	- 0.7	- 0.6	- 0.5	- 0.5	- 0.4	- 0.4	- 0.4	- 0.3	15.5
16.0	- 1.0	- 0.9	- 0.8	- 0.7	- 0.6	- 0.6	- 0.5	- 0.5	- 0.4	- 0.4	16.0
16.5	- 1.1	- 1.0	- 0.9	- 0.8	- 0.7	- 0.7	- 0.6	- 0.6	- 0.5	- 0.5	16.5
17.0	- 1.1	- 1.1	- 1.0	- 0.9	- 0.8	- 0.7	- 0.7	- 0.6	- 0.6	- 0.6	17.0
17.5	- 1.2	- 1.2	- 1.1	- 0.9	- 0.9	- 0.8	- 0.8	- 0.7	- 0.7	- 0.7	17.5
18.0	- 1.3	- 1.2	- 1.1	- 1.0	- 0.9	- 0.9	- 0.9	- 0.8	- 0.8	- 0.8	18.0
18.5	- 1.4	- 1.3	- 1.2	- 1.1	- 1.0	- 1.0	- 0.9	- 0.9	- 0.9	- 0.8	18.5
19.0	- 1.5	- 1.4	- 1.3	- 1.2	- 1.1	- 1.1	- 1.0	- 1.0	- 1.0	- 0.9	19.0
19.5	- 1.5	- 1.5	- 1.4	- 1.3	- 1.2	- 1.1	- 1.1	- 1.1	- 1.0	- 1.0	19.5
20.0	- 1.6	- 1.6	- 1.5	- 1.4	- 1.3	- 1.2	- 1.2	- 1.2	- 1.1	- 1.1	20.0
20.5	- 1.7	- 1.6	- 1.5	- 1.4	- 1.4	- 1.3	- 1.3	- 1.2	- 1.2	- 1.2	20.5
21.0	- 1.8	- 1.7	- 1.6	- 1.5	- 1.4	- 1.4	- 1.4	- 1.3	- 1.3	- 1.3	21.0
21.5	- 1.9	- 1.8	- 1.7	- 1.6	- 1.5	- 1.5	- 1.4	- 1.4	- 1.4	- 1.4	21.5
22.0	- 1.9	- 1.9	- 1.8	- 1.7	- 1.6	- 1.6	- 1.5	- 1.5	- 1.5	- 1.4	22.0
22.5	- 2.0	- 2.0	- 1.9	- 1.8	- 1.7	- 1.6	- 1.6	- 1.6	- 1.6	- 1.5	22.5
23.0	- 2.1	- 2.0	- 1.9	- 1.8	- 1.8	- 1.7	- 1.7	- 1.7	- 1.6	- 1.6	23.0
23.5	- 2.2	- 2.1	- 2.0	- 1.9	- 1.9	- 1.8	- 1.8	- 1.7	- 1.7	- 1.7	23.5
24.0	- 2.2	- 2.2	- 2.1	- 2.0	- 1.9	- 1.9	- 1.9	- 1.8	- 1.8	- 1.8	24.0
24.5	- 2.3	- 2.3	- 2.2	- 2.1	- 2.0	- 2.0	- 1.9	- 1.9	- 1.9	- 1.9	24.5
25.0	- 2.4	- 2.4	- 2.3	- 2.2	- 2.1	- 2.1	- 2.0	- 2.0	- 2.0	- 2.0	25.0
25.5	- 2.5	- 2.4	- 2.3	- 2.2	- 2.2	- 2.1	- 2.1	- 2.1	- 2.1	- 2.0	25.5
26.0	- 2.6	- 2.5	- 2.4	- 2.3	- 2.3	- 2.2	- 2.2	- 2.2	- 2.2	- 2.1	26.0
26.5	- 2.6	- 2.6	- 2.5	- 2.4	- 2.3	- 2.3	- 2.3	- 2.3	- 2.2	- 2.2	26.5
27.0	- 2.7	- 2.7	- 2.6	- 2.5	- 2.4	- 2.4	- 2.4	- 2.3	- 2.3	- 2.3	27.0
27.5	- 2.8	- 2.8	- 2.7	- 2.6	- 2.5	- 2.5	- 2.4	- 2.4	- 2.4	- 2.4	27.5

Attached thermometer 21.0

Barometer as read 976.2

Reduction to cistern pressure –1.4

Pressure at the cistern	976.2
	–1.4
	974.8

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Step 2: Determine Station Pressure

Current dry–bulb temperature	5.0
Pressure at the cistern	974.8
Reduction to station pressure	12.2
Station pressure 974.8 + 12.2 =	987.0

1995-Oct-05 11:39 2400572 YVM BROUGHTON ISLAND A NWT Q

REDUCTION FROM CISTERN PRESSURE TO STATION PRESSURE/DE LA CUVETTE A LA STATION

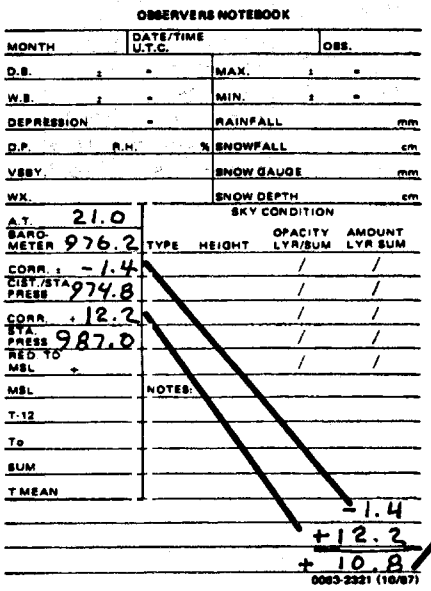
ELEVATIONS : STATION 6.4 M. CISTERN / CUVETTE 111.0 M.

