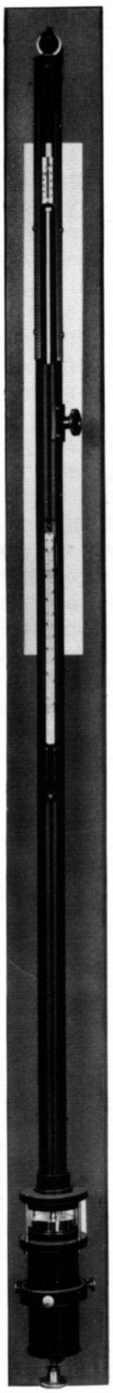

453
National
Weather
Service
Type

Instruction Booklet

for use with

PRINCO

Fortin type mercurial

Barometers

English Language
Edition

Revised 1/07

Manufactured by

PRINCO INSTRUMENTS, INC.
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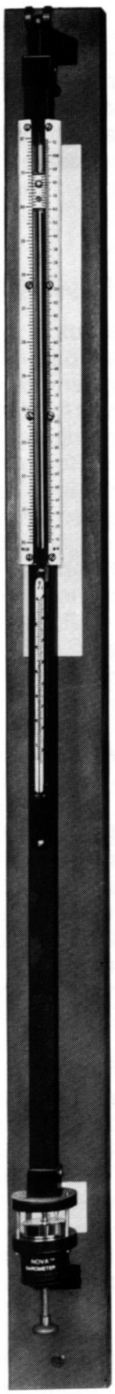
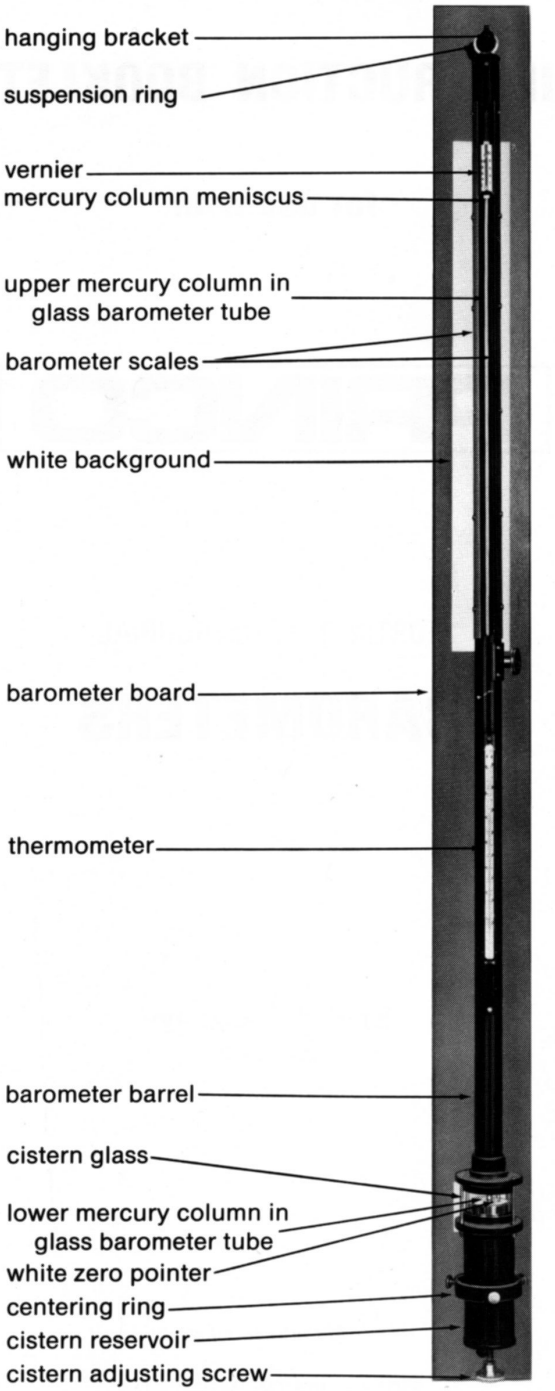


469
NOVA™
Economy
Model

Figure 1. FORTIN TYPE MERCURIAL BAROMETER



453X
High
Altitude
Barometer

Instructions

Common Errors

1. The mercury column in barometers must be "*locked up*" before moving, or air will get into the barometer tube. This is done by turning the cistern adjusting screw in until slight resistance is felt then backing off slightly, thus minimizing all air and vacuum spaces. See Appendix 2, Moving and Shipping the Barometer. Further, the cistern adjusting screw should always be turned *slowly*. See the Location and Mounting Caution below. *Always take these precautions to preserve the high vacuum in your barometer tube*.
2. A barometer is primarily an altimeter, as you go up in altitude, the pressure goes down. Mercurial barometers read the local station pressure, *not the higher reported sea level "barometric pressure"*. See Automatic Barometer Corrections below, also Appendix 1, Sea Level Pressure.
3. At a given altitude, changes in barometric pressure are quite small and *must be measured accurately and recorded regularly to be detected*. As long as there is a free liquid mercury surface in the tube and cistern, your barometer absolutely will respond to the slightest change in pressure. See Setting the Cistern Level and Reading the Vernier below, also Appendix 2, Barometer Troubleshooting.

Unpacking

1. You should save the shipping box and packing materials in case the barometer ever needs to be returned.
2. Open the outer carton, and remove the barometer mounting board.
3. Remove the inner square cardboard sleeve, containing the barometer, and the foam end caps.
4. Cut the tape on the square cardboard sleeve and fold it open, revealing the barometer in its plastic bag.
5. Cut the plastic tie that holds the barometer and plastic containment bag to the "egg crate" foam.
6. Look for mercury in the plastic containment bag. It is not unusual to see some mercury in the bag, which has been forced through the gaskets or semipermeable breathable chamois by many possible atmospheres of dynamic hydraulic mercurial pressure, if the barometer was roughly handled. Up to about 2 ml (½ teaspoon) can be lost with no effect on the operation of the barometer. A small amount of mercury in the bag will spread and look like a lot. If you see large amounts of mercury, before unpacking further, visually check for a broken glass barometer tube or air bubbles in it, as in the next section.
7. If the long glass barometer tube is broken, or you detect an air bubble of greater than 1 mm diameter, it **means the barometer is defective and requires repair.**
8. If you elect to continue unpacking, and there is loose mercury present in the containment bag, secure an empty clean plastic trash bag lined trash can. Secure the trash can on a nonslip surface, near a corner that can securely support the barometer. Also read Appendix 2, Mercury Clean Up Guidelines.
9. Hold the barometer *upside down* in its plastic bag and gently tap the bag and barometer over the trash can, to get most of the mercury to the lower end of the containment bag. Then cut the upper end of the bag and pull the barometer out. Place the barometer, still upside down, in the lined trash can in a secure position. Maneuver (without wiping) any remaining droplets into the plastic trash bag. Residual specks of mercury may be picked up with sticky tape. Pour the recyclable mercury into a plastic bottle.
10. Dispose of mercury and contaminated items as instructed in Appendix 2, Mercury Clean Up Guidelines.

Checking for Air in the Barometer Tube

1. Visually check for air bubbles in the barometer tube as follows:
   1.1. The cistern adjusting screw should be screwed in, so that mercury fills the cistern and barometer tube, as in Appendix 2, Moving and Shipping the Barometer.

1.2. With the Model 469 NOVA™ School Grade Barometer, rotate the barometer on its axis to view the length of the glass tube from the back. With the Model 453 National Weather Service Type Barometer, rotate the barometer to view the front exposed portion of the tube between the scales.

1.3. Slowly rock the barometer through the horizontal toward the upright position and back several times, while carefully watching the exposed long glass barometer tube for an air bubble, which would tend to gravitate towards the elevated end.

1.4. If you *see* an air bubble greater than 1 mm in diameter, go to Instructions, Unpacking, Step 7 above; or to Appendix 2, Manipulating Air Bubbles. If not, you may proceed to Step 2.

2. You may further check for air in two additional ways as follows:

2.1. Perform the "*metallic click*" test: Slowly turn the barometer to the upright position. Then slowly turn the cistern adjusting screw out, so that while mercury still fills the cistern, it does not quite come to the top of the glass barometer tube. Slowly tilt the barometer until the mercury strikes the top of the long glass barometer tube (about 30 degrees off the vertical, at sea level). A sharp high pitched "click", like a small metal hammer tapping glass, indicates a good vacuum; a lower pitched "clap" indicates air. Do this with your ear near the point of impact several times until satisfied that you know which you heard. When finished, lock up the mercury column and invert the barometer before moving.

2.2. *Compare* the barometer with another mercurial barometer known to be accurate. The barometers must be side by side for accurate comparison. Comparing like barometer scales in the same system of units does not require any corrections. If comparing to an aneroid barometer you would need to apply the corrections. Up to 24 hours may be required, for the barometers to come to thermal equilibrium. The weather services always report a hypothetical sea level "barometric pressure". When reconciling your barometer reading with the reported barometric pressure, allowance must also be made for the substantial increase in pressure from your altitude down to sea level (see Automatic Barometer Corrections below, also Appendix 1, Sea Level Pressure).

Location and Mounting

The place where the barometer is to be installed should be carefully selected. It should be a sturdy plumb wall, away from pedestrian traffic, which is free from vibrations and fluctuations of temperature and pressure. An inside wall usually has less temperature fluctuation than an outside wall. The barometer should not be close to a radiator or other fluctuating heat source. It should not be in the same room with an air compressor or other source of pressure disturbance. The lighting should be adequate to facilitate setting of the mercury level to the white zero pointer. If artificial light is used, select a source that does not radiate too much heat. If the barometer is in an aisle, it should be protected from passers-by.

Mount the barometer board firmly in a vertical position, so that the barometer scales will be at approximately eye level. Use a plumb bob or level to make sure the barometer board, and subsequently the barometer itself, is vertical. A slant in any direction would cause the barometer indication to be too high. *Slowly and carefully* turn the barometer right side up; place the lower cistern end in the barometer centering ring and the suspension ring in the hanging bracket. Secure the barometer in a vertical position. Slowly turn the cistern adjusting screw down until the mercury level in the cistern is at the white zero pointer (at sea level for the Model 469 NOVA™ economy model about 12 full turns, for the Model 453 National Weather Service Type about 17 full turns, more at higher altitudes). If the mercury column does not come down when the screw is turned, tap the top of the barometer with your fingers to snap it loose. With a very high vacuum in the barometer tube, this tap may be necessary the first time the mercury column is lowered. At first the mercury in the glass barometer tube will fall quite rapidly. When it gets near the pressure at your altitude, the rate of fall will abruptly decrease and the mercury levels in both the barometer tube and cistern will fall slowly in unison. Continue slowly turning until the mercury level in the cistern, as viewed through the cistern glass, is just touching the white zero pointer.

Caution: *The cistern adjusting screw should always be turned down slowly*; particularly with the Model 453 Weather Service Type barometer, otherwise air could be sucked into the cistern, causing air bubbles to rise to the surface. Turning the cistern adjusting screw *up* too rapidly has caused a tornado like whirlpool of air to be sucked into the barometer tube, and could possibly cause mercury under pressure to seep through the seals or kidskin bag. Before moving the barometer, the cistern adjusting screw should always be slowly screwed in until slight resistance is felt then backing off slightly, see Appendix 2, Moving the Barometer.

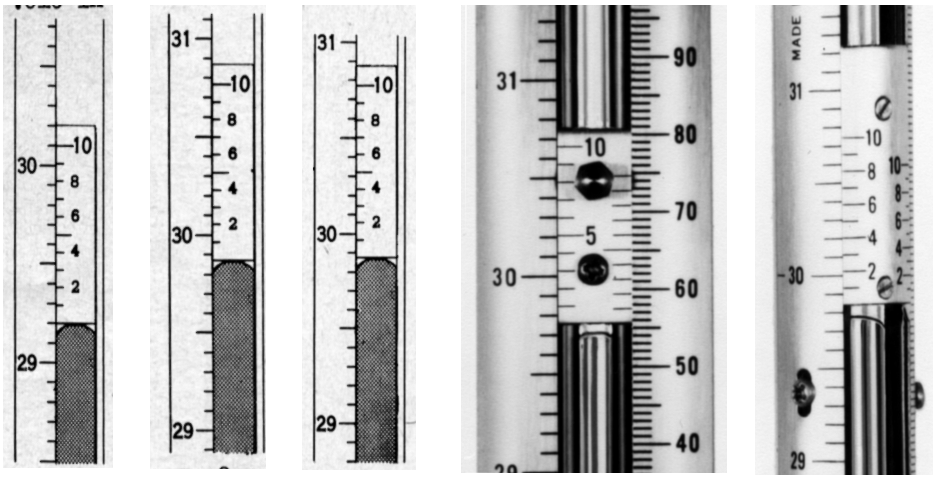
Setting the Cistern Level and Reading the Vernier

1. Turn the cistern adjusting screw at the bottom of the cistern reservoir until the mercury, as viewed through the cistern glass, comes up from below to just touch the white zero pointer. See Figure 2, Cistern Set to White Zero Pointer. The white zero pointer will dimple the mercury surface. Light reflection in the dimple will indicate its magnitude. The smaller the dimple, the more accurately the level has been adjusted. If there is no dimple, the mercury level should be adjusted higher.
2. Tap the cistern glass and the upper small diameter glass barometer tube, at the level of the mercury column meniscus, to bring each meniscus to its average height.
3. Recheck and readjust, if necessary, the level of mercury in the cistern as in Step 1.
4. Raise the vernier above the top of the mercury meniscus, and then lower it very slowly, until the bottom edges appear to be just touching the top of the mercury meniscus. To eliminate parallax, the observer's eye should be in the same plane as the front and back bottom horizontal edges of the vernier sleeve. When the vernier is properly adjusted a white light will be visible at both sides of the mercury meniscus but not at the top. There will, however, be a slight haze over the top of the mercury.
5. Read the barometer scale(s) directly adjacent to the bottom horizontal edge (ignoring any flanges) of the movable vernier, as in Figure 3, Sample Readings of the Vernier, reading 1. Estimate between the lines, then use the lines on the vernier scale to confirm or refine the estimated between the lines digit. If the seventh line on the vernier lines up most closely with a line on the main scale, then the closest between the lines estimate should have been a seven, as in Figure 3, reading 2. Now estimate the next digit by comparing the alignments of the lines below and above the most closely aligned line, and add or subtract 0 to 0.5 to or from the previous digit, as in Figure 3, readings 3, 4, 5, and 6.

