Barometer Calibration Procedures

Before submitting your barometer for a professional calibration it is important that you understand the procedure so you can take proper advantage of this service. This process starts by understanding what we read from the barometer and how to interpret it.

Most users who choose to have a calibrated barometer wish to know or report the proper sea level pressure for their location. The instrument to be used for this measurement is, however, always at some elevation above sea level—either a few feet or many hundreds of feet, or more.

Thus there are always two steps to reading and reporting a proper sea level pressure. Step one is to read the instrument and then refer to the Barometer Calibration Table to make any necessary corrections. The calibration table (or graph) provides a unique correction for each barometer reading—in that sense, it is similar to a Deviation Table for a magnetic compass. This correction can be plus or minus. Once this correction has been applied, the result is called the *Station Pressure* for that instrument location.

Station Pressure = Barometer Reading ± Calibration Correction

The station pressure must then be corrected for the elevation of the barometer above sea level. This is called the *Elevation Correction*. For each elevation in feet or meters there is a specific correction that must be added to the station pressure to obtain the proper sea level pressure. At a fixed location, the elevation correction is a fixed number, which is added to all readings. On a large ship at sea, the elevation of the instrument above sea level changes with the draft of the vessel, so the current loading must be taken into account to determine the elevation of the barometer above sea level, and from this the elevation correction can be determined.

Sea-level Pressure = Station Pressure + Elevation Correction.

A sample Reading

Your barometer #1982B is located at an elevation of 57 feet. It reads 1031.4 mb. What is the sea level pressure? Refer to Barometer #1982B calibration data from Table 1 to learn that the correction at this pressure is -0.2 mb, so:

Station Pressure = Barometer Reading + Calibration Correction
= 1031.4 mb - 0.2 mb
= 1031.2 mb.

At 57 ft above sea level the elevation correction from Table 2 is + 2.1 mb, so we get

Sea-level Pressure = Station Pressure + Elevation Correction
= 1031.2 mb + 2.1 mb
= 1033.3 mb

Table 1.
Barometer #1982B Calibration

Barometer Reading	*Correction mb*
940	+0.8
950	+0.7
960	+0.7
970	+0.6
980	+0.4
990	+0.3
1000	+0.2
1010	0.0
1020	-0.1
1030	-0.2
1040	-0.4
1050	-0.6

The professional barometer calibration service provides the user with calibration data such as shown in Table 1. The data can be in the form of a table or a graph, or both. This data is obtained by placing the barometer into a test chamber whose pressure can be controlled over the full range of atmospheric pressure by use of a vacuum pump.

At several pressures over the full range, the pressure on the test instrument is compared to an accurate standard pressure gauge, and the difference between these two pressures is the calibration correction for that pressure. Usually the test standard instrument is directly traceable to an instrument from the National Institute of Standards and Technology (NIST).

It is important to recognize that most barometers have some level of correction needed at each pressure indicated, although on quality instruments this could be a very small correction. Nevertheless, because there is some correction needed, the uncorrected reading of the instrument directly from the dial will rarely be its most accurate value unless you happen to read it at the pressure that was selected for the calibration. Every barometer can be set to be precisely correct at one pressure. The pressure chosen for this setting at the time of calibration is usually in the range of 1010 to 1016 mb, corresponding to the range of average pressures at sea level. Thus you would expect the required corrections to be smallest in this range and generally larger at the lower and/or higher ends of the barometer dial.