AJOUTER A LA PRESSION A LA CUVETTE / APPLY TO CISTERN PRESSURE

SERIAL NO: BE70-706

PRESSION A LA CUVETTE / CISTERN PRESSURE

TEMP DEG C	#	940	950	960	970	980	990	1000	1010	1020	1030	#	TEMP DEG C
-30.0	#	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.8	15.0	15.1	#	-30.0
-20.0	#	13.3	13.4	13.6	13.7	13.8	14.0	14.1	14.3	14.4	14.5	#	-20.0
-10.0	#	12.8	12.9	13.0	13.2	13.3	13.4	13.6	13.7	13.9	14.0	#	-10.0
0.0	#	12.3	12.4	12.6	12.7	12.8	13.0	13.1	13.2	13.3	13.5	#	0.0
10.0	#	11.9	12.0	12.1	12.2	12.4	12.5	12.6	12.7	12.9	13.0	#	10.0
	#											#	
20.0	#	11.5	11.6	11.7	11.8	11.9	12.1	12.2	12.3	12.4	12.6	#	20.0
30.0	#	11.1	11.2	11.3	11.4	11.6	11.7	11.8	11.9	12.0	12.1	#	30.0
40.0	#	10.7	10.8	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.8	#	40.0


OBSERVERS NOTEBOOK

MONTH | DATE/TIME U.T.C. | OBS.

D.B. : - | MAX. : -

W.B. : - | MIN. : -

DEPRESSION - | RAINFALL mm

D.P. R.H. % | SNOWFALL cm

VSBY. | SNOW GAUGE mm

WX. | SNOW DEPTH cm

A.T. 21.0

BARO-METER 976.2

CORR. : -1.4

CIST./STA. PRESS 974.8

CORR. + 12.2

STA. PRESS 987.0

RED. TO MSL +

MSL

T-12

To

SUM

T MEAN

SKY CONDITION

TYPE	HEIGHT	OPACITY LYR/SUM	AMOUNT LYR SUM
		/	/
		/	/
		/	/
		/	/

NOTES:

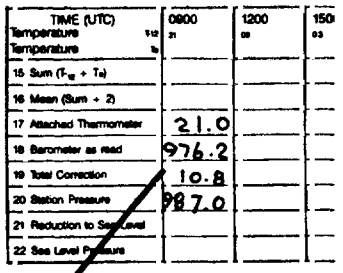
-1.4

+12.2

+10.8

0083-2321 (10/87)

Typical Observers Notebook and form 63–2322 station pressure entries.


TIME (UTC)	0900	1200	150
Temperature			
Temperature			
15 Sum (T_w + T_d)			
16 Mean (Sum ÷ 2)			
17 Attached Thermometer	21.0		
18 Barometer as read	976.2		
19 Total Correction	10.8		
20 Station Pressure	987.0		
21 Reduction to Sea Level			
22 Sea Level Pressure			

Total correction is the algebraic sum of reductions from both tables.

Amendment n° 14
June 1996

EXAMPLE III: HOW TO CALCULATE THE MEAN SEA LEVEL PRESSURE

1995-Nov-06 07:39 FORT GOOD HOPE A

REDUCTION OF STATION PRESSURE TO SEA LEVEL / LA PRESSION AU NIVEAU DE LA MER

STATION ELEVATION / ELEVATION DE LA STATION: 81.7 M. 81.8 G.P.M.

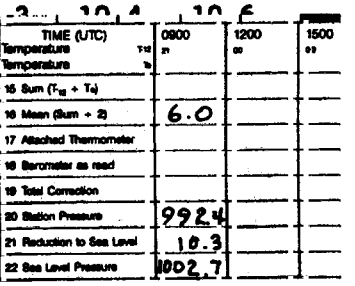
AJOUTER A LA PRESSION A LA STATION(MB) / ADD TO STATION PRESSURE(MB)

TEMPERATURE CELSIUS	*	PRESSION A LA STATION / STATION PRESSURE 950.0	970.0	990.0	1010.0	1030.0	1050.0
	*	969.9	989.9	1009.9	1029.9	1049.9	1069.9
-59.0 <--> -53.1	*	11.6	11.9	12.1	12.3	12.6	12.8
-53.0 <--> -47.1	*	11.4	11.6	11.9	12.1	12.3	12.6
-47.0 <--> -41.1	*	11.2	11.4	11.6	11.9	12.1	12.3
-41.0 <--> -35.1	*	11.0	11.2	11.4	11.7	11.9	12.1
-35.0 <--> -29.1	*	10.8	11.0	11.2	11.5	11.7	11.9
-29.0 <--> -23.1	*	10.6	10.8	11.0	11.3	11.5	11.7
-23.0 <--> -17.1	*	10.4	10.7	10.9	11.1	11.3	11.5
-17.0 <--> -11.1	*	10.3	10.5	10.7	10.9	11.2	11.4
-11.0 <--> - 5.1	*	10.2	10.4	10.6	10.8	11.0	11.2
- 5.0 <--> 0.9	*	10.0	10.2	10.4	10.6	10.9	11.1
1.0 <--> 6.9	*	9.9	10.1	10.3	10.5	10.7	10.9
7.0 <--> 12.9	*	9.8	10.0	10.2	10.4	10.6	10.8
13.0 <--> 18.9	*	9.7	9.9	10.1	10.3	10.5	10.7
19.0 <--> 24.9	*	9.6	9.8	10.0	10.2	10.4	10.6
25.0 <--> 30.9	*	9.5	9.7	9.9	10.1	10.3	10.5
31.0 <--> 36.9	*	9.4	9.6	9.8	10.0	10.2	10.4

Select the appropriate range for station pressure

Select the appropriate range for mean temperature

Select reduction to MSL



TIME (UTC)	0900	1200	1500
Temperature °F			
Temperature °C			
15 Sum (T_W + T_A)			
16 Mean (Sum ÷ 2)	6.0		
17 Attached Thermometer			
18 Barometer as read			
19 Total Correction			
20 Station Pressure	992.4		
21 Reduction to Sea Level	10.3		
22 Sea Level Pressure	1002.7		

4.3.3 Mean Sea Level Pressure

4.3.3.1 Mean Sea Level Pressure is computed from the station pressure and reported in observations so that the barometric pressures at stations of different elevations can be compared at a common level for synoptic purposes. Each station is supplied with a table "Reduction of Station Pressure to Sea Level" which gives the equivalent pressures in hectopascals of an imaginary column of air extending from the station elevation to mean sea level, as determined by the station pressure and an assumed temperature of the imaginary air column (the mean of the air temperatures, now and 12 hours previously).