Figure 2. Cistern Set to Zero Pointer

Figure 3. Sample Readings of the Vernier

(the vernier's lower edges should appear to just touch the mercury meniscus)



Scale reading	29.200 In.	29.800 in.	29.800 in.	29.700 in.	755.00 mm	29.800 in.
Vernier increment	.000 in.	.070 in.	.073 in.	.059 in.	.61 mm	.043 in.
Barometer reading	29.200 in.	29.870 in.	29.873 in.	29.759 in.	755.61 mm	29.843 in.

Appendix 1 – Manual Corrections

Certificate Correction

If your barometer has been certified, apply the "certificate correction" first. The steps below are numbered to correspond to the numbers in Tables 2 or 3.

1. Record the observed "barometer reading" to 0.001 in. Hg, 0.01 mm Hg, or 0.01 mb, and the "temperature" in the same system of units indicated by the thermometer attached to the barometer to 0.1°.
2. Record the "certificate correction" from the "Barometer Factory Certificate of Calibration" if you have one.
3. Apply the "certificate correction", with due regard to sign, to the "observed barometer reading", to obtain the "certificate corrected reading". Plus (+) corrections are to be added, minus (-) are to be subtracted.

Traditional Temperature and Gravity Corrections

This method does not require a calculator, although you will find one handy for using the *multipliers* as a precise shortcut. Each time a reading is taken, the individual corrections are determined manually in the tables. The most commonly used ranges on the axes of the tables are incremented in multiples of 0.01, 0.1, 1.0, or 100, to make interpolation as easy as possible, with no division necessary (other than moving the decimal point). The tables are further generally arranged with the next greater absolute value above, to simplify the subtraction needed for interpolation; but otherwise progress as you would read a page. To help you with your search of the tables, the most commonly used coordinates are highlighted in gray.

4. Utilizing the indicated "temperature", the "certificate corrected reading", and Table 4 for English scales or Table 5 for metric scales, obtain and record the "temperature correction", interpolating vertically and horizontally, and rounding off to 0.001 in., 0.01 mm, or 0.01 mb.
5. Subtract the "temperature correction" from the "certificate corrected reading" to obtain the "temperature corrected reading".
6. Determine your latitude, which can be read off of almost any map of your area, to a tenth of a degree. With your latitude, the "temperature corrected reading", and Tables 6 or 7, obtain and record the "gravity correction", interpolating vertically and horizontally, and rounding off to 0.001 in., 0.01 mm, or 0.01 mb.
7. Apply the "gravity correction", with due regard to sign, to the "temperature corrected reading", to obtain the "local station pressure". Plus (+) corrections are to be added, minus (-) corrections are to be subtracted. This is the pressure that most laboratories need.

Table 2. Sample Traditional Corrections

At 72.5°F (-0.003,967)/22.5°C (-0.003,662), 40.2°N latitude (-0.000.490), and 243 feet/74.1 meters

	inch	millimeter	millibar
1. Barometer reading and temp.	29.298 in. Hg @ 72.5°F	743.86 mm Hg @ 22.5°C	991.72 mb @ 22.5°C
2. Certificate correction if any, + or -	-0.004 in.	-0.01 mm	-0.01 mb
3. Certificate corrected reading	29.294 in. Hg @ 72.5°F	743.85 mm Hg @ 22.5°C	991.71 mb @ 22.5°C
4. Temperature correction (Tbl. 4,5)	-0.116 in.	-2.72 mm	-3.63 mb
5. Temperature corrected reading	29.178 in. Hg @ 32°F	741.13 mm Hg @ 0°C	988.08 mb @ 0°C
6. Gravity correction (Tbl. 7,8), + or -	-0.014 in.	-0.36 mm	-0.48 mb
7. **Local station pressure**	**29.164 in. Hg @ 32°F**	**740.76 mm Hg @ 0°C**	**987.60 mb**
8. Pressure alitiude (Table 8)	708 feet	215.7 meters	215.8 meters
9. Minus (-) the true altitude	-243 feet	-74.1 meters	-74.1 meters
10. Pressure altitude differential, + or -	465 feet	141.6 meters	141.7 meters
11. Sea level pressure (Table 9)	29.422 in. Hg @ 32°F	747.33 mm Hg @ 0°C	996.35 mb

Easier Temperature and Gravity Corrections

Here is a new easier way, using a calculator, to accurately obtain the normal combined temperature and gravity corrections by combining the multipliers. Locate your normal laboratory temperature's nearest printed temperature, in Table 4 for English scales, or Table 5 for metric scales, and its corresponding "*multiplier for English, or metric, temperature correction*". Normally correcting to this whole degree temperature will simplify determining any variations. If you like, you can adjust your room thermostat to maintain this whole degree temperature. Find your latitude, which can be read off of almost any map of your area, to a tenth of a degree. Determine the "*multiplier for gravity correction*" (Tables 6 or 7) for your exact latitude, interpolated vertically (you'll only have to do these things *once*). Algebraically sum each multiplier (subtract -, add + multipliers) with 1.000,000, and multiply the two resulting "multipliers for answer" together. For example, English scales normally at 72°F and 40.2°N would be:

1.000,000		1.000,000					
-0.003,922		-0.000,490					
0.996,078	x	0.999,510	=	0.995,590			

Ours is normally at _____ and _____ and is:

1.0000,000		1.0000,000					
_____		_____					
	x		=				

This gives you, once and for all, your unique constant "*multiplier for normally corrected pressure*". *Multiplying this constant factor times your barometer readings may be all you ever need to do*. For greatest accuracy, which avoids the round off errors inherent in the tables, follow the steps below.

4. Record your constant "*multiplier for normally corrected pressure*" as determined above, on this line.
5. Use an ordinary calculator to multiply your "*multiplier for normally corrected pressure*" times the "certificate corrected reading" to obtain the "normally corrected pressure", rounding off to 0.001 in., 0.01 mm, or 0.01 mb.
6. If the temperature should vary from your normal, you may accurately calculate the "temperature variation correction", or find it in the temperature correction tables. It is the difference in the temperature correction for the actual temperature minus that for the normal whole degree temperature. At standard pressure (p_o) it is -0.0027 in. Hg/°F at 72°F, -0.123 mm Hg/°C or -0.165 mb/°C at 22°C, and varies in direct proportion with the certificate corrected reading (x p_c/p_o). For all normal room temperatures the preceding values, adjusted for pressure if necessary, may be used with excellent accuracy. For extreme temperatures it can be calculated as p_c x dM_{tc}/dt x Δt, where the equation for dM_{tc}/dt is given in Appendix 2, equation 1 b. It is positive (+) for a decreased temperature, and negative (-) for an increased temperature.
7. Apply this "temperature variation difference", with due regard to sign, to the "normally corrected pressure", to obtain the "local station pressure". Plus (+) corrections are to be added, minus (-) corrections are to be subtracted. This is the pressure that most laboratories need.

Table 3. Sample Easier Corrections

Normally at 72°F (-0.003,922) or 22°C (-0.003,580), 40.2°N latitude (-0.000,490), and 243 feet/74.1 meters

	inch	millimeter	millibar
1. Barometer reading and temp.	29.300 in. Hg @ 73.0°F	743.92 mm Hg @ 23.0°C	991.81 mb @ 21.0°C
2. Certificate correction if any, + or -	~~-0.004~~ in.	~~-0.01~~ mm	~~-0.01~~ mb
3. Certificate corrected reading	29.296 in. Hg @ 73.0°F	743.91 mm Hg @ 23.0°C	991.80 mb @ 21.0°C
4. *Multplr. for norm. corrected press.*	*x* ~~0.995590~~	x ~~0.995932~~	x ~~0.995932~~
5. Normally corrected pressure	29.167 in. Hg @ 32°F	740.88 mm Hg @ 0°C	987.77 mb @ 0°C
6. Temp. variation correction, + or -	~~-0.003~~ in.	~~-0.12~~ mm	~~0.16~~ mb
7. **Local station pressure**	**29.164 in. Hg @ 32°F**	**740.76 mm Hg @ 0°C**	**987.93 mb**
8. Pressure alitiude (Table 8)	707 feet	215.7 meters	213.0 meters
9. Minus (-) the true altitude	~~-243~~ feet	~~-74.1~~ meters	~~-74.1~~ meters
10. Pressure altitude differential, + or -	464 feet	141.6 meters	138.9 meters
11. Sea level pressure (Table 9)	29.422 in. Hg @ 32°F	747.33 mm Hg @ 0°C	996.68 mb

Sea Level Pressure

Your temperature and gravity corrected barometer reading gives you the “local station pressure” at the level of the free surface of the mercury in the cistern. This is what most laboratories need, for blood gas analysis or other pressure sensitive applications.

A barometer is primarily an altimeter, as pressure decreases substantially with altitude. If you need to calculate the sea level pressure, for weather forecast comparisons or altimeter setting, you must determine the “true altitude” of your barometer’s cistern’s free surface, preferably to the nearest foot. This may be obtained by referring to a topographic map of your area and adding the altitude of the cistern above ground level, or by having a survey done by a surveyor. The steps below, in the English system, are numbered to correspond to the numbers in Tables 2 and 3. Tables 8 and 9 are published here in the English system only. For the many metric system units, we recommend you use our “MS Excel Spreadsheet for Automatic Barometer Corrections” (Table 1), see Instructions, Automatic Barometer Corrections.

8. Utilizing the “local station pressure” and Table 8, obtain the “pressure altitude” interpolating and rounding off to the nearest foot.
9. Enter the “true altitude”, as determined above, on this line. Then change its sign in preparation for the next step.
10. Algebraically sum minus (-) the “true altitude” and the “pressure altitude”. If the signs are similar this involves mathematical addition. If the signs are dissimilar this involves mathematical subtraction of the smaller from the larger. In either case the resulting “pressure altitude differential” is assigned the sign of the larger absolute value.
11. Utilizing the above determined “pressure altitude differential” with sign, and Table 9, obtain the “sea level pressure” interpolating and rounding off to one-thousandth of an inch. This is what the weather services report as the “barometric pressure” and altimeter setting.