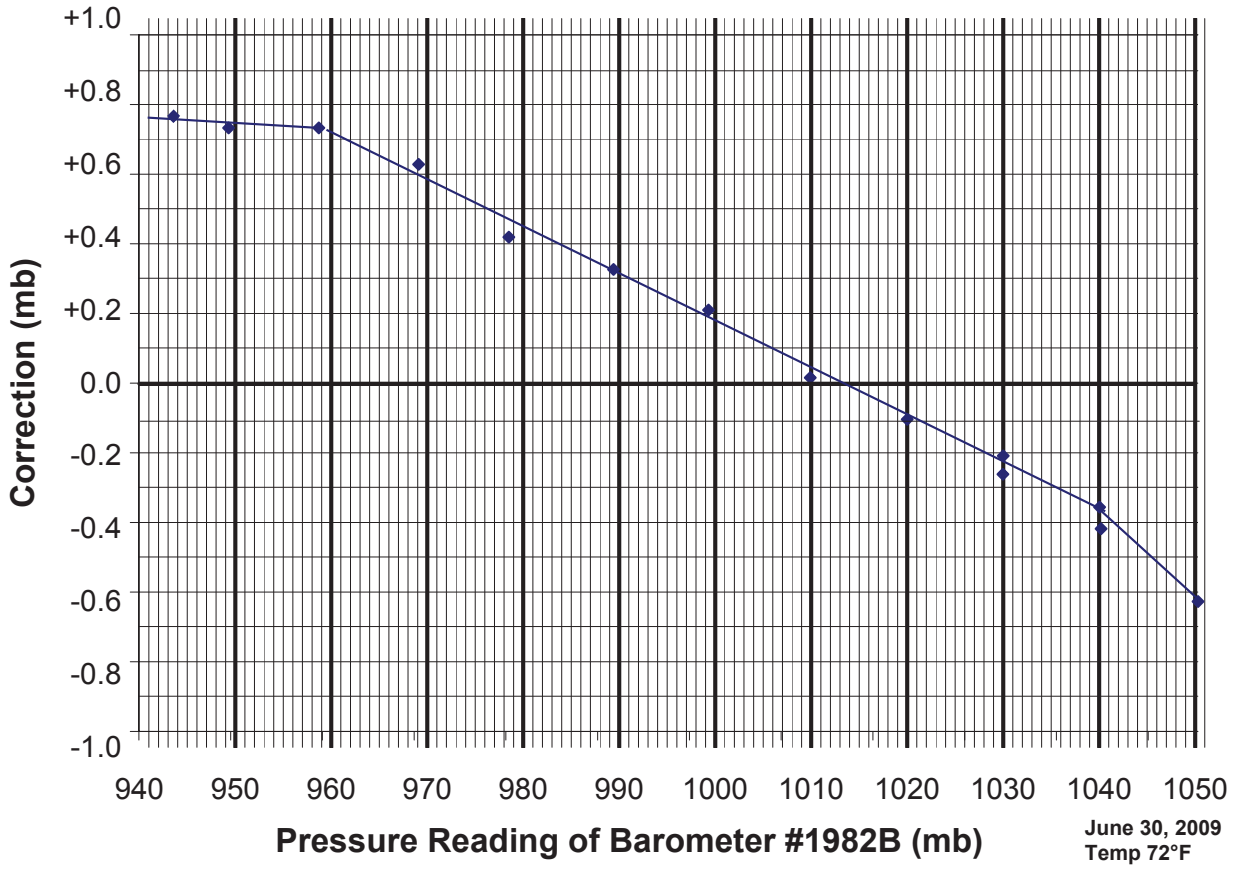

Figure 1. Calibration data that was used to create the Calibration Table shown in Table 1.

Table 2. Elevation Correction — Pressure correction vs. elevation*

Elevation		Correction + mb
ft	meter	
0	0.0	0.0
1	0.3	0.0
2	0.6	0.1
3	0.9	0.1
4	1.2	0.1
5	1.5	0.2
6	1.8	0.2
7	2.1	0.3
8	2.4	0.3
9	2.7	0.3
10	3.0	0.4
11	3.4	0.4
12	3.7	0.4
13	4.0	0.5
14	4.3	0.5
15	4.6	0.5
16	4.9	0.6
17	5.2	0.6
18	5.5	0.7
19	5.8	0.7
20	6.1	0.7
21	6.4	0.8
22	6.7	0.8
23	7.0	0.8
24	7.3	0.9
25	7.6	0.9
26	7.9	1.0
27	8.2	1.0
28	8.5	1.0
29	8.8	1.1
30	9.1	1.1
31	9.4	1.1
32	9.8	1.2
33	10.1	1.2
34	10.4	1.2
35	10.7	1.3
36	11.0	1.3
37	11.3	1.4
38	11.6	1.4

Elevation		Correction + mb
ft	meter	
39	11.9	1.4
40	12.2	1.5
41	12.5	1.5
42	12.8	1.5
43	13.1	1.6
44	13.4	1.6
45	13.7	1.6
46	14.0	1.7
47	14.3	1.7
48	14.6	1.8
49	14.9	1.8
50	15.2	1.8
51	15.5	1.9
52	15.8	1.9
53	16.2	1.9
54	16.5	2.0
55	16.8	2.0
56	17.1	2.0
57	17.4	2.1
58	17.7	2.1
59	18.0	2.2
60	18.3	2.2
61	18.6	2.2
62	18.9	2.3
63	19.2	2.3
64	19.5	2.3
65	19.8	2.4
66	20.1	2.4
67	20.4	2.5
68	20.7	2.5
69	21.0	2.5
70	21.3	2.6
71	21.6	2.6
72	21.9	2.6
73	22.3	2.7
74	22.6	2.7
75	22.9	2.7
76	23.2	2.8
77	23.5	2.8