4.3.3.2 If when calculating the mean temperature, the dry bulb temperature of 12 hours previously is not known, use the temperature of 12 hours before as determined from the thermograph. Stations collocated with an automatic station may use the temperature derived from the automatic station for the temperature of 12 hours before. When the temperature of 12 hours before cannot be determined from any of the foregoing methods, the observer, using data available, shall make an estimate of the temperature 12 hours previously.

4.3.3.3 The Sea Level Reduction shall be calculated for each measurement of sea level pressure taken at 0000, 0300, 0600, 0900, 1200, 1500, 1800 and 2100 UTC. For observations of pressure taken at times other than the above, the previously calculated Sea Level Reduction may be used, provided it was determined not more than 2 hours previously; otherwise a Sea Level Reduction shall be calculated at the time of the observation.

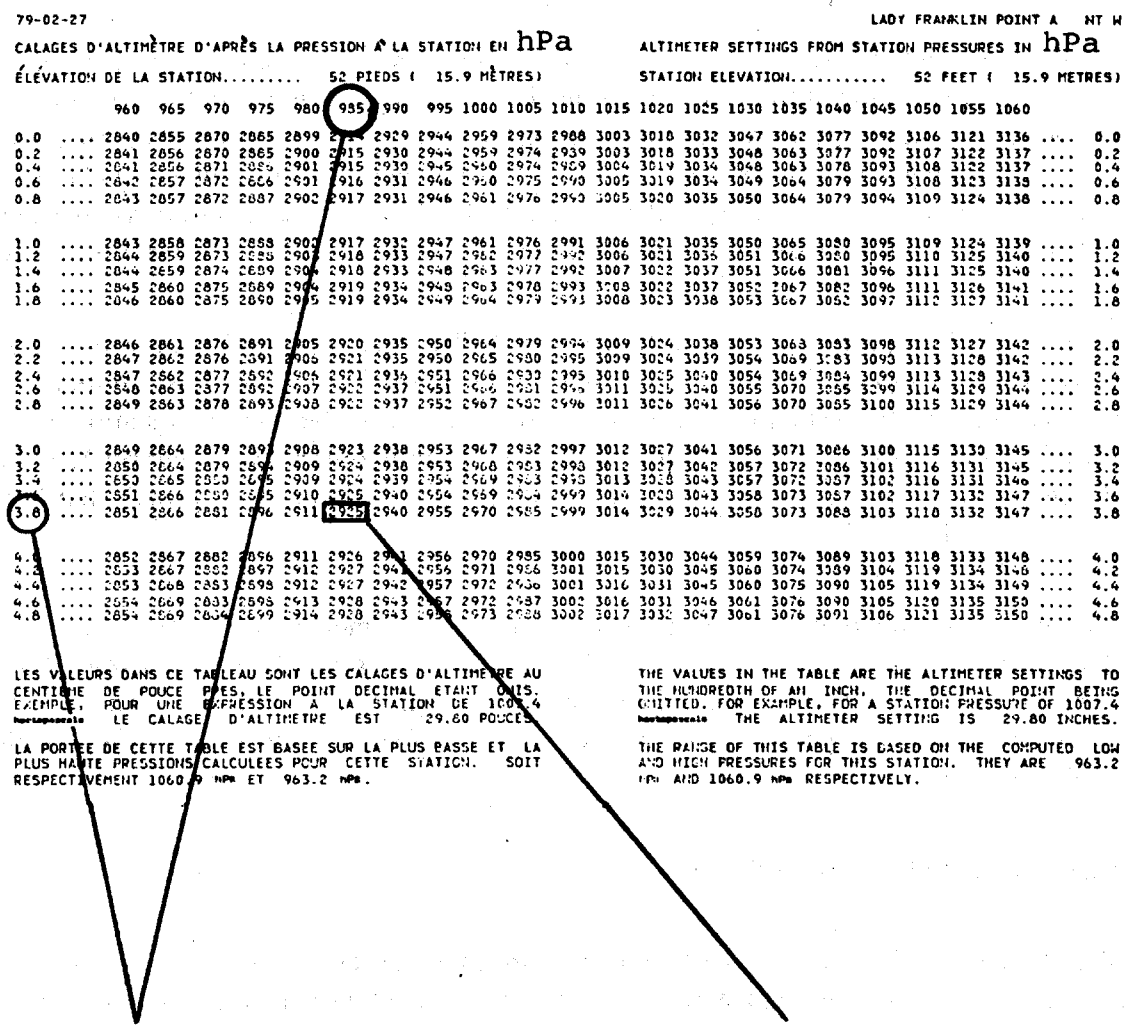
4.4 ALTIMETER SETTING (QNH)

4.4.1 The altimeter setting is a computed value of mean sea level pressure expressed in inches and hundredths of mercury, which is used to set the sub–scale of an altimeter so that the height scale of the altimeter indicates the height of the instrument above mean sea level.

4.4.1.1 The altimeter setting is obtained by applying the station pressure to the table "Altimeter Setting from Station Pressure in Millibars" which is supplied to each station where it is required.

Amend. No. 9
Sept. 1987

EXAMPLE IV: HOW TO DETERMINE THE ALTIMETER SETTING



79-02-27 LADY FRANKLIN POINT A NT W

CALAGES D'ALTIMÈTRE D'APRÈS LA PRESSION A LA STATION EN hPa

ÉLÉVATION DE LA STATION..... 52 PIEDS (15.9 MÈTRES)

ALTIMETER SETTINGS FROM STATION PRESSURES IN hPa

STATION ELEVATION..... 52 FEET (15.9 METRES)