Table 4. Traditional Temperature Correction, English Units[Ref. 2, 3+A42]

To reduce the reading of the barometer to standard temperature

Temp-erature °F	*Multiplier for Engl. Temp. Correction*[a]	Certificate Corrected Barometer Reading, Inches of Mercury (in. Hg) 15"	20"	21"	22"	23"	24"	25"	26"	27"	28"	29"	30"	31"	32"	33"
		Pressure Altitude, feet 17906'	10731'	9474'	8266'	7100'	5976'	4888'	3835'	2815'	1825'	863'	-73'	-984'	-1871'	-2736'
120	-0.008,223	-.123	-.164	-.173	-.181	-.189	-.197	-.206	-.214	-.222	-.230	-.238	-.247	-.255	-.263	-.271
115	-0.007,777	-.117	-.156	-.163	-.171	-.179	-.187	-.194	-.202	-.210	-.218	-.226	-.233	-.241	-.249	-.257
110	-0.007,331	-.110	-.147	-.154	-.161	-.169	-.176	-.183	-.191	-.198	-.205	-.213	-.220	-.227	-.235	-.242
105	-0.006,884	-.103	-.138	-.145	-.151	-.158	-.165	-.172	-.179	-.186	-.193	-.200	-.207	-.213	-.220	-.227
100	-0.006,436	-.097	-.129	-.135	-.142	-.148	-.154	-.161	-.167	-.174	-.180	-.187	-.193	-.200	-.206	-.212
98	-0.006,257	-.094	-.125	-.131	-.138	-.144	-.150	-.156	-.163	-.169	-.175	-.181	-.188	-.194	-.200	-.206
96	-0.006,078	-.091	-.122	-.128	-.134	-.140	-.146	-.152	-.158	-.164	-.170	-.176	-.182	-.188	-.194	-.201
94	-0.005,899	-.088	-.118	-.124	-.130	-.136	-.142	-.147	-.153	-.159	-.165	-.171	-.177	-.183	-.189	-.195
92	-0.005,719	-.086	-.114	-.120	-.126	-.132	-.137	-.143	-.149	-.154	-.160	-.166	-.172	-.177	-.183	-.189
90	-0.005,540	-.083	-.111	-.116	-.122	-.127	-.133	-.138	-.144	-.150	-.155	-.161	-.166	-.172	-.177	-.183
88	-0.005,360	-.080	-.107	-.113	-.118	-.123	-.129	-.134	-.139	-.145	-.150	-.155	-.161	-.166	-.172	-.177
86	-0.005,181	-.078	-.104	-.109	-.114	-.119	-.124	-.130	-.135	-.140	-.145	-.150	-.155	-.161	-.166	-.171
84	-0.005,001	-.075	-.100	-.105	-.110	-.115	-.120	-.125	-.130	-.135	-.140	-.145	-.150	-.155	-.160	-.165
82	-0.004,822	-.072	-.096	-.101	-.106	-.111	-.116	-.121	-.125	-.130	-.135	-.140	-.145	-.149	-.154	-.159
80	-0.004,642	-.070	-.093	-.097	-.102	-.107	-.111	-.116	-.121	-.125	-.130	-.135	-.139	-.144	-.149	-.153
79	-0.004,552	-.068	-.091	-.096	-.100	-.105	-.109	-.114	-.118	-.123	-.127	-.132	-.137	-.141	-.146	-.150
78	-0.004,462	-.067	-.089	-.094	-.098	-.103	-.107	-.112	-.116	-.120	-.125	-.129	-.134	-.138	-.143	-.147
77	-0.004,372	-.066	-.087	-.092	-.096	-.101	-.105	-.109	-.114	-.118	-.122	-.127	-.131	-.136	-.140	-.144
76	-0.004,282	-.064	-.086	-.090	-.094	-.098	-.103	-.107	-.111	-.116	-.120	-.124	-.128	-.133	-.137	-.141
75	-0.004,192	-.063	-.084	-.088	-.092	-.096	-.101	-.105	-.109	-.113	-.117	-.122	-.126	-.130	-.134	-.138
74	-0.004,102	-.062	-.082	-.086	-.090	-.094	-.098	-.103	-.107	-.111	-.115	-.119	-.123	-.127	-.131	-.135
73	-0.004,012	-.060	-.080	-.084	-.088	-.092	-.096	-.100	-.104	-.108	-.112	-.116	-.120	-.124	-.128	-.132
72	-0.003,922	-.059	-.078	-.082	-.086	-.090	-.094	-.098	-.102	-.106	-.110	-.114	-.118	-.122	-.126	-.129
71	-0.003,832	-.057	-.077	-.080	-.084	-.088	-.092	-.096	-.100	-.103	-.107	-.111	-.115	-.119	-.123	-.126
70	-0.003,742	-.056	-.075	-.079	-.082	-.086	-.090	-.094	-.097	-.101	-.105	-.109	-.112	-.116	-.120	-.123
69	-0.003,652	-.055	-.073	-.077	-.080	-.084	-.088	-.091	-.095	-.099	-.102	-.106	-.110	-.113	-.117	-.121
68	-0.003,562	-.053	-.071	-.075	-.078	-.082	-.085	-.089	-.093	-.096	-.100	-.103	-.107	-.110	-.114	-.118
67	-0.003,472	-.052	-.069	-.073	-.076	-.080	-.083	-.087	-.090	-.094	-.097	-.101	-.104	-.108	-.111	-.115
66	-0.003,382	-.051	-.068	-.071	-.074	-.078	-.081	-.085	-.088	-.091	-.095	-.098	-.101	-.105	-.108	-.112
65	-0.003,291	-.049	-.066	-.069	-.072	-.076	-.079	-.082	-.086	-.089	-.092	-.095	-.099	-.102	-.105	-.109
64	-0.003,201	-.048	-.064	-.067	-.070	-.074	-.077	-.080	-.083	-.086	-.090	-.093	-.096	-.099	-.102	-.106
63	-0.003,111	-.047	-.062	-.065	-.068	-.072	-.075	-.078	-.081	-.084	-.087	-.090	-.093	-.096	-.100	-.103
62	-0.003,021	-.045	-.060	-.063	-.066	-.069	-.073	-.076	-.079	-.082	-.085	-.088	-.091	-.094	-.097	-.100
61	-0.002,931	-.044	-.059	-.062	-.064	-.067	-.070	-.073	-.076	-.079	-.082	-.085	-.088	-.091	-.094	-.097
60	-0.002,840	-.043	-.057	-.060	-.062	-.065	-.068	-.071	-.074	-.077	-.080	-.082	-.085	-.088	-.091	-.094
58	-0.002,660	-.040	-.053	-.056	-.059	-.061	-.064	-.066	-.069	-.072	-.074	-.077	-.080	-.082	-.085	-.088
56	-0.002,479	-.037	-.050	-.052	-.055	-.057	-.060	-.062	-.064	-.067	-.069	-.072	-.074	-.077	-.079	-.082
54	-0.002,298	-.034	-.046	-.048	-.051	-.053	-.055	-.057	-.060	-.062	-.064	-.067	-.069	-.071	-.074	-.076
52	-0.002,118	-.032	-.042	-.044	-.047	-.049	-.051	-.053	-.055	-.057	-.059	-.061	-.064	-.066	-.068	-.070
50	-0.001,937	-.029	-.039	-.041	-.043	-.045	-.046	-.048	-.050	-.052	-.054	-.056	-.058	-.060	-.062	-.064
48	-0.001,756	-.026	-.035	-.037	-.039	-.040	-.042	-.044	-.046	-.047	-.049	-.051	-.053	-.054	-.056	-.058
46	-0.001,575	-.024	-.031	-.033	-.035	-.036	-.038	-.039	-.041	-.043	-.044	-.046	-.047	-.049	-.050	-.052
44	-0.001,394	-.021	-.028	-.029	-.031	-.032	-.033	-.035	-.036	-.038	-.039	-.040	-.042	-.043	-.045	-.046
42	-0.001,213	-.018	-.024	-.025	-.027	-.028	-.029	-.030	-.032	-.033	-.034	-.035	-.036	-.038	-.039	-.040
40	-0.001,032	-.015	-.021	-.022	-.023	-.024	-.025	-.026	-.027	-.028	-.029	-.030	-.031	-.032	-.033	-.034
35	-0.000,578	-.009	-.012	-.012	-.013	-.013	-.014	-.014	-.015	-.016	-.016	-.017	-.017	-.018	-.019	-.019
30	-0.000,124	-.002	-.002	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.003	-.004	-.004	-.004	-.004	-.004

[a] Multiply the certificate corrected barometer reading by the appropriate "*Multiplier for English Temperature Correction*", interpolated vertically as required, to obtain the temperature correction in the English system accurately, without horizontal interpolation in the tables.

Table 5. Traditional Temperature Correction, Metric Units[Ref. 1,2, 3]

To reduce the reading of the barometer to standard temperature

Temp-erature °C	*Multiplier for Metric Temp. Correction*[b]	Certificate Corrected Reading, Millimeters Mercury (mm Hg) or Millibars (mb)[c]								
		400	500	600	700	800	900	1000	1100	1200
		Pressure Altitude for mm / mb, meters								
		5096 m	3395 m	1950 m 4206 m	688 m 3012 m	-435 m 1949 m	-1449 m 988 m	111 m	-698 m	-1450 m
50	-0.008,096	-3.24	-4.05	-4.86	-5.67	-6.48	-7.29	-8.10	-8.91	-9.72
48	-0.007,775	-3.11	-3.89	-4.67	-5.44	-6.22	-7.00	-7.78	-8.55	-9.33
46	-0.007,454	-2.98	-3.73	-4.47	-5.22	-5.96	-6.71	-7.45	-8.20	-8.94
44	-0.007,133	-2.85	-3.57	-4.28	-4.99	-5.71	-6.42	-7.13	-7.85	-8.56
42	-0.006,811	-2.72	-3.41	-4.09	-4.77	-5.45	-6.13	-6.81	-7.49	-8.17
40	-0.006,489	-2.60	-3.24	-3.89	-4.54	-5.19	-5.84	-6.49	-7.14	-7.79
39	-0.006,328	-2.53	-3.16	-3.80	-4.43	-5.06	-5.69	-6.33	-6.96	-7.59
38	-0.006,167	-2.47	-3.08	-3.70	-4.32	-4.93	-5.55	-6.17	-6.78	-7.40
37	-0.006,005	-2.40	-3.00	-3.60	-4.20	-4.80	-5.40	-6.01	-6.61	-7.21
36	-0.005,844	-2.34	-2.92	-3.51	-4.09	-4.68	-5.26	-5.84	-6.43	-7.01
35	-0.005,683	-2.27	-2.84	-3.41	-3.98	-4.55	-5.11	-5.68	-6.25	-6.82
34	-0.005,521	-2.21	-2.76	-3.31	-3.87	-4.42	-4.97	-5.52	-6.07	-6.63
33	-0.005,360	-2.14	-2.68	-3.22	-3.75	-4.29	-4.82	-5.36	-5.90	-6.43
32	-0.005,199	-2.08	-2.60	-3.12	-3.64	-4.16	-4.68	-5.20	-5.72	-6.24
31	-0.005,037	-2.01	-2.52	-3.02	-3.53	-4.03	-4.53	-5.04	-5.54	-6.04
30	-0.004,875	-1.95	-2.44	-2.93	-3.41	-3.90	-4.39	-4.88	-5.36	-5.85
29	-0.004,714	-1.89	-2.36	-2.83	-3.30	-3.77	-4.24	-4.71	-5.19	-5.66
28	-0.004,552	-1.82	-2.28	-2.73	-3.19	-3.64	-4.10	-4.55	-5.01	-5.46
27	-0.004,390	-1.76	-2.20	-2.63	-3.07	-3.51	-3.95	-4.39	-4.83	-5.27
26	-0.004,228	-1.69	-2.11	-2.54	-2.96	-3.38	-3.81	-4.23	-4.65	-5.07
25	-0.004,67	-1.63	-2.03	-2.44	-2.85	-3.25	-3.66	-4.07	-4.47	-4.88
24	-0.003,905	-1.56	-1.95	-2.34	-2.73	-3.12	-3.51	-3.90	-4.30	-4.69
23	-0.003,743	-1.50	-1.87	-2.25	-2.62	-2.99	-3.37	-3.74	-4.12	-4.49
22	-0.003,580	-1.43	-1.79	-2.15	-2.51	-2.86	-3.22	-3.58	-3.94	-4.30
21	-0.003,418	-1.37	-1.71	-2.05	-2.39	-2.73	-3.08	-3.42	-3.76	-4.10
20	-0.003,256	-1.30	-1.63	-1.95	-2.28	-2.60	-2.93	-3.26	-3.58	-3.91
19	-0.003,094	-1.24	-1.55	-1.86	-2.17	-2.48	-2.78	-3.09	-3.40	-3.71
18	-0.002,932	-1.17	-1.47	-1.76	-2.05	-2.35	-2.64	-2.93	-3.22	-3.52
17	-0.002,769	-1.11	-1.38	-1.66	-1.94	-2.22	-2.49	-2.77	-3.05	-3.32
16	-0.002,607	-1.04	-1.30	-1.56	-1.82	-2.09	-2.35	-2.61	-2.87	-3.13
15	-0.002,444	-0.98	-1.22	-1.47	-1.71	-1.96	-2.20	-2.44	-2.69	-2.93
14	-0.002,282	-0.91	-1.14	-1.37	-1.60	-1.83	-2.05	-2.28	-2.51	-2.74
13	-0.002,119	-0.85	-1.06	-1.27	-1.48	-1.70	-1.91	-2.12	-2.33	-2.54
12	-0.001,957	-0.78	-0.98	-1.17	-1.37	-1.57	-1.76	-1.96	-2.15	-2.35
11	-0.001,794	-0.72	-0.90	-1.08	-1.26	-1.44	-1.61	-1.79	-1.97	-2.15
10	-0.001,631	-0.65	-0.82	-0.98	-1.14	-1.30	-1.47	-1.63	-1.79	-1.96
8	-0.001,305	-0.52	-0.65	-0.78	-0.91	-1.04	-1.17	-1.31	-1.44	-1.57
6	-0.000,979	-0.39	-0.49	-0.59	-0.69	-0.78	-0.88	-0.98	-1.08	-1.18
4	-0.000,653	-0.26	-0.33	-0.39	-0.46	-0.52	-0.59	-0.65	-0.72	-0.78
2	-0.000,327	-0.13	-0.16	-0.20	-0.23	-0.26	-0.29	-0.33	-0.36	-0.39
0	0.000,000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[b] Multiply the certificate corrected barometer reading by the appropriate "*Multiplier for Metric Temperature Correction*", interpolated vertically as required, to obtain the temperature correction in the metric system accurately, without horizontal interpolation in the tables.