Elevation		Correction + mb
ft	meter	
78	23.8	2.9
79	24.1	2.9
80	24.4	2.9
81	24.7	3.0
82	25.0	3.0
83	25.3	3.0
84	25.6	3.1
85	25.9	3.1
86	26.2	3.1
87	26.5	3.2
88	26.8	3.2
89	27.1	3.3
90	27.4	3.3
91	27.7	3.3
92	28.0	3.4
93	28.3	3.4
94	28.7	3.4
95	29.0	3.5
96	29.3	3.5
97	29.6	3.5
98	29.9	3.6
99	30.2	3.6
100	30.5	3.7
100	30.5	3.7
110	33.5	4.0
120	36.6	4.4
130	39.6	4.8
140	42.7	5.1
150	45.7	5.5
160	48.8	5.8
170	51.8	6.2
180	54.9	6.6
190	57.9	6.9
200	61.0	7.3
210	64.0	7.7
220	67.1	8.0
230	70.1	8.4
240	73.2	8.8
250	76.2	9.1

Elevation		Correction + mb
ft	meter	
260	79.2	9.5
270	82.3	9.8
280	85.3	10.2
290	88.4	10.6
300	91.4	10.9
310	94.5	11.3
320	97.5	11.7
330	100.6	12.0
340	103.6	12.4
350	106.7	12.8
360	109.7	13.1
370	112.8	13.5
380	115.8	13.8
390	118.9	14.2
400	121.9	14.6
410	125.0	14.9
420	128.0	15.3
430	131.1	15.6
440	134.1	16.0
450	137.2	16.4
460	140.2	16.7
470	143.3	17.1
480	146.3	17.5
490	149.4	17.8
500	152.4	18.2
510	155.4	18.5
520	158.5	18.9
530	161.5	19.3
540	164.6	19.6
550	167.6	20.0
560	170.7	20.3
570	173.7	20.7
580	176.8	21.1
590	179.8	21.4
600	182.9	21.8
610	185.9	22.1
620	189.0	22.5
630	192.0	22.9
640	195.1	23.2

* Example. Your station pressure is 1020.5 and your barometer is 82 ft above sea level. The elevation correction is +3.0 mb, so the Sea-Level pressure = station pressure + elevation correction = 1020.5 + 3.0 = 1023.5 mb. The elevation correction is always positive when you are above sea level.

Barometer quality and shape of the calibration curve

Generally a higher quality barometer will have lower corrections on the calibration curve and these corrections will change very little across the full range of pressures. However, the crucial factor in obtaining accurate pressures from your barometer is not the magnitude of the correction, but its dependability. A poor barometer will not have reproducible corrections, which the calibrator will discover in the process of calibration. Such instruments cannot be used for dependably accurate pressures.

On the other hand, it is often found that instruments can have rather large corrections at the ends of the atmospheric pressure range, and still be very dependable for accurate pressures once these corrections are applied. The goal of the calibrator is to establish this list of corrections for your instrument and confirm that they are dependable, which from a practical point of view means they were the same after testing the instrument on several passes through the full pressure range, in both directions.

In many cases, a good calibration can render a relatively inexpensive instrument into one that provides accurate pressures with the use of its custom corrections, which would otherwise only be obtainable with a much more expensive instrument.

Barometer shipments

If shipping your instrument to the calibration laboratory, it is of course crucial that you package it very carefully, with at least 6 inches of firm packing material around all sides, and mark the outside of the box FRAGILE.

Ground shipments are preferred over air if possible, and the package must be insured for the full value of a new replacement instrument of the same quality.

It is also best to include a description of its recent behavior and handling, and any other information you think might be relevant to the calibration of the instrument. Also record the time and date and pressure displayed on the dial at its normal location at the time it was removed for shipping. Table 3 is a sample form for this information.

When transporting the instrument by car, it is best to open a window before closing the door to prevent possible bursts of high pressure.

How to check your barometer

Go to www.starpath.com/barometers. You will find there a way to enter your Lat and Lon and this free service will find the 10 closest places to you that have live accurate atmospheric pressure online with the range and bearing to each. There is also a mathematical form you can fill out and submit to receive the correct average value for your location at a selected time. Full instructions are provided. It works worldwide.

Table 3. Barometer Calibration Form

Please fill in the following information if known, otherwise mark through the space —— .

Date_____

Owner's name_____

Barometer brand/Model/Serial no_____

Owner's telephone_____

Owner's email_____

Address or Vessel_____

_____

Usual elevation of the instrument (or range)_____

Date of original purchase if known_____

Last documented reading

Time and date_____

Latitude and Longitude (or description of location)_____

Elevation_____

Barometer reading_____

Time and date the instrument must arrive back to the owner_____

Owner's Comments_____

_____

_____

========== *Calibrator's notes below* ==========

Arrival time and date_____

Present reading_____ at elevation _____at temperature _____

Station pressure at the time _____

Calibrator's Comments _____

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