	960	965	970	975	980	985	990	995	1000	1005	1010	1015	1020	1025	1030	1035	1040	1045	1050	1055	1060	
0.0	....	2840	2855	2870	2885	2899	2914	2929	2944	2959	2973	2988	3003	3018	3032	3047	3062	3077	3092	3106	3121	3136	....	0.0
0.2	....	2841	2856	2870	2885	2900	2915	2930	2944	2959	2974	2989	3003	3018	3033	3048	3063	3077	3092	3107	3122	3137	....	0.2
0.4	....	2841	2856	2871	2886	2901	2915	2930	2945	2960	2974	2989	3004	3019	3034	3048	3063	3078	3093	3108	3122	3137	....	0.4
0.6	....	2842	2857	2872	2886	2901	2916	2931	2946	2960	2975	2990	3005	3019	3034	3049	3064	3079	3093	3108	3123	3138	....	0.6
0.8	....	2843	2857	2872	2887	2902	2917	2931	2946	2961	2976	2990	3005	3020	3035	3050	3064	3079	3094	3109	3124	3138	....	0.8
1.0	....	2843	2858	2873	2888	2902	2917	2932	2947	2961	2976	2991	3006	3021	3035	3050	3065	3080	3095	3109	3124	3139	....	1.0
1.2	....	2844	2859	2873	2888	2903	2918	2933	2947	2962	2977	2992	3006	3021	3036	3051	3066	3080	3095	3110	3125	3140	....	1.2
1.4	....	2844	2859	2874	2889	2904	2918	2933	2948	2963	2977	2992	3007	3022	3037	3051	3066	3081	3096	3111	3125	3140	....	1.4
1.6	....	2845	2860	2875	2889	2904	2919	2934	2949	2963	2978	2993	3008	3022	3037	3052	3067	3082	3096	3111	3126	3141	....	1.6
1.8	....	2846	2860	2875	2890	2905	2919	2934	2949	2964	2979	2993	3008	3023	3038	3053	3067	3082	3097	3112	3127	3141	....	1.8
2.0	....	2846	2861	2876	2891	2905	2920	2935	2950	2964	2979	2994	3009	3024	3038	3053	3068	3083	3098	3112	3127	3142	....	2.0
2.2	....	2847	2862	2876	2891	2906	2921	2935	2950	2965	2980	2995	3009	3024	3039	3054	3069	3083	3098	3113	3128	3142	....	2.2
2.4	....	2847	2862	2877	2892	2906	2921	2936	2951	2966	2980	2995	3010	3025	3040	3054	3069	3084	3099	3113	3128	3143	....	2.4
2.6	....	2848	2863	2877	2892	2907	2922	2937	2951	2966	2981	2996	3011	3025	3040	3055	3070	3085	3099	3114	3129	3144	....	2.6
2.8	....	2849	2863	2878	2893	2908	2922	2937	2952	2967	2982	2996	3011	3026	3041	3056	3070	3085	3100	3115	3129	3144	....	2.8
3.0	....	2849	2864	2879	2893	2908	2923	2938	2953	2967	2982	2997	3012	3027	3041	3056	3071	3086	3100	3115	3130	3145	....	3.0
3.2	....	2850	2864	2879	2894	2909	2924	2938	2953	2968	2983	2998	3012	3027	3042	3057	3072	3086	3101	3116	3131	3145	....	3.2
3.4	....	2850	2865	2880	2895	2909	2924	2939	2954	2969	2983	2998	3013	3028	3043	3057	3072	3087	3102	3116	3131	3146	....	3.4
3.6	....	2851	2866	2880	2895	2910	2925	2940	2954	2969	2984	2999	3014	3029	3043	3058	3073	3087	3102	3117	3132	3147	....	3.6
3.8	....	2851	2866	2881	2896	2911	2925	2940	2955	2970	2985	2999	3014	3029	3044	3058	3073	3088	3103	3118	3132	3147	....	3.8
4.0	....	2852	2867	2882	2896	2911	2926	2941	2956	2970	2985	3000	3015	3030	3044	3059	3074	3089	3103	3118	3133	3148	....	4.0
4.2	....	2853	2867	2882	2897	2912	2927	2941	2956	2971	2986	3001	3015	3030	3045	3060	3074	3089	3104	3119	3134	3148	....	4.2
4.4	....	2853	2868	2883	2898	2912	2927	2942	2957	2972	2986	3001	3016	3031	3045	3060	3075	3090	3105	3119	3134	3149	....	4.4
4.6	....	2854	2869	2883	2898	2913	2928	2943	2957	2972	2987	3002	3016	3031	3046	3061	3076	3090	3105	3120	3135	3150	....	4.6
4.8	....	2854	2869	2884	2899	2914	2928	2943	2958	2973	2988	3002	3017	3032	3047	3061	3076	3091	3106	3121	3135	3150	....	4.8

LES VALEURS DANS CE TABLEAU SONT LES CALAGES D'ALTIMÈTRE AU CENTIÈME DE POUCE PRÈS, LE POINT DÉCIMAL ÉTANT OMIS. EXEMPLE, POUR UNE PRESSION A LA STATION DE 1007.4 hectopascals LE CALAGE D'ALTIMÈTRE EST 29.60 POUCES.

LA PORTÉE DE CETTE TABLE EST BASÉE SUR LA PLUS BASSE ET LA PLUS HAUTE PRESSIONS CALCULÉES POUR CETTE STATION. SOIT RESPECTIVEMENT 1060.9 hPa ET 963.2 hPa.

THE VALUES IN THE TABLE ARE THE ALTIMETER SETTINGS TO THE HUNDREDTH OF AN INCH, THE DECIMAL POINT BEING OMITTED. FOR EXAMPLE, FOR A STATION PRESSURE OF 1007.4 hectopascals THE ALTIMETER SETTING IS 29.60 INCHES.

THE RANGE OF THIS TABLE IS BASED ON THE COMPUTED LOW AND HIGH PRESSURES FOR THIS STATION. THEY ARE 963.2 hPa AND 1060.9 hPa RESPECTIVELY.

Use the two values which added together equal the Station Pressure.

Altimeter setting is 29.25 inches.

This example uses Station Pressure 988.9.

Note: (1) When values cannot be selected to exactly equal the station pressure, the station pressure selected shall be the next lower value: i.e., the altimeter setting above is for a station pressure of 988.8 hPa, because tabulated values cannot be selected to exactly equal the station pressure of 988.9 hPa.

(2) Should the station pressure be outside of the range on your altimeter setting table, DO NOT EXTRAPOLATE. Report the altimeter setting as missing and notify your Regional Headquarters. An extension to the altimeter setting table shall then be provided to your station.