[c] Centimeters of mercury (cm Hg) and kiloPascal (kPa) corrections may be obtained by moving the decimal points in the column headings, and body of the table, one place to the left. The *Multiplier* does not change as it applies to all four metric units.

Table 6. Traditional Gravity Correction, English Units[Ref. 2, 3]

To reduce the reading of the barometer to standard gravity

Our latitude is _____, our interpolated *Multiplier for Gravity Correction* is _____

Latitude °N or °S	*Multiplier for Gravity Correction*[d]	Temperature Corrected Barometer Reading, Inches of Mercury (in. Hg)														
		15"	20"	21"	22"	23"	24"	25"	26"	27"	28"	29"	30"	31"	32"	33"
		Pressure Altitude, feet														
		17906'	10731'	9474'	8266'	7100'	5976'	4888'	3835'	2815'	1825'	863'	-73'	-984'	-1871'	-2736'
90	+0.002,593	+.039	+.052	+.054	+.057	+.060	+.062	+.065	+.067	+.070	+.073	+.075	+.078	+.080	+.083	+.086
85	+0.002,553	+.038	+.051	+.054	+.056	+.059	+.061	+.064	+.066	+.069	+.071	+.074	+.077	+.079	+.082	+.084
80	+0.002,433	+.037	+.049	+.051	+.054	+.056	+.058	+.061	+.063	+.066	+.068	+.071	+.073	+.075	+.078	+.080
75	+0.002,238	+.034	+.045	+.047	+.049	+.051	+.054	+.056	+.058	+.060	+.063	+.065	+.067	+.069	+.072	+.074
70	+0.001,974	+.030	+.039	+.041	+.043	+.045	+.047	+.049	+.051	+.053	+.055	+.057	+.059	+.061	+.063	+.065
68	+0.001,850	+.028	+.037	+.039	+.041	+.043	+.044	+.046	+.048	+.050	+.052	+.054	+.056	+.057	+.059	+.061
66	+0.001,717	+.026	+.034	+.036	+.038	+.039	+.041	+.043	+.045	+.046	+.048	+.050	+.052	+.053	+.055	+.057
64	+0.001,576	+.024	+.032	+.033	+.035	+.036	+.038	+.039	+.041	+.043	+.044	+.046	+.047	+.049	+.050	+.052
62	+0.001,427	+.021	+.029	+.030	+.031	+.033	+.034	+.036	+.037	+.039	+.040	+.041	+.043	+.044	+.046	+.047
60	+0.001,270	+.019	+.025	+.027	+.028	+.029	+.030	+.032	+.033	+.034	+.036	+.037	+.038	+.039	+.041	+.042
58	+0.001,107	+.017	+.022	+.023	+.024	+.025	+.027	+.028	+.029	+.030	+.031	+.032	+.033	+.034	+.035	+.037
56	+0.000,939	+.014	+.019	+.020	+.021	+.022	+.023	+.023	+.024	+.025	+.026	+.027	+.028	+.029	+.030	+.031
54	+0.000,766	+.011	+.015	+.016	+.017	+.018	+.018	+.019	+.020	+.021	+.021	+.022	+.023	+.024	+.024	+.025
52	+0.000,588	+.009	+.012	+.012	+.013	+.014	+.014	+.015	+.015	+.016	+.016	+.017	+.018	+.018	+.019	+.019
50	+0.000,408	+.006	+.008	+.009	+.009	+.009	+.010	+.010	+.011	+.011	+.011	+.012	+.012	+.013	+.013	+.013
49	+0.000,317	+.005	+.006	+.007	+.007	+.007	+.008	+.008	+.008	+.009	+.009	+.009	+.010	+.010	+.010	+.010
48	+0.000,226	+.003	+.005	+.005	+.005	+.005	+.005	+.006	+.006	+.006	+.006	+.007	+.007	+.007	+.007	+.007
47	+0.000,134	+.002	+.003	+.003	+.003	+.003	+.003	+.003	+.003	+.004	+.004	+.004	+.004	+.004	+.004	+.004
46	+0.000,042	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001
45	-0.000,050	-.001	-.001	-.001	-.001	-.001	-.001	-.001	-.001	-.001	-.001	-.001	-.001	-.002	-.002	-.002
44	-0.000,142	-.002	-.003	-.003	-.003	-.003	-.003	-.004	-.004	-.004	-.004	-.004	-.004	-.004	-.005	-.005
43	-0.000,234	-.004	-.005	-.005	-.005	-.005	-.006	-.006	-.006	-.006	-.007	-.007	-.007	-.007	-.007	-.008
42	-0.000,326	-.005	-.007	-.007	-.007	-.007	-.008	-.008	-.008	-.009	-.009	-.009	-.010	-.010	-.010	-.011
41	-0.000,417	-.006	-.008	-.009	-.009	-.010	-.010	-.010	-.011	-.011	-.012	-.012	-.013	-.013	-.013	-.014
40	-0.000,508	-.008	-.010	-.011	-.011	-.012	-.012	-.013	-.013	-.014	-.014	-.015	-.015	-.016	-.016	-.017
39	-0.000,598	-.009	-.012	-.013	-.013	-.014	-.014	-.015	-.016	-.016	-.017	-.017	-.018	-.019	-.019	-.020
38	-0.000,688	-.010	-.014	-.014	-.015	-.016	-.017	-.017	-.018	-.019	-.019	-.020	-.021	-.021	-.022	-.023
37	-0.000,776	-.012	-.016	-.016	-.017	-.018	-.019	-.019	-.020	-.021	-.022	-.023	-.023	-.024	-.025	-.026
36	-0.000,864	-.013	-.017	-.018	-.019	-.020	-.021	-.022	-.022	-.023	-.024	-.025	-.026	-.027	-.028	-.029
35	-0.000,951	-.014	-.019	-.020	-.021	-.022	-.023	-.024	-.025	-.026	-.027	-.028	-.029	-.029	-.030	-.031
34	-0.001,037	-.016	-.021	-.022	-.023	-.024	-.025	-.026	-.027	-.028	-.029	-.030	-.031	-.032	-.033	-.034
33	-0.001,122	-.017	-.022	-.024	-.025	-.026	-.027	-.028	-.029	-.030	-.031	-.033	-.034	-.035	-.036	-.037
32	-0.001,205	-.018	-.024	-.025	-.027	-.028	-.029	-.030	-.031	-.033	-.034	-.035	-.036	-.037	-.039	-.040
31	-0.001,287	-.019	-.026	-.027	-.028	-.030	-.031	-.032	-.033	-.035	-.036	-.037	-.039	-.040	-.041	-.042
30	-0.001,367	-.021	-.027	-.029	-.030	-.031	-.033	-.034	-.036	-.037	-.038	-.040	-.041	-.042	-.044	-.045
28	-0.001,523	-.023	-.030	-.032	-.034	-.035	-.037	-.038	-.040	-.041	-.043	-.044	-.046	-.047	-.049	-.050
26	-0.001,671	-.025	-.033	-.035	-.037	-.038	-.040	-.042	-.043	-.045	-.047	-.048	-.050	-.052	-.053	-.055
24	-0.001,812	-.027	-.036	-.038	-.040	-.042	-.043	-.045	-.047	-.049	-.051	-.053	-.054	-.056	-.058	-.060
22	-0.001,944	-.029	-.039	-.041	-.043	-.045	-.047	-.049	-.051	-.052	-.054	-.056	-.058	-.060	-.062	-.064
20	-0.002,067	-.031	-.041	-.043	-.045	-.048	-.050	-.052	-.054	-.056	-.058	-.060	-.062	-.064	-.066	-.068
15	-0.002,329	-.035	-.047	-.049	-.051	-.054	-.056	-.058	-.061	-.063	-.065	-.068	-.070	-.072	-.075	-.077
10	-0.002,523	-.038	-.050	-.053	-.056	-.058	-.061	-.063	-.066	-.068	-.071	-.073	-.076	-.078	-.081	-.083
5	-0.002,641	-.040	-.053	-.055	-.058	-.061	-.063	-.066	-.069	-.071	-.074	-.077	-.079	-.082	-.085	-.087
0	-0.002,681	-.040	-.054	-.056	-.059	-.062	-.064	-.067	-.070	-.072	-.075	-.078	-.080	-.083	-.086	-.088

[d] Multiply the temperature corrected barometer reading by the "*Multiplier for Gravity Correction*", interpolated vertically as required, to obtain the gravity correction accurately, without horizontal interpolation in the tables.

Table 7. Traditional Gravity Correction, Metric Units[Ref. 1,2, 3]

To reduce the reading of the barometer to standard gravity

Our latitude is _____, our interpolated *Multiplier for Gravity Correction* is _____

Latitude °N or °S	*Multiplier for Gravity Correction*[d]	Temperature Corrected Reading, Millimeters Mercury (mm Hg) or Millibars (mb)[c]								
		400	500	600	700	800	900	1000	1100	1200
		Pressure Altitude for mm / mb, meters								
		5096 m	3395 m	1950 m 4206 m	688 m 3012 m	-435 m 1949 m	-1449 m 988 m	111 m	-698 m	-1450 m
90	+0.002,593	+1.04	+1.30	+1.56	+1.82	+2.07	+2.33	+2.59	+2.85	+3.11
85	+0.002,553	+1.02	+1.28	+1.53	+1.79	+2.04	+2.30	+2.55	+2.81	+3.06
80	+0.002,433	+0.97	+1.22	+1.46	+1.70	+1.95	+2.19	+2.43	+2.68	+2.92
75	+0.002,238	+0.90	+1.12	+1.34	+1.57	+1.79	+2.01	+2.24	+2.46	+2.69
70	+0.001,974	+0.79	+0.99	+1.18	+1.38	+1.58	+1.78	+1.97	+2.17	+2.37
65	+0.001,648	+0.66	+0.82	+0.99	+1.15	+1.32	+1.48	+1.65	+1.81	+1.98
60	+0.001,270	+0.51	+0.64	+0.76	+0.89	+1.02	+1.14	+1.27	+1.40	+1.52
58	+0.001,107	+0.44	+0.55	+0.66	+0.78	+0.89	+1.00	+1.11	+1.22	+1.33
56	+0.000,939	+0.38	+0.47	+0.56	+0.66	+0.75	+0.84	+0.94	+1.03	+1.13
54	+0.000,766	+0.31	+0.38	+0.46	+0.54	+0.61	+0.69	+0.77	+0.84	+0.92
52	+0.000,588	+0.24	+0.29	+0.35	+0.41	+0.47	+0.53	+0.59	+0.65	+0.71
50	+0.000,408	+0.16	+0.20	+0.24	+0.29	+0.33	+0.37	+0.41	+0.45	+0.49
49	+0.000,317	+0.13	+0.16	+0.19	+0.22	+0.25	+0.29	+0.32	+0.35	+0.38
48	+0.000,226	+0.09	+0.11	+0.14	+0.16	+0.18	+0.20	+0.23	+0.25	+0.27
47	+0.000,134	+0.05	+0.07	+0.08	+0.09	+0.11	+0.12	+0.13	+0.15	+0.16
46	+0.000,042	+0.02	+0.02	+0.03	+0.03	+0.03	+0.04	+0.04	+0.05	+0.05
45	-0.000,050	-0.02	-0.02	-0.03	-0.03	-0.04	-0.04	-0.05	-0.05	-0.06
44	-0.000,142	-0.06	-0.07	-0.09	-0.10	-0.11	-0.13	-0.14	-0.16	-0.17
43	-0.000,234	-0.09	-0.12	-0.14	-0.16	-0.19	-0.21	-0.23	-0.26	-0.28
42	-0.000,326	-0.13	-0.16	-0.20	-0.23	-0.26	-0.29	-0.33	-0.36	-0.39
41	-0.000,417	-0.17	-0.21	-0.25	-0.29	-0.33	-0.38	-0.42	-0.46	-0.50
40	-0.000,508	-0.20	-0.25	-0.30	-0.36	-0.41	-0.46	-0.51	-0.56	-0.61
39	-0.000,598	-0.24	-0.30	-0.36	-0.42	-0.48	-0.54	-0.60	-0.66	-0.72
38	-0.000,688	-0.28	-0.34	-0.41	-0.48	-0.55	-0.62	-0.69	-0.76	-0.83
37	-0.000,776	-0.31	-0.39	-0.47	-0.54	-0.62	-0.70	-0.78	-0.85	-0.93
36	-0.000,864	-0.35	-0.43	-0.52	-0.61	-0.69	-0.78	-0.86	-0.95	-1.04
35	-0.000,951	-0.38	-0.48	-0.57	-0.67	-0.76	-0.86	-0.95	-1.05	-1.14
34	-0.001,037	-0.41	-0.52	-0.62	-0.73	-0.83	-0.93	-1.04	-1.14	-1.24
33	-0.001,122	-0.45	-0.56	-0.67	-0.79	-0.90	-1.01	-1.12	-1.23	-1.35
32	-0.001,205	-0.48	-0.60	-0.72	-0.84	-0.96	-1.08	-1.20	-1.33	-1.45
31	-0.001,287	-0.51	-0.64	-0.77	-0.90	-1.03	-1.16	-1.29	-1.42	-1.54
30	-0.001,367	-0.55	-0.68	-0.82	-0.96	-1.09	-1.23	-1.37	-1.50	-1.64
28	-0.001,523	-0.61	-0.76	-0.91	-1.07	-1.22	-1.37	-1.52	-1.68	-1.83
26	-0.001,671	-0.67	-0.84	-1.00	-1.17	-1.34	-1.50	-1.67	-1.84	-2.01
24	-0.001,812	-0.72	-0.91	-1.09	-1.27	-1.45	-1.63	-1.81	-1.99	-2.17
22	-0.001,944	-0.78	-0.97	-1.17	-1.36	-1.56	-1.75	-1.94	-2.14	-2.33
20	-0.002,067	-0.83	-1.03	-1.24	-1.45	-1.65	-1.86	-2.07	-2.27	-2.48
15	-0.002,329	-0.93	-1.16	-1.40	-1.63	-1.86	-2.10	-2.33	-2.56	-2.80
10	-0.002,523	-1.01	-1.26	-1.51	-1.77	-2.02	-2.27	-2.52	-2.78	-3.03
5	-0.002,641	-1.06	-1.32	-1.58	-1.85	-2.11	-2.38	-2.64	-2.91	-3.17
0	-0.002,681	-1.07	-1.34	-1.61	-1.88	-2.14	-2.41	-2.68	-2.95	-3.22

[d] Multiply the temperature corrected barometer reading by the "*Multiplier for Gravity Correction*", interpolated vertically as required to obtain the gravity correction accurately, without horizontal interpolation in the tables.