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October 1994

4.4.2 The pressure values given in the table are computed on the basis of assumed averages of atmospheric pressure and temperature known as the International Civil Aviation Organization (ICAO) Standard Atmosphere, which are the conditions to which altimeters are calibrated. It is apparent therefore, that the mean sea level pressure computed in this way will not, in general, correspond to the MSL pressure obtained using the "Reduction of Station Pressure to Sea Level" referred to in para. 4.3.3. It should be noted also that since the altimeter setting is obtained directly from the station pressure, the height datum from which the table is computed is the station elevation. This figure will be seen printed in the heading of the station's Altimeter Setting Table.

4.5 DIGITAL ALTIMETER DISPLAY SYSTEM – DADS

4.5.1 Purpose. The Digital Altimeter Display System is one which senses the station pressure, converts the pressure to an altimeter setting for that station, transmits and displays the data at various MOT/DND working positions controlling aircraft movement at an airport. At these control positions the altimeter setting is on display continuously and the system automatically updates the altimeter setting at least every 10 minutes, or if required, as often as every minute.

4.5.2 Reliability. Although extensive testing has shown the DADS to be most reliable, it is nevertheless the responsibility of the duty observer to monitor this equipment on an hourly basis and, as required, correct the DADS altimeter setting to the altimeter setting which was calculated from the mercury barometer.

4.5.3 System Function (see diagram, para 4.5.6). Information on the station pressure is obtained from a sensitive aneroid barometer in the Sensor Converter. By means of a gear train selected for the particular station elevation, the station pressure is converted to an altimeter setting which is electronically transmitted by the Local Distributor (para 4.5.6 Fig. 1) through multicables directly to a maximum of 6 Display Drivers (DD) within 150 m. Each DD may then drive up to 6 displays located within 30 m. Alternatively, the altimeter setting indication is transmitted to greater distances by telemetry to a Receiver Decoder to a maximum of 6 Display Drivers within 150 m and each Display Driver may service up to 6 remote displays within 30 m of the Display Driver. In the Surface Observing Operations room a standard rack contains equipment as shown in para 4.5.6 Fig. 1 or Fig. 2. As the gear train in the Sensor Converter does not give a completely accurate conversion of station pressure to altimeter seeting throughout the entire range of possible pressure change, provision has been made for a manual insertion, by the duty weather observer of a correction into the system. This correction, identified by comparing the calculation of altimeter setting from the mercury barometer with that displayed by DADS, is electronically inserted into the system in increments of .01 inch by means of a Correction Function Switch (para 4.5.6 Fig. 3). The range of the Correction Function Switch is from +.02 inch to –.02 inch.

4.5.3.1 The automatic update interval for the display of the altimeter setting is manually selected by the duty weather observer and may be chosen as follows: once every 10 minutes, 5 minutes or 1 minute.

4.5.3.1.1 The chosen interval of time between successive altimeter settings is governed by criteria of pressure change as evidenced by the microbarograph and the mercury barometer. The time interval selected by the duty weather observer is such that successively displayed altimeter setting will rarely differ by more than .01 inch.

4.5.3.2 A manually operated update button in Surface Observing Operations will permit the initiation of a new altimeter setting display regardless of how recently the update mechanism has operated. Upon completion of the manual updating, the next reported value will be at the end of the time interval set on the Update Function Switch.

4.5.3.3 The remote displays have internally illuminated electro–mechanical "wheels" (one wheel for each of four digits) and a low pressure (less than 29.93 inches) warning light. When a malfunction develops in the system, the altimeter setting display goes to a blank state. The power for illumination of the DADS display module and the timing logic to drive the "wheels" is obtained from the Display Driver.

4.5.3.4 The Display Driver in each operational area, Tower, Terminal Control Unit (TCU), or Area Control Centre (ACC) has a Monitor Display attached thereto, located at a designated monitoring position in each area. The purpose of this display is to provide status indication of the power output for the internal illumination of the "wheels" and the drive logic to "wheels". A failure of the driver in either of these functions will be indicated by an alarm (audio and visual) at the monitoring working position.

4.5.3.5 System Power. Where "no–break" power exists at an airfield, Ministry of Transport policy states that all parts of the DADS system shall be connected to this power source. However, the system design is such that if different power sources are used in parts of the system, the system integrity is still retained.

4.5.3.5.1 Total System Power Failure. Upon the return of total power from a total power failure for the system, whether on "no–break", commercial or standby supply, the DADS equipment will automatically update a new altimeter setting value at all remote displays.

4.5.3.5.2 Partial System Power Failure. In the event that power fails in part of the system:

(1) at the observing site – the entire DADS system fails to supply reliable data (see para. 4.5.4(e));

(2) at the tower display area or the Air Traffic Control display area – a rapid cycling (7 secs. from blank to reading to blank) of display will occur in the weather office (see para. 4.5.4.(e)).

The above symptoms will occur in DADS System, illustrated in para. 4.5.6 Figure 2. These same symptoms may also occur if power returns to only part of the system after total system power failure.

4.5.4 Routine Responsibilities of Duty Weather Observer re DADS.

(a) Briefings: At the commencement of each shift, obtain information on the expected rate of pressure change for the station during the work period, by:

(i) attending or obtaining by phone a weather briefing; or

(ii) consulting the Canadian Meteorological Centre 36–hour Prognostic Chart.

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(b) Microbarograph: Monitor the microbarograph and ensure that maintenance and operating procedures, as listed in Instrument Manual 11–Barographs, are followed.

(c) Update Function Switch: ("Sample Interval" in Fig. 3, para. 4.5.6). Ensure that the Update Function Switch is set at one minute. Notify T&E technician of any malfunctioning of equipment.

(d) Correction Function Switch: ("Increase Decrease" in Fig. 3, para. 4.5.6). Maintain agreement between the altimeter setting displayed by DADS and the altimeter setting as calculated from the mercury barometer as follows:

(1) Immediately prior to reading the mercury barometer at each hourly observation, push the Update Button; ("Sample" in Fig. 3, para. 4.5.6).

(2) Read and record in Observer's Notebook or work sheet, the display value (DADS altimeter setting);

(3) Immediately calculate the altimeter setting from the barometer reading;

(4) Compare the altimeter settings, i.e., the display value and the calculated value. If they differ, do another complete check, starting again from step (1) above;

(5) After re–checking, if the display value and the calculated value differ by .01 or .02 inch (either positive or negative), then the reading is acceptable, no change is required;

(6) Record in Column 1 (Form 63–2322) the correction value, as displayed by the sensor converter, if different from the previously recorded value (not required on Form 63–2325);

(7) If the display value and the calculated value differ by .03 inch or more (positive or negative), shut down the DADS equipment, record the shut–down in Col. 1, Form 63–2322, and notify the appropriate technician of the malfunction.

(e) General – In the event of any detected malfunction of the DADS equipment, notification of the system failure shall be made immediately to the designated maintenance liasion officer in Air Traffic Control. Local arrangement may permit the notification of the designated T&E maintenance officer as an alternative.

(f) Malfunction Detection

(1) In DADS System illustrated by Figure 1, para. 4.5.6, any of the following indicates malfunction:

power failure (lights go out);
continuous blanking of display is evident;
inability to insert correction value on Correction Function Switch into system.

(2) In DADS System illustrated by Figure 2, para. 4.5.6, any of the following indicates malfunction:

power failure (lights go out);
rapid cycling of the display (see 4.5.3.5.2); continuous blanking of display is evident;

inability to insert correction value on Correction Function Switch into system;

no momentary blanking of the display prior to the update.

4.5.5 Responsibility of Duty Weather Observer re: Dads and Aircraft Accident

4.5.5.1 Upon request from the Tower Control, or on becoming aware of an aircraft accident in the vicinity, the duty observer shall observe the following procedures, in addition to those described under Accident Check Observation, para. 10.3.7.

(1) Note the Altimeter Setting on the DADS display.

Record this value on the Surface Weather Record Form which contains the Accident Check Observation, and identify it as the DADS altimeter setting.

(2) Manually activate the DADS equipment to obtain an Altimeter Setting by pressing the manual Update Function Switch.

Record and identify the Updated Altimeter Setting on the Surface Weather Record Form which contains the Accident Check Observation;

(3) Immediately calculate a new Altimeter Setting from the mercury barometer;

Record and identify this value on the Surface Weather Record Form which contains the Accident Check Observation.

Note: Since the Altimeter Settings observed and recorded as required in steps (1), (2), and (3) are in fact part of the Accident Check Observation, the security of these data and their release shall be in accordance with para. 10.3.7.1, 10.3.7.3 and 10.3.7.4.