[c] Centimeters of mercury (cm Hg) and kiloPascal (kPa) corrections may be obtained by moving the decimal points in the column headings, and body of the table, one place to the left. The *Multiplier* does not change as it applies to all four metric units.

Table 8. Pressure Altitude, ft. vs. Local Station Pressure, in.

Based on the ICAO standard atmosphere[Ref. 3]

	15.0"	15.1"	15.2"	15.3"	15.4"	15.5"	15.6"	15.7"	15.8"	15.9"
+0.00"	17.906	17.745	17.584	17.425	17.266	17.108	16.951	16.794	16.639	16.484
+0.01"	17.890	17.729	17.568	17.409	17.250	17.092	16.935	16.779	16.623	16.469
+0.02"	17.874	17.712	17.552	17.393	17.234	17.076	16.919	16.763	16.608	16.453
+0.03"	17.857	17.696	17.536	17.377	17.218	17.061	16.904	16.748	16.592	16.438
+0.04"	17.841	17.680	17.520	17.361	17.202	17.045	16.888	16.732	16.577	16.422
+0.05"	17.825	17.664	17.504	17.345	17.187	17.029	16.872	16.717	16.561	16.407
+0.06"	17.809	17.648	17.488	17.329	17.171	17.013	16.857	16.701	16.546	16.392
+0.07"	17.793	17.632	17.472	17.313	17.155	16.998	16.841	16.685	16.530	16.376
+0.08"	17.777	17.616	17.456	17.297	17.139	16.982	16.826	16.670	16.515	16.361
+0.09"	17.761	17.600	17.440	17.282	17.124	16.966	16.810	16.654	16.500	16.346
+0.10"	17.745	17.584	17.425	17.266	17.108	16.951	16.794	16.639	16.484	16.330

	16.0"	16.1"	16.2"	16.3"	16.4"	16.5"	16.6"	16.7"	16.8"	16.9"
+0.00"	16.330	16.177	16.025	15.873	15.722	15.572	15.423	15.274	15.126	14.979
+0.01"	16.315	16.162	16.010	15.858	15.707	15.557	15.408	15.259	15.111	14.964
+0.02"	16.300	16.147	15.994	15.843	15.692	15.542	15.393	15.244	15.097	14.950
+0.03"	16.284	16.131	15.979	15.828	15.677	15.527	15.378	15.230	15.082	14.935
+0.04"	16.269	16.116	15.964	15.813	15.662	15.512	15.363	15.215	15.067	14.920
+0.05"	16.254	16.101	15.949	15.798	15.647	15.497	15.348	15.200	15.052	14.906
+0.06"	16.238	16.086	15.934	15.782	15.632	15.482	15.333	15.185	15.038	14.891
+0.07"	16.223	16.070	15.918	15.767	15.617	15.467	15.319	15.170	15.023	14.876
+0.08"	16.208	16.055	15.903	15.752	15.602	15.453	15.304	15.156	15.008	14.862
+0.09"	16.192	16.040	15.888	15.737	15.587	15.438	15.289	15.141	14.994	14.847
+0.10"	16.177	16.025	15.873	15.722	15.572	15.423	15.274	15.126	14.979	14.832

	17.0"	17.1"	17.2"	17.3"	17.4"	17.5"	17.6"	17.7"	17.8"	17.9"
+0.00"	14.832	14.687	14.541	14.397	14.253	14.110	13.968	13.826	13.685	13.544
+0.01"	14.818	14.672	14.527	14.383	14.239	14.096	13.953	13.812	13.671	13.530
+0.02"	14.803	14.657	14.512	14.368	14.224	14.081	13.939	13.797	13.656	13.516
+0.03"	14.789	14.643	14.498	14.354	14.210	14.067	13.925	13.783	13.642	13.502
+0.04"	14.774	14.628	14.484	14.339	14.196	14.053	13.911	13.769	13.628	13.488
+0.05"	14.759	14.614	14.469	14.325	14.181	14.039	13.897	13.755	13.614	13.474
+0.06"	14.745	14.599	14.455	14.311	14.167	14.024	13.882	13.741	13.600	13.460
+0.07"	14.730	14.585	14.440	14.296	14.153	14.010	13.868	13.727	13.586	13.446
+0.08"	14.716	14.570	14.426	14.282	14.139	13.996	13.854	13.713	13.572	13.432
+0.09"	14.701	14.556	14.411	14.267	14.124	13.982	13.840	13.699	13.558	13.418
+0.10"	14.687	14.541	14.397	14.253	14.110	13.968	13.826	13.685	13.544	13.404

	18.0"	18.1"	18.2"	18.3"	18.4"	18.5"	18.6"	18.7"	18.8"	18.9"
+0.00"	13.404	13.265	13.126	12.988	12.851	12.714	12.578	12.442	12.307	12.173
+0.01"	13.390	13.251	13.112	12.975	12.837	12.700	12.564	12.429	12.294	12.159
+0.02"	13.376	13.237	13.099	12.961	12.823	12.687	12.551	12.415	12.280	12.146
+0.03"	13.362	13.223	13.085	12.947	12.810	12.673	12.537	12.402	12.267	12.133
+0.04"	13.348	13.209	13.071	12.933	12.796	12.660	12.524	12.388	12.253	12.119
+0.05"	13.334	13.196	13.057	12.920	12.782	12.646	12.510	12.375	12.240	12.106
+0.06"	13.321	13.182	13.043	12.906	12.769	12.632	12.496	12.361	12.227	12.092
+0.07"	13.307	13.168	13.030	12.892	12.755	12.619	12.483	12.348	12.213	12.079
+0.08"	13.293	13.154	13.016	12.878	12.741	12.605	12.469	12.334	12.200	12.066
+0.09"	13.279	13.140	13.002	12.865	12.728	12.591	12.456	12.321	12.186	12.052
+0.10"	13.265	13.126	12.988	12.851	12.714	12.578	12.442	12.307	12.173	12.039

	19.0"	19.1"	19.2"	19.3"	19.4"	19.5"	19.6"	19.7"	19.8"	19.9"
+0.00"	12.039	11.906	11.773	11.641	11.509	11.378	11.247	11.117	10.988	10.859
+0.01"	12.026	11.892	11.760	11.628	11.496	11.365	11.234	11.104	10.975	10.846
+0.02"	12.012	11.879	11.746	11.614	11.483	11.352	11.221	11.092	10.962	10.833
+0.03"	11.999	11.866	11.733	11.601	11.470	11.339	11.208	11.079	10.949	10.820
+0.04"	11.986	11.852	11.720	11.588	11.457	11.326	11.195	11.066	10.936	10.808
+0.05"	11.972	11.839	11.707	11.575	11.443	11.313	11.182	11.053	10.923	10.795
+0.06"	11.959	11.826	11.694	11.562	11.430	11.300	11.169	11.040	10.911	10.782
+0.07"	11.946	11.813	11.680	11.549	11.417	11.287	11.156	11.027	10.898	10.769
+0.08"	11.932	11.799	11.667	11.535	11.404	11.274	11.143	11.014	10.885	10.756
+0.09"	11.919	11.786	11.654	11.522	11.391	11.260	11.130	11.001	10.872	10.743
+0.10"	11.906	11.773	11.641	11.509	11.378	11.247	11.117	10.988	10.859	10.731

Table 8. Pressure Altitude, ft. vs. Local Station Pressure, in.–Continued

Based on the ICAO standard atmosphere[Ref. 3]

	20.0"	20.1"	20.2"	20.3"	20.4"	20.5"	20.6"	20.7"	20.8"	20.9"
+0.00"	10,731	10,603	10,475	10,349	10,222	10,096	9,971	9,846	9,722	9,598
+0.01"	10,718	10,590	10,463	10,336	10,210	10,084	9,958	9,834	9,709	9,585
+0.02"	10,705	10,577	10,450	10,323	10,197	10,071	9,946	9,821	9,697	9,573
+0.03"	10,692	10,564	10,437	10,311	10,184	10,059	9,933	9,809	9,684	9,561
+0.04"	10,679	10,552	10,425	10,298	10,172	10,046	9,921	9,796	9,672	9,548
+0.05"	10,667	10,539	10,412	10,285	10,159	10,034	9,908	9,784	9,660	9,536
+0.06"	10,654	10,526	10,399	10,273	10,147	10,021	9,896	9,771	9,647	9,524
+0.07"	10,641	10,514	10,387	10,260	10,134	10,008	9,883	9,759	9,635	9,511
+0.08"	10,628	10,501	10,374	10,247	10,121	9,996	9,871	9,746	9,622	9,499
+0.09"	10,616	10,488	10,361	10,235	10,109	9,983	9,858	9,734	9,610	9,487
+0.10"	10,603	10,475	10,349	10,222	10,096	9,971	9,846	9,722	9,598	9,474

	21.0"	21.1"	21.2"	21.3"	21.4"	21.5"	21.6"	21.7"	21.8"	21.9"
+0.00"	9,474	9,351	9,229	9,107	8,985	8,864	8,744	8,623	8,504	8,384
+0.01"	9,462	9,339	9,217	9,095	8,973	8,852	8,732	8,611	8,492	8,372
+0.02"	9,450	9,327	9,204	9,083	8,961	8,840	8,720	8,599	8,480	8,361
+0.03"	9,437	9,315	9,192	9,070	8,949	8,828	8,707	8,587	8,468	8,349
+0.04"	9,425	9,302	9,180	9,058	8,937	8,816	8,695	8,575	8,456	8,337
+0.05"	9,413	9,290	9,168	9,046	8,925	8,804	8,683	8,563	8,444	8,325
+0.06"	9,400	9,278	9,156	9,034	8,913	8,792	8,671	8,552	8,432	8,313
+0.07"	9,388	9,266	9,143	9,022	8,900	8,780	8,659	8,540	8,420	8,301
+0.08"	9,376	9,253	9,131	9,010	8,888	8,768	8,647	8,528	8,408	8,289
+0.09"	9,364	9,241	9,119	8,997	8,876	8,756	8,635	8,516	8,396	8,277
+0.10"	9,351	9,229	9,107	8,985	8,864	8,744	8,623	8,504	8,384	8,266

	22.0"	22.1"	22.2"	22.3"	22.4"	22.5"	22.6"	22.7"	22.8"	22.9"
+0.00"	8,266	8,147	8,029	7,912	7,794	7,678	7,561	7,446	7,330	7,215
+0.01"	8,254	8,135	8,017	7,900	7,783	7,666	7,550	7,434	7,319	7,204
+0.02"	8,242	8,123	8,006	7,888	7,771	7,654	7,538	7,422	7,307	7,192
+0.03"	8,230	8,112	7,994	7,876	7,759	7,643	7,527	7,411	7,296	7,181
+0.04"	8,218	8,100	7,982	7,865	7,748	7,631	7,515	7,399	7,284	7,169
+0.05"	8,206	8,088	7,970	7,853	7,736	7,620	7,503	7,388	7,273	7,158
+0.06"	8,194	8,076	7,959	7,841	7,724	7,608	7,492	7,376	7,261	7,146
+0.07"	8,183	8,064	7,947	7,830	7,713	7,596	7,480	7,365	7,250	7,135
+0.08"	8,171	8,053	7,935	7,818	7,701	7,585	7,469	7,353	7,238	7,123
+0.09"	8,159	8,041	7,923	7,806	7,689	7,573	7,457	7,342	7,227	7,112
+0.10"	8,147	8,029	7,912	7,794	7,678	7,561	7,446	7,330	7,215	7,100

	23.0"	23.1"	23.2"	23.3"	23.4"	23.5"	23.6"	23.7"	23.8"	23.9"
+0.00"	7,100	6,986	6,872	6,759	6,646	6,533	6,421	6,309	6,198	6,086
+0.01"	7,089	6,975	6,861	6,748	6,635	6,522	6,410	6,298	6,186	6,075
+0.02"	7,078	6,963	6,850	6,736	6,623	6,511	6,399	6,287	6,175	6,064
+0.03"	7,066	6,952	6,838	6,725	6,612	6,499	6,387	6,276	6,164	6,053
+0.04"	7,055	6,941	6,827	6,714	6,601	6,488	6,376	6,264	6,153	6,042
+0.05"	7,043	6,929	6,816	6,702	6,589	6,477	6,365	6,253	6,142	6,031
+0.06"	7,032	6,918	6,804	6,691	6,578	6,466	6,354	6,242	6,131	6,020
+0.07"	7,020	6,906	6,793	6,680	6,567	6,455	6,343	6,231	6,120	6,009
+0.08"	7,009	6,895	6,782	6,668	6,556	6,443	6,331	6,220	6,109	5,998
+0.09"	6,998	6,884	6,770	6,657	6,544	6,432	6,320	6,209	6,098	5,987
+0.10"	6,986	6,872	6,759	6,646	6,533	6,421	6,309	6,198	6,086	5,976

	24.0"	24.1"	24.2"	24.3"	24.4"	24.5"	24.6"	24.7"	24.8"	24.9"
+0.00"	5,976	5,865	5,755	5,646	5,536	5,427	5,319	5,211	5,103	4,995
+0.01"	5,965	5,854	5,744	5,635	5,525	5,417	5,308	5,200	5,092	4,985
+0.02"	5,954	5,843	5,733	5,624	5,515	5,406	5,297	5,189	5,081	4,974
+0.03"	5,943	5,832	5,722	5,613	5,504	5,395	5,286	5,178	5,071	4,963
+0.04"	5,931	5,821	5,711	5,602	5,493	5,384	5,276	5,168	5,060	4,952
+0.05"	5,920	5,810	5,700	5,591	5,482	5,373	5,265	5,157	5,049	4,942
+0.06"	5,909	5,799	5,689	5,580	5,471	5,362	5,254	5,146	5,038	4,931
+0.07"	5,898	5,788	5,678	5,569	5,460	5,351	5,243	5,135	5,028	4,920
+0.08"	5,887	5,777	5,668	5,558	5,449	5,341	5,232	5,124	5,017	4,910
+0.09"	5,876	5,766	5,657	5,547	5,438	5,330	5,221	5,114	5,006	4,899
+0.10"	5,865	5,755	5,646	5,536	5,427	5,319	5,211	5,103	4,995	4,888

Table 8. Pressure Altitude, ft. vs. Local Station Pressure, in.–Continued

Based on the ICAO standard atmosphere[Ref. 3]

	25.0"	25.1"	25.2"	25.3"	25.4"	25.5"	25.6"	25.7"	25.8"	25.9"
+0.00"	4,888	4,781	4,675	4,569	4,463	4,358	4,253	4,148	4,043	3,939
+0.01"	4,878	4,771	4,664	4,558	4,453	4,347	4,242	4,137	4,033	3,929
+0.02"	4,867	4,760	4,654	4,548	4,442	4,337	4,232	4,127	4,023	3,918
+0.03"	4,856	4,749	4,643	4,537	4,431	4,326	4,221	4,116	4,012	3,908
+0.04"	4,845	4,739	4,632	4,527	4,421	4,316	4,211	4,106	4,002	3,898
+0.05"	4,835	4,728	4,622	4,516	4,410	4,305	4,200	4,096	3,991	3,887
+0.06"	4,824	4,718	4,611	4,505	4,400	4,295	4,190	4,085	3,981	3,877
+0.07"	4,813	4,707	4,601	4,495	4,389	4,284	4,179	4,075	3,970	3,867
+0.08"	4,803	4,696	4,590	4,484	4,379	4,274	4,169	4,064	3,960	3,856
+0.09"	4,792	4,686	4,579	4,474	4,368	4,263	4,158	4,054	3,950	3,846
+0.10"	4,781	4,675	4,569	4,463	4,358	4,253	4,148	4,043	3,939	3,835

	26.0"	26.1"	26.2"	26.3"	26.4"	26.5"	26.6"	26.7"	26.8"	26.9"
+0.00"	3,835	3,732	3,629	3,526	3,424	3,321	3,219	3,118	3,017	2,916
+0.01"	3,825	3,722	3,619	3,516	3,413	3,311	3,209	3,108	3,006	2,906
+0.02"	3,815	3,711	3,608	3,505	3,403	3,301	3,199	3,098	2,996	2,895
+0.03"	3,804	3,701	3,598	3,495	3,393	3,291	3,189	3,087	2,986	2,885
+0.04"	3,794	3,691	3,588	3,485	3,383	3,281	3,179	3,077	2,976	2,875
+0.05"	3,784	3,680	3,577	3,475	3,372	3,270	3,169	3,067	2,966	2,865
+0.06"	3,773	3,670	3,567	3,464	3,362	3,260	3,158	3,057	2,956	2,855
+0.07"	3,763	3,660	3,557	3,454	3,352	3,250	3,148	3,047	2,946	2,845
+0.08"	3,753	3,649	3,547	3,444	3,342	3,240	3,138	3,037	2,936	2,835
+0.09"	3,742	3,639	3,536	3,434	3,332	3,230	3,128	3,027	2,926	2,825
+0.10"	3,732	3,629	3,526	3,424	3,321	3,219	3,118	3,017	2,916	2,815

	27.0"	27.1"	27.2"	27.3"	27.4"	27.5"	27.6"	27.7"	27.8"	27.9"
+0.00"	2,815	2,715	2,615	2,515	2,415	2,316	2,217	2,119	2,020	1,922
+0.01"	2,805	2,705	2,605	2,505	2,405	2,306	2,207	2,109	2,011	1,913
+0.02"	2,795	2,695	2,595	2,495	2,395	2,296	2,198	2,099	2,001	1,903
+0.03"	2,785	2,685	2,585	2,485	2,386	2,286	2,188	2,089	1,991	1,893
+0.04"	2,775	2,675	2,575	2,475	2,376	2,277	2,178	2,079	1,981	1,883
+0.05"	2,765	2,665	2,565	2,465	2,366	2,267	2,168	2,070	1,971	1,873
+0.06"	2,755	2,655	2,555	2,455	2,356	2,257	2,158	2,060	1,962	1,864
+0.07"	2,745	2,645	2,545	2,445	2,346	2,247	2,148	2,050	1,952	1,854
+0.08"	2,735	2,635	2,535	2,435	2,336	2,237	2,138	2,040	1,942	1,844
+0.09"	2,725	2,625	2,525	2,425	2,326	2,227	2,129	2,030	1,932	1,834
+0.10"	2,715	2,615	2,515	2,415	2,316	2,217	2,119	2,020	1,922	1,825

	28.0"	28.1"	28.2"	28.3"	28.4"	28.5"	28.6"	28.7"	28.8"	28.9"
+0.00"	1,825	1,727	1,630	1,533	1,437	1,340	1,244	1,148	1,053	958
+0.01"	1,815	1,717	1,620	1,523	1,427	1,331	1,235	1,139	1,043	948
+0.02"	1,805	1,708	1,611	1,514	1,417	1,321	1,225	1,129	1,034	939
+0.03"	1,795	1,698	1,601	1,504	1,408	1,311	1,215	1,120	1,024	929
+0.04"	1,786	1,688	1,591	1,494	1,398	1,302	1,206	1,110	1,015	920
+0.05"	1,776	1,679	1,582	1,485	1,388	1,292	1,196	1,101	1,005	910
+0.06"	1,766	1,669	1,572	1,475	1,379	1,283	1,187	1,091	996	901
+0.07"	1,756	1,659	1,562	1,466	1,369	1,273	1,177	1,081	986	891
+0.08"	1,747	1,649	1,553	1,456	1,359	1,263	1,167	1,072	977	882
+0.09"	1,737	1,640	1,543	1,446	1,350	1,254	1,158	1,062	967	872
+0.10"	1,727	1,630	1,533	1,437	1,340	1,244	1,148	1,053	958	863

	29.0"	29.1"	29.2"	29.3"	29.4"	29.5"	29.6"	29.7"	29.8"	29.9"
+0.00"	863	768	673	579	485	392	298	205	112	19
+0.01"	853	758	664	570	476	382	289	196	103	10
+0.02"	844	749	655	560	467	373	280	186	94	1
+0.03"	834	740	645	551	457	364	270	177	84	
+0.04"	825	730	636	542	448	354	261	168	75	
+0.05"	815	721	626	532	438	345	252	159	66	
+0.06"	806	711	617	523	429	336	242	149	56	
+0.07"	796	702	607	513	420	326	233	140	47	
+0.08"	787	692	598	504	410	317	224	131	38	
+0.09"	777	683	589	495	401	308	214	121	29	
+0.10"	768	673	579	485	392	298	205	112	19	

Table 8. Pressure Altitude, ft. vs. Local Station Pressure, in.–Concluded

Based on the ICAO standard atmosphere[Ref. 3]

+0.10"										-73
+0.09"										-64
+0.08"										-55
+0.07"										-45
+0.06"										-36
+0.05"										-27
+0.04"										-18
+0.03"										-8
+0.02"										+1
+0.01"										
+0.00"										
										29.9"
+0.10"	-165	-257	-349	-440	-531	-622	-713	-803	-894	-984
+0.09"	-156	-248	-340	-431	-522	-613	-704	-794	-885	-975
+0.08"	-147	-239	-330	-422	-513	-604	-695	-785	-876	-966
+0.07"	-138	-230	-321	-413	-504	-595	-686	-776	-867	-957
+0.06"	-128	-220	-312	-404	-495	-586	-677	-767	-858	-948
+0.05"	-119	-211	-303	-394	-486	-577	-668	-758	-849	-939
+0.04"	-110	-202	-294	-385	-477	-568	-659	-749	-840	-930
+0.03"	-101	-193	-285	-376	-468	-559	-650	-740	-831	-921
+0.02"	-91	-184	-275	-367	-458	-550	-640	-731	-821	-912
+0.01"	-82	-174	-266	-358	-449	-540	-631	-722	-812	-903
+0.00"	-73	-165	-257	-349	-440	-531	-622	-713	-803	-894
	30.0"	30.1"	30.2"	30.3"	30.4"	30.5"	30.6"	30.7"	30.8"	30.9"
+0.10"	-1.073	-1.163	-1.252	-1.341	-1.430	-1.519	-1.607	-1.695	-1.783	-1.871
+0.09"	-1.064	-1.154	-1.243	-1.332	-1.421	-1.510	-1.598	-1.686	-1.774	-1.862
+0.08"	-1.055	-1.145	-1.234	-1.323	-1.412	-1.501	-1.589	-1.678	-1.766	-1.853
+0.07"	-1.046	-1.136	-1.225	-1.315	-1.403	-1.492	-1.581	-1.669	-1.757	-1.845
+0.06"	-1.038	-1.127	-1.217	-1.306	-1.395	-1.483	-1.572	-1.660	-1.748	-1.836
+0.05"	-1.029	-1.118	-1.208	-1.297	-1.386	-1.474	-1.563	-1.651	-1.739	-1.827
+0.04"	-1.020	-1.109	-1.199	-1.288	-1.377	-1.466	-1.554	-1.642	-1.730	-1.818
+0.03"	-1.011	-1.100	-1.190	-1.279	-1.368	-1.457	-1.545	-1.634	-1.722	-1.809
+0.02"	-1.002	-1.091	-1.181	-1.270	-1.359	-1.448	-1.536	-1.625	-1.713	-1.801
+0.01"	-993	-1.082	-1.172	-1.261	-1.350	-1.439	-1.528	-1.616	-1.704	-1.792
+0.00"	-984	-1.073	-1.163	-1.252	-1.341	-1.430	-1.519	-1.607	-1.695	-1.783
	31.0"	31.1"	31.2"	31.3"	31.4"	31.5"	31.6"	31.7"	31.8"	31.9"
+0.10"	-1.958	-2.046	-2.133	-2.219	-2.306	-2.392	-2.479	-2.565	-2.650	-2.736
+0.09"	-1.950	-2.037	-2.124	-2.211	-2.297	-2.384	-2.470	-2.556	-2.642	-2.727
+0.08"	-1.941	-2.028	-2.115	-2.202	-2.289	-2.375	-2.461	-2.547	-2.633	-2.719
+0.07"	-1.932	-2.019	-2.106	-2.193	-2.280	-2.366	-2.453	-2.539	-2.625	-2.710
+0.06"	-1.923	-2.011	-2.098	-2.185	-2.271	-2.358	-2.444	-2.530	-2.616	-2.702
+0.05"	-1.915	-2.002	-2.089	-2.176	-2.263	-2.349	-2.436	-2.522	-2.607	-2.693
+0.04"	-1.906	-1.993	-2.080	-2.167	-2.254	-2.341	-2.427	-2.513	-2.599	-2.685
+0.03"	-1.897	-1.984	-2.072	-2.159	-2.245	-2.332	-2.418	-2.504	-2.590	-2.676
+0.02"	-1.888	-1.976	-2.063	-2.150	-2.237	-2.323	-2.410	-2.496	-2.582	-2.667
+0.01"	-1.880	-1.967	-2.054	-2.141	-2.228	-2.315	-2.401	-2.487	-2.573	-2.659
+0.00"	-1.871	-1.958	-2.046	-2.133	-2.219	-2.306	-2.392	-2.479	-2.565	-2.650
	32.0"	32.1"	32.2"	32.3"	32.4"	32.5"	32.6"	32.7"	32.8"	32.9"

Table 9. Sea Level Pressure, in. vs. Pressure Altitude Differential, ft.