4.5.6 Diagram – DADS

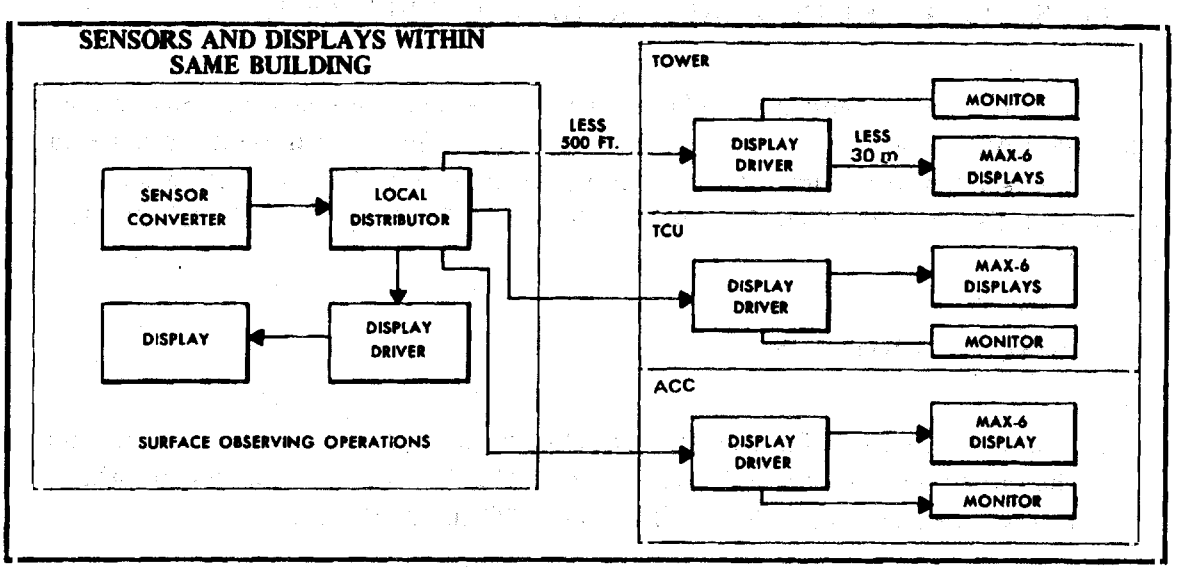

Figure 1

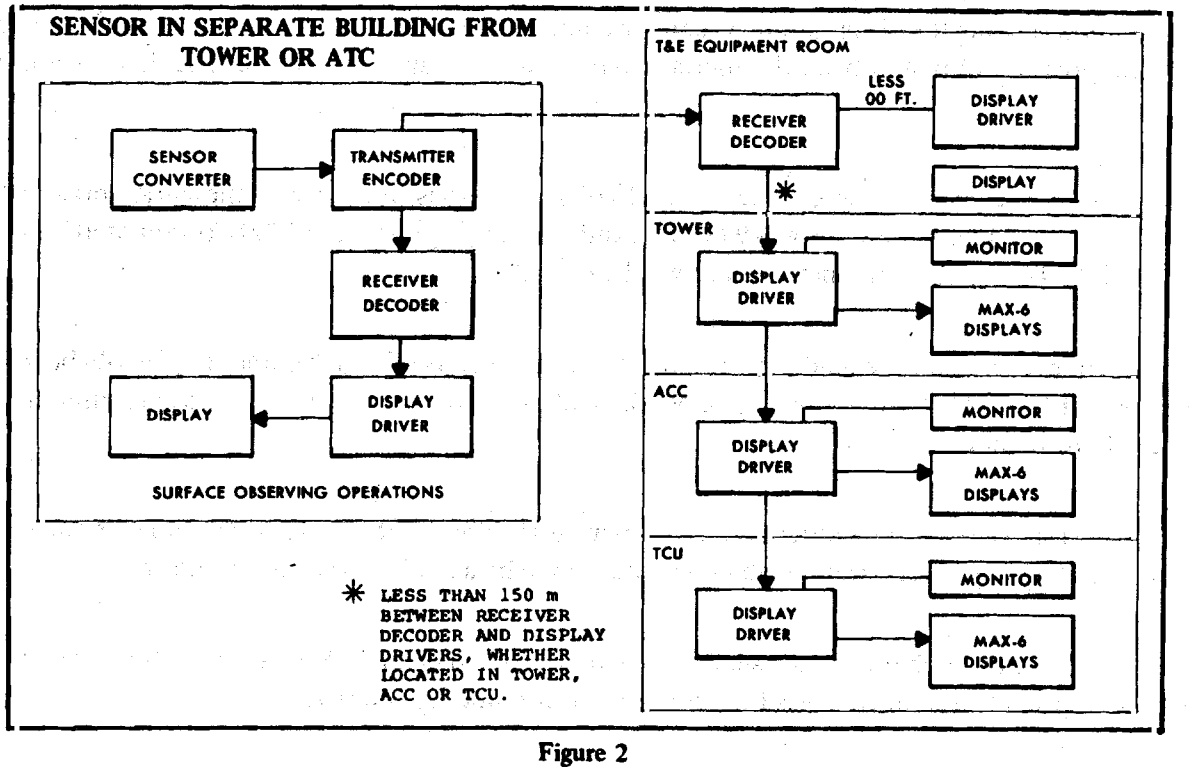

Figure 2

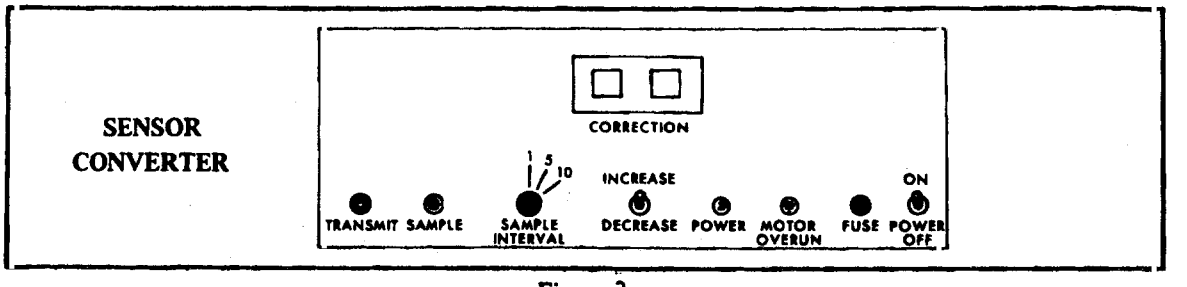

Figure 3

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4.6 PRESSURE AT THE OFFICIAL AERODROME LEVEL (QFE)

4.6.1 The QFE is the pressure at the official aerodrome level according to the assumptions of the ICAO Standard Atmosphere previously described. When the QFE is used to set the sub–scale of a pressure–scale type sensitive altimeter in an aircraft, the altimeter will indicate zero when the aircraft is on the ground. IN CANADA THE QFE SHALL NOT BE SUPPLIED BY METEOROLOGICAL PERSONNEL.

4.7 PRESSURE TENDENCY

4.7.1 Pressure tendency is defined as the characteristic and the amount of the change in station pressure in the three hours preceding the observation. The tendency is included in weather reports which are taken at 0000, 0300, 0600, 0900, 1200, 1500, 1800 and 2100 UTC.

4.7.1.1 Amount. The amount of the pressure tendency is the net change in station pressure in the three hours preceding the observation. When the amount cannot be determined from measurements of station pressure obtained from the mercury barometer, the amount shall be calculated from the barograph.

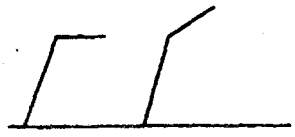
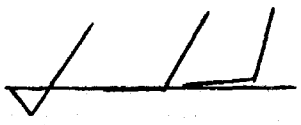
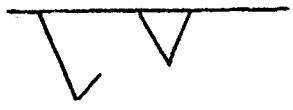
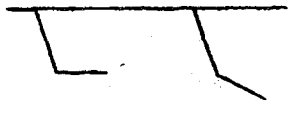
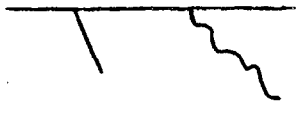
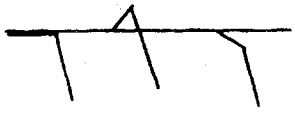
4.7.1.2 Tendency amount is determined in tenths of hectopascals. Example: If the station pressure at 0900 Coordinated Universal Time was 998.2 hPa and the station pressure at 1200 Coordinated Universal Time is 999.0 hPa the tendency amount will be 0.8 hPa.

4.7.1.3 Time Marks shall be made on the barograph chart at 00 and 12 UTC and they should be made at the 06 and 18 UTC observations. Time Marks shall be made immediately after the reading of the mercury barometer.

4.7.2 Characteristic. The tendency characteristic is the nature of the pressure change in the three hours preceding the observation. It shall be determined by a study of the barograph trace.

4.7.2.1 The tendency characteristic shall be coded as outlined in the following instructions, which are designed to provide a uniform basis for coding 3–hour tendency characteristics.

4.7.2.2 The tendency characteristic code table with a graphical representation corresponding to each code figure follows:

CODE FIGURE	GRAPHIC REPRESENTATION	CHARACTERISTIC	ATMOSPHERIC PRESSURE
0		Increasing, then decreasing	Same as or higher than 3 hours ago
1		Increasing then steady, or increasing then increasing more slowly	Higher than 3 hours ago
2		Increasing – steadily or unsteadily	
3		Decreasing or steady, then increasing; or increasing then increasing more rapidly	
4		Stead y	Same as 3 hours ago
5		Decreasing, then increasing	Same as or lower than 3 hours ago
6		Decreasing – then steady or decreasing, then decreasing more slowly	Lower than 3 hours ago
7		Decreasing – steadily or unsteadily	
8		Steady or increasing then decreasing; or, decreasing, then decreasing more rapidly	

4.7.2.3 The following instructions shall be used as a guide for coding the tendency characteristic.

4.7.2.3.1 When the trace is a smooth curve which clearly resembles one of the graphic representations shown in para. 4.7.2.2, the tendency characteristic can be coded without difficulty. However, it may be difficult in some cases to decide whether the trace approximates a straight line (/ or \ ), or contains an angle (/ or \ ). The observer must use his own best judgment to decide which code figure to use in such cases.