Based on the ICAO standard atmosphere[Ref. 3]

-100'				32.958	32.841	32.725	32.609	32.493	32.378	32.263
-90'				32.946	32.830	32.713	32.597	32.482	32.366	32.251
-80'				32.935	32.818	32.702	32.586	32.470	32.355	32.240
-70'				32.923	32.806	32.690	32.574	32.458	32.343	32.228
-60'				32.911	32.795	32.678	32.562	32.447	32.332	32.217
-50'				32.900	32.783	32.667	32.551	32.435	32.320	32.205
-40'				32.888	32.771	32.655	32.539	32.424	32.309	32.194
-30'			32.993	32.876	32.760	32.644	32.528	32.412	32.297	32.182
-20'			32.982	32.865	32.748	32.632	32.516	32.401	32.286	32.171
-10'			32.970	32.853	32.737	32.620	32.505	32.389	32.274	32.159
0'			32.958	32.841	32.725	32.609	32.493	32.378	32.263	32.148
			-2,700'	-2,600'	-2,500'	-2,400'	-2,300'	-2,200'	-2,100'	-2,000'
-100'	32.148	32.033	31.919	31.805	31.692	31.579	31.466	31.354	31.242	31.130
-90'	32.136	32.022	31.908	31.794	31.681	31.568	31.455	31.342	31.230	31.119
-80'	32.125	32.010	31.896	31.783	31.669	31.556	31.444	31.331	31.219	31.107
-70'	32.113	31.999	31.885	31.771	31.658	31.545	31.432	31.320	31.208	31.096
-60'	32.102	31.988	31.874	31.760	31.647	31.534	31.421	31.309	31.197	31.085
-50'	32.091	31.976	31.862	31.749	31.635	31.522	31.410	31.298	31.186	31.074
-40'	32.079	31.965	31.851	31.737	31.624	31.511	31.399	31.286	31.174	31.063
-30'	32.068	31.953	31.840	31.726	31.613	31.500	31.387	31.275	31.163	31.052
-20'	32.056	31.942	31.828	31.715	31.601	31.489	31.376	31.264	31.152	31.040
-10'	32.045	31.931	31.817	31.703	31.590	31.477	31.365	31.253	31.141	31.029
0'	32.033	31.919	31.805	31.692	31.579	31.466	31.354	31.242	31.130	31.018
	-1,900'	-1,800'	-1,700'	-1,600'	-1,500'	-1,400'	-1,300'	-1,200'	-1,100'	-1,000'
-100'	31.018	30.907	30.796	30.686	30.575	30.466	30.356	30.247	30.138	30.029
-90'	31.007	30.896	30.785	30.675	30.564	30.455	30.345	30.236	30.127	30.018
-80'	30.996	30.885	30.774	30.664	30.553	30.444	30.334	30.225	30.116	30.008
-70'	30.985	30.874	30.763	30.653	30.542	30.433	30.323	30.214	30.105	29.997
-60'	30.974	30.863	30.752	30.642	30.531	30.422	30.312	30.203	30.094	29.986
-50'	30.963	30.852	30.741	30.631	30.521	30.411	30.301	30.192	30.084	29.975
-40'	30.951	30.841	30.730	30.620	30.510	30.400	30.290	30.181	30.073	29.964
-30'	30.940	30.829	30.719	30.609	30.499	30.389	30.280	30.171	30.062	29.953
-20'	30.929	30.818	30.708	30.597	30.488	30.378	30.269	30.160	30.051	29.943
-10'	30.918	30.807	30.697	30.586	30.477	30.367	30.258	30.149	30.040	29.932
0'	30.907	30.796	30.686	30.575	30.466	30.356	30.247	30.138	30.029	29.921
	-900'	-800'	-700'	-600'	-500'	-400'	-300'	-200'	-100'	0'

	0'	+100'	+200'	+300'	+400'	+500'	+600'	+700'	+800'	+900'
+0'	29.921	29.813	29.705	29.598	29.491	29.384	29.278	29.172	29.066	28.961
+10'	29.910	29.802	29.695	29.587	29.480	29.374	29.267	29.161	29.055	28.950
+20'	29.899	29.791	29.684	29.577	29.470	29.363	29.257	29.151	29.045	28.940
+30'	29.889	29.781	29.673	29.566	29.459	29.352	29.246	29.140	29.034	28.929
+40'	29.878	29.770	29.662	29.555	29.448	29.342	29.235	29.129	29.024	28.918
+50'	29.867	29.759	29.652	29.544	29.438	29.331	29.225	29.119	29.013	28.908
+60'	29.856	29.748	29.641	29.534	29.427	29.320	29.214	29.108	29.003	28.897
+70'	29.845	29.738	29.630	29.523	29.416	29.310	29.204	29.098	28.992	28.887
+80'	29.835	29.727	29.619	29.512	29.406	29.299	29.193	29.087	28.982	28.876
+90'	29.824	29.716	29.609	29.502	29.395	29.289	29.182	29.077	28.971	28.866
+100'	29.813	29.705	29.598	29.491	29.384	29.278	29.172	29.066	28.961	28.855

Table 9. Sea Level Pressure, in. vs. Pressure Altitude Differential, ft.–Con.

Based on the ICAO standard atmosphere[Ref. 3]

	+1,000'	+1,100'	+1,200'	+1,300'	+1,400'	+1,500'	+1,600'	+1,700'	+1,800'	+1,900'
+0'	28.855	28.751	28.646	28.542	28.438	28.334	28.231	28.128	28.025	27.923
+10'	28.845	28.740	28.636	28.531	28.428	28.324	28.221	28.118	28.015	27.913
+20'	28.834	28.730	28.625	28.521	28.417	28.314	28.210	28.107	28.005	27.902
+30'	28.824	28.719	28.615	28.511	28.407	28.303	28.200	28.097	27.995	27.892
+40'	28.813	28.709	28.604	28.500	28.396	28.293	28.190	28.087	27.984	27.882
+50'	28.803	28.698	28.594	28.490	28.386	28.283	28.179	28.077	27.974	27.872
+60'	28.792	28.688	28.583	28.479	28.376	28.272	28.169	28.066	27.964	27.862
+70'	28.782	28.677	28.573	28.469	28.365	28.262	28.159	28.056	27.954	27.851
+80'	28.772	28.667	28.563	28.459	28.355	28.252	28.149	28.046	27.943	27.841
+90'	28.761	28.656	28.552	28.448	28.345	28.241	28.138	28.036	27.933	27.831
+100'	28.751	28.646	28.542	28.438	28.334	28.231	28.128	28.025	27.923	27.821

	+2,000'	+2,100'	+2,200'	+2,300'	+2,400'	+2,500'	+2,600'	+2,700'	+2,800'	+2,900'
+0'	27.821	27.719	27.618	27.516	27.415	27.315	27.215	27.115	27.015	26.916
+10'	27.811	27.709	27.607	27.506	27.405	27.305	27.205	27.105	27.005	26.906
+20'	27.800	27.699	27.597	27.496	27.395	27.295	27.195	27.095	26.995	26.896
+30'	27.790	27.689	27.587	27.486	27.385	27.285	27.185	27.085	26.985	26.886
+40'	27.780	27.678	27.577	27.476	27.375	27.275	27.175	27.075	26.975	26.876
+50'	27.770	27.668	27.567	27.466	27.365	27.265	27.165	27.065	26.965	26.866
+60'	27.760	27.658	27.557	27.456	27.355	27.255	27.155	27.055	26.955	26.856
+70'	27.750	27.648	27.547	27.446	27.345	27.245	27.145	27.045	26.945	26.846
+80'	27.739	27.638	27.537	27.436	27.335	27.235	27.135	27.035	26.935	26.836
+90'	27.729	27.628	27.526	27.426	27.325	27.225	27.125	27.025	26.925	26.826
+100'	27.719	27.618	27.516	27.415	27.315	27.215	27.115	27.015	26.916	26.816

	+3,000'	+3,100'	+3,200'	+3,300'	+3,400'	+3,500'	+3,600'	+3,700'	+3,800'	+3,900'
+0'	26.816	26.718	26.619	26.521	26.423	26.325	26.228	26.131	26.034	25.938
+10'	26.807	26.708	26.609	26.511	26.413	26.316	26.218	26.121	26.025	25.928
+20'	26.797	26.698	26.599	26.501	26.403	26.306	26.209	26.112	26.015	25.919
+30'	26.787	26.688	26.590	26.491	26.394	26.296	26.199	26.102	26.005	25.909
+40'	26.777	26.678	26.580	26.482	26.384	26.286	26.189	26.092	25.996	25.899
+50'	26.767	26.668	26.570	26.472	26.374	26.277	26.179	26.083	25.986	25.890
+60'	26.757	26.658	26.560	26.462	26.364	26.267	26.170	26.073	25.976	25.880
+70'	26.747	26.649	26.550	26.452	26.355	26.257	26.160	26.063	25.967	25.870
+80'	26.737	26.639	26.541	26.443	26.345	26.247	26.150	26.054	25.957	25.861
+90'	26.727	26.629	26.531	26.433	26.335	26.238	26.141	26.044	25.947	25.851
+100'	26.718	26.619	26.521	26.423	26.325	26.228	26.131	26.034	25.938	25.842

	+4,000'	+4,100'	+4,200'	+4,300'	+4,400'	+4,500'	+4,600'	+4,700'	+4,800'	+4,900'
+0'	25.842	25.746	25.650	25.555	25.460	25.365	25.271	25.176	25.083	24.989
+10'	25.832	25.736	25.641	25.545	25.450	25.356	25.261	25.167	25.073	24.980
+20'	25.822	25.727	25.631	25.536	25.441	25.346	25.252	25.158	25.064	24.970
+30'	25.813	25.717	25.622	25.526	25.431	25.337	25.242	25.148	25.054	24.961
+40'	25.803	25.707	25.612	25.517	25.422	25.327	25.233	25.139	25.045	24.952
+50'	25.794	25.698	25.602	25.507	25.412	25.318	25.224	25.129	25.036	24.942
+60'	25.784	25.688	25.593	25.498	25.403	25.308	25.214	25.120	25.026	24.933
+70'	25.774	25.679	25.583	25.488	25.393	25.299	25.205	25.111	25.017	24.924
+80'	25.765	25.669	25.574	25.479	25.384	25.289	25.195	25.101	25.008	24.914
+90'	25.755	25.660	25.564	25.469	25.375	25.280	25.186	25.092	24.998	24.905
+100'	25.746	25.650	25.555	25.460	25.365	25.271	25.176	25.083	24.989	24.896

Appendix 2 – Miscellaneous Information

Principle of Operation

A Fortin type mercurial barometer consists of a long glass tube, closed at one end, evacuated, filled with mercury and inverted; the open end being submerged in a reservoir of mercury called the cistern, whose level in a Fortin type barometer is adjustable. Mercury is supported in the glass tube by the atmospheric pressure acting on the mercury in the cistern, and its height is an accurate measure of that pressure. If the pressure changes even slightly, the liquid mercury level must change in direct proportion, making it a highly reliable and accurate instrument. Air should never be allowed to enter the barometer tube. Air in the barometer tube could depress the mercury column causing it to read too low, or it could cause a separation of the mercury column causing it to read too high.

Pressure changes due to weather changes are relatively small and must be measured accurately. During periods of fair weather, the barometric pressure may not change appreciably for days on end. With the arrival of foul weather, however, the barometer may drop markedly over a short period. The long scales, however, are only necessary to allow for the decreased pressure at high altitudes. When the pressure increases, the cistern level will be depressed slightly as mercury rises higher in the glass barometer tube. The change in levels is inversely proportional to the cross sectional areas of the cistern and tube. When taking a reading, the mercury level in the cistern is first set to the white zero pointer, and then the height of the mercury column is measured against a scale. Accuracy in setting *each* level is of equal (not relative) importance, as any setting error is directly reflected in the resulting reading. I.e. a 0.002” error in *either* setting will lead to exactly a 0.002” error in the resulting reading. The hydraulics has nothing to do with the setting error, unless you fail to reset the cistern level.