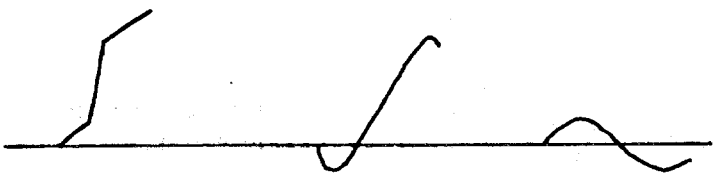
4.7.2.3.2 When the trace contains minor irregularities but in general resembles one of the graphic representations shown in para. 4.7.2.2 disregard the minor irregularities and code the general characteristic of the trace.

Examples:

Code 0 Code 5

4.7.2.3.3 When the trace may apparently be represented by two characteristics, code the characteristic which represents the last part of the trace provided this agrees with the net 3–hour pressure change.

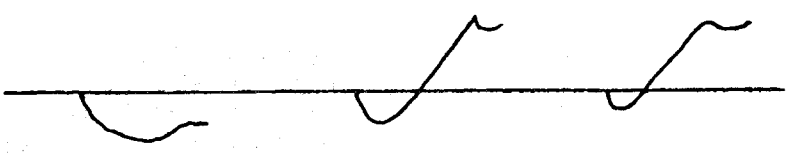
Examples:



Code 1 Code 0 Code 5

4.7.2.3.4 When the trace may apparently be represented by two characteristics and the characteristic of the last part of the trace is not compatible with the net 3–hour pressure change, code the characteristic which is most representative of the whole 3–hour trace.

Examples:



Code 5 Code 2 Code 1

(Note: In the two examples on the right above, it is rather difficult to decide whether to use code figures 1 or 2. The observer must use his own best judgment in such cases).

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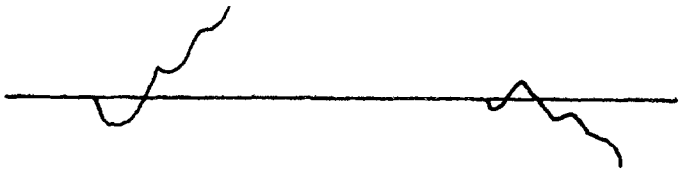
4.7.2.3.5 When the trace contains three or more clearly identifiable characteristics, use code figure 2 or 7 as appropriate for the net 3–hour pressure change.

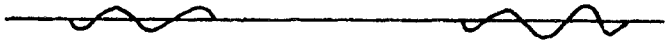
Examples:



Code 2 Code 7

4.7.2.3.6 When the trace is not steady but the net 3–hour pressure change is zero, use code figure 0 or 5 as appropriate for the last part of the trace (code figure 4 is only used when the trace is steady and the net pressure change is zero).

Examples:



Code 0 Code 5

4.8 BAROMETRY PROCEDURES FOR THE ACCEPTANCE OF COMPUTER GENERATED PRESSURE CALCULATIONS

4.8.1 Pressure calculations from data entry screens shall not be used for dissemination until accepted by the regional inspector. Some discrepancies between the software pressure calculations and the calculations based on station pressure tables have occurred. There may be a number of reasons for this; (e.g. old tables in use, stations constants that have changed from those in the Station Information System (SIS), etc.) The following procedures shall be followed to certify computer generated pressure calculations.

4.8.2 Prior to testing the pressure calculations the regional inspector shall verify station elevation, cistern elevation, barometer serial number and determine that the following tables are up to date:

Reduction of Barometer Readings to Station Pressure
Reduction of barometer Readings to Pressure at the Cistern (if used)
Reduction of Pressure at Cistern to Station Pressure (if used)
Reduction of Station Pressure to Sea Level
Altimeter Setting from Station Pressure in hPa

4.8.3 When the data entry screen is installed the station shall collect and record 7 days of pressure calculation data from the screen and the station tables. Ideally there should be a ± 20°C mean temperature variation and a ± 30 hPa pressure variation during the week. At the end of the period forward the data to the regional inspector. For these calculations the site should interpolate data from the "Reduction of Station Pressure to Sea Level" tables.

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4.8.4 The regional inspector will examine the data for any discrepancies, and if there are none the new data entry screen pressure calculations are acceptable.

4.8.5 Acceptable pressure calculation limits:

Station pressure	± 0.1 hPa.
Sea level pressure	± 0.2 hPa. (if data is interpolated from tables)
Altimeter setting	± 0.01 in.

4.8.6 Pressure calculation discrepancies greater than the above would have to be explained and resolved prior to approval. In cases where the inspector is unable to rationalize discrepancies, forward all calculations to the National Weather Weather Services Directorate Barometry Specialist for investigation and approval.

4.8.7 Until the testing and approval process has been completed, observing stations shall use established procedures and tables to do pressure calculations. The new data entry screens may be used to transmit observations, however the manual pressure readings must be entered on the screen.

4.8.8 Acceptance testing must be performed for the following circumstances:

Each new data entry system installation.
When ever station barometer is moved or changed.
During the annual station inspection (annual comparison readings).
Whenever the files are changed.

4.9 AWOS PRESSURE COMPARISON READINGS

4.9.1 These instructions apply to sites that are equipped with data entry screens that perform pressure calculations and are co–located with an AWOS. Note in all cases the pressure calculations must have been accepted as in section 4.8.

4.9.2 At sites where the pressure calculations have been accepted the following procedures may be used:

1. The hourly AWOS station pressure value may be used as an entry on the data input screen (thus the attached thermometer and mercury barometer values need not be used.)
2. When the AWOS station pressure is being used then the AWOS station pressure must be compared to the station mercury barometer once each day (preferably at the start of the day).
3. The AWOS station pressure must be within ± 0.2 hpa. of the mercury barometer station pressure calculation if the AWOS station pressure is to be used..
4. If the AWOS station pressure is outside of the limit above, then the mercury barometer must be used to calculate station pressure. Report such cases to the Regional Inspector.
5. Record the comparison reading and time UTC in column 1 of form 63–2322.