Technical Information on Scales and Mercury Measurement

Each scale is set at the factory by comparison with a scale certified by the National Institute of Standards and Technology (N.I.S.T.). They read the local station pressure without the necessity of correcting for capillary depression.

The standard temperature for the density of mercury is 32°F or 0°C. Mercury expands, becoming less dense, with increasing temperature. The effect of the expansion of mercury is about 10 times as great as that of the expansion of the brass and scales. Since the barometer will probably not be near 32°F or 0°C, for high accuracy it is important to apply the temperature correction to reduce your reading to mercury at standard temperature. The standard temperature for English scales is 62°F and that for metric scales is 0°C. This means that an English scale will appear contracted relative to a metric scale, when viewed at the same temperature, without the temperature correction applied. If it is desired to convert an English reading to a metric reading, or vice versa, always apply the temperature correction(s) in the proper system(s), before making the conversion. The barometer barrel is made of brass. The barometer scale has a coefficient of thermal expansion essentially equal to that of brass. Because standard materials are used, standard combined temperature correction tables, such as Tables 4 and 5; and equations, given below, may be used.

The reading of the barometer is also affected by gravity (which is affected by the oblate spheroid shape of the earth) and the centrifugal force of the rotation of the earth, all of which vary with latitude. The combined gravity correction is generally smaller than the temperature correction. At a given latitude, the *multiplier for gravity correction* will be a constant. Standard gravity corrections are given in Tables 6 and 7, or you can compute the *multiplier for gravity* correction for your exact latitude using the equation given below. Our MS Excel 2000 Spreadsheet for Automatic Barometer Corrections (Table 1) computes all of the corrections exactly.

The Barometer Correction Equations

The equations below *may* be used to calculate your own *special multipliers*, or to automate the barometer corrections on your system.

1. *Multiplier for temperature correction and its derivative with respect to temperature*:

$$M_{tc} = [1+L(t-t_s)]/[1+M(t-t_m)] - 1, \qquad dM_{tc}/dt = -[M-L-ML(t_s-t_m)]/[1+M(t-t_m)]^2$$

2. *Multiplier for gravity correction*:[Ref. 1, 3]

$$M_{gc} = [1-0.0026373\cos(2\phi)+0.0000059\cos^2(2\phi)]980.616/980.665 - 1$$

3. *ICAO*[Ref. 3] *pressure altitude vs. station pressure, and sea level pressure vs. pressure altitude differential*:[Ref. 3]

$$H = [1-(p_{sp}/p_o)^{1/5.2561}]288.16/0.0065, \qquad p_{sl} = p_o(1-0.0065\Delta H/288.16)^{5.2561}$$

Where:		English[Ref. 2, 3]	Metric[Ref. 1, 2, 3]
M	= coef. of volume thermal expansion of mercury,	0.000,101,0 in.^{3}/in.^{3}°F,	0.000,181,8 m^3/m^3°C
L	= coefficient of linear thermal expansion of brass,	0.000,010,2 in./in.°F,	0.000,018,4 m/m°C
t	= variable temperature of the barometer,	degrees Fahrenheit (°F)	degrees Celsius (°C)
t_s	= standard temperature for the scales,	62°F,	0°C
t_m	= std. temperature for the density of mercury,	32°F,	0°C
p_o	= standard pressure at sea level,	29.921 in. Hg	760 mm Hg, 1013.25 mb

ϕ = latitude, degrees north or south (in MS Excel you must convert to radians or multiply by $\pi/180°$)
H = pressure altitude, meters (feet x 12 in./ft. x 0.0254 m/in.)
ΔH = pressure altitude differential, meters (feet x 12 in./ft. x 0.0254 m/in.)

Certification of Traceability and Accuracy

All PRINCO Fortin type mercurial barometers, Models 453, 453X and 469, have scales which were set at the time of manufacture to a near zero correction by comparison with a Fortin type mercurial barometer whose scales were calibrated traceable to the National Institute of Standards & Technology (N.I.S.T.). Barometer scales may be read more accurately than they can be set.

Fortin type mercurial barometers are accurate to ±0.01 inches of mercury, ±0.2 mm of mercury, or ±0.3 mb, when carefully set and read, and after the certificate, temperature, and gravity corrections have been applied. The thermometer on the barometer is accurate to ±1°F/±0.5°C. If the barometer is not abused in any way, it should never go out of calibration.

Moving and Shipping the Barometer

1. ***Moving the Barometer****: Before moving the barometer the* ***mercury column must be "locked up"*** by screwing the cistern adjusting screw in until slight resistance is felt and then backing off slightly to relieve any pressure. This minimizes any air or vacuum spaces. If the barometer is moved or tilted, while the cistern level is in a lowered position, as a painter might do, it will likely get air in the barometer tube. Once the mercury column has been "locked up", the barometer may safely be taken off the wall and carefully turned to the horizontal, or better yet *upside down*, position for transporting.
2. **Shipping the Barometer**:

   WARNING:

   BAROMETERS CONTAIN MERCURY – A REGULATED HAZARDOUS MATERIAL (HAZMAT) BEFORE PACKING OR SHIPPING CHECK WITH APPROPRIATE AUTHORITIES.

   IMPORTANT: Some barometers contain more than 1 pound of mercury, a "reportable quantity". Only a trained, certified HAZMAT professional is authorized to handle its shipment.

Barometer Troubleshooting

1. Barometer reads too low.
   1.1. Reported “barometric pressure” is always *sea level* pressure. Barometric pressure *decreases* with altitude approximately 0.0011 inch per foot, or 1.07 inches per 1000 foot of altitude. See Instructions, Automatic Barometer Corrections, also Appendix 1, Sea Level Pressure.
   1.2. Check for air in the barometer tube; see Instructions, Checking for Air in the Barometer Tube.
2. Barometer reads too high.
   2.1. Make sure that the cistern level is lowered to the white zero pointer.
   2.2. Check for air in the barometer tube, with a separation of mercury column; see Instructions, Checking for Air in the Barometer Tube.
   2.3. Apply the temperature and gravity corrections that are generally negative.
   2.4. It is highly unlikely that a mercurial barometer used correctly could read high, so check to see that the barometer being used for comparison isn’t reading low.
   2.5. Someone may have lowered the scale(s), perhaps in an attempt to get it to read the higher reported sea level pressure.
3. Barometer doesn’t respond to, or track, the barometric pressure.
   3.1. Make sure that the cistern level is lowered to the white zero pointer.
   3.2. During periods of fair weather, pressure may remain constant for days on end. It must be measured using the vernier very accurately and recorded to detect any change, see Instructions, Setting the Cistern Level and Reading the Vernier. With the arrival of foul weather it may drop by an inch or so over a short period. The long scales are only there to accommodate the different pressure levels at different altitudes. Unless you take it to those altitudes (3,000’ for the 453, 12,000’ for the 453X, and 10,000’ for the 469), the mercury level will *never* go there. The air pressure at your location supports the liquid mercury column; if the pressure goes down, the mercury cannot stay up, and vise versa.
4. The barometer tube has air in it. See Instructions, Unpacking 7; or Appendix 2, Manipulating Air Bubbles.
5. Need certification of traceability. Appendix 2, Certification of Traceability and Accuracy.
6. Need to have the barometer calibrated. It is best to order this when ordering the barometer, however you can return the barometer to the factory for a “Factory Certificate of Calibration” which will show the corrections to be applied to each scale. Before moving read Appendix 2, Moving and Shipping the Barometer.
7. The glass tube was broken and mercury spilled. See Appendix 2, Mercury Clean Up Guidelines. The barometer itself may be returned to the factory for repairs and a new vacuum degassed and mercury filled glass barometer tube. See Appendix 2, Moving and Shipping the Barometer.

Manipulating Air Bubbles

With air bubbles greater than 1 mm in diameter, it may be possible to remove the bulk of the air with the following manipulations. However the vacuum in the barometer is apt to be impaired.

1. The mercury column should be “locked up”, see Appendix 1, Moving and Shipping the Barometer. Remove the tape from the adjusting screw and back it out one turn to take any pressure off the bubble(s).
2. By tilting the barometer from the horizontal, manipulate the largest bubble to pickup any and all small bubbles. When all the bubbles are joined into one, raise the cistern so it will go to that end of the tube.
3. If the bubble stops, hold the barometer near the cistern end, in the inverted position, over a plastic trash can lined with a plastic trash bag (just in case the tube should break), and gently tap the barometer on its mounting ball. If it is still reluctant to move, try warming the mercury column below the bubble with a hair dryer, but do not use too much heat. The bubble should rise and disappear behind the cistern top.

4. Tap the barometer gently on its mounting ball several times more to “float” the bubble into the cistern. You cannot see this happen. After tapping several times, screw in the cistern adjusting screw until slight resistance is felt, “locking up” the mercury column, so as not to get another air bubble in the tube. Now go to Instructions, Checking for Air in the Barometer Tube, Step 1.2. Repeat from Step 1.2, until the air bubble disappears. An air bubble may be removed from the Model 469 NOVA™ School Grade Barometer on the first try, however it may take two or three attempts. The Model 453 National Weather Service barometer, with its largely covered tube, will present more difficulties.

Mercury Clean Up Guidelines[4]

1. *Never, Never,* . . .
   1.1. *Never* use an ordinary vacuum cleaner. There are, however, numerous especially designed mercury vacuum cleaners listed in reference 4 and the Thomas Register.
   1.2. *Never* heat exposed mercury.
   1.3. *Never* dispose of mercury down a drain or sewer.
   1.4. *Never* contact the mercury with your skin, nondisposable clothing, or gold or silver jewelry.
   1.5. *Never* sweep mercury with a floor broom.
   1.6. *Never* walk around wearing mercury contaminated shoe soles.
2. Assemble your *disposable* clean up tools.
   2.1. Disposable bottle with a tight lid, preferably plastic, and an optional paper funnel.
   2.2. Disposable squeeze-bottle or squeeze-bulb dropper, syringe, or aspirator bottle (optional).
   2.3. Disposable paper towels, plain straight edge paper, and a stiff paper or cardboard pusher.
   2.4. Disposable sticky tape, preferably wide duct, packing, or masking tape.
   2.5. Disposable small plastic bags and plastic trash bags.
   2.6. Flashlight (optional) can be protected by a disposable transparent plastic bag covering.
   2.7. Disposable gloves, preferably rubber, latex, or vinyl (optional).
   2.8. Wear inexpensive or old clothes, shoes, or coverings, which you can dispose of.
3. Perform the clean up.
   3.1. With the stiff paper or cardboard pusher, move broken pieces of glass onto paper towels, fold, and seal in plastic bags. Place the open bottle, with paper funnel, on plastic or paper.
   3.2. Similarly carefully gather and coalesce beads of mercury onto paper or paper towel, and/or suck up with the optional disposable dropper, syringe, or aspirator bottle. Very carefully deposit the runny mercury into the bottle, and repeat until you can’t collect any more mercury. A low movable flashlight will facilitate locating remaining droplets, by creating a movable dark halo shadow and accentuating their silver shine.
   3.3. Carefully pick up remaining mercury and glass particles with the sticky side of the sticky tape. Do not shake, or the liquid mercury will drop off. You can tap the tape over the optional paper funnel, to reclaim additional mercury. Stick the tape to paper, sealing in the remaining mercury and glass particles, fold, and seal in plastic bags.
   3.4. Powdered sulfur will indicate mercury, and powdered zinc will amalgamate with it. Mercury vapor testers, vapor badges, and urine tests may also be used to detect mercury.
   3.5. When all is cleaned up, tightly cap the bottle. Tape shut, and place in a plastic bag. Quantities of mercury up to one pound (1 lb.) may be shipped, via UPS/RPS ground (not by U.S. mail), to Princo Instruments, Inc., for recycling. Label package, “Consumer Commodity ORM-D” (Other Restricted Materials: D).

3.6. All contaminated items, including funnel, cardboard, paper and tape, should be double sealed in plastic bags. If they contain more than 0.2 mg/liter, ship it to a mercury disposal facility[4]. Otherwise dispose as trash in an approved dumpsite, not for incineration.

3.7. Wash your hands with soap and water, and/or shower, before touching things, eating or smoking. Possibly exposed shoes and clothing should be disposed of, or hand washed separately and thoroughly, and thoroughly aired-out in warm sunshine before recycling.

3.8. Ventilate the area for a minimum of two days.

References

1. Letestu, S., "International Meteorological Tables", World Meteorological Organization, WMO-No. 118.TP.94, Geneva, Switzerland, 1966, with amendments through July 1973.
2. List, Robert J., "Smithsonian Meteorological Tables", Smithsonian Miscellaneous Collections, Vol. 114, Publication 4014, Smithsonian Institution Press, 6th revised edition 1949, 5th reprint 1971.
3. "Manual of Barometry", (WBAN), Volume 1, First Edition, U.S. Department of Commerce, Weather Bureau, Washington, D.C., 1963.
4. "Guidelines for the Safe Clean-up of Mercury Spilled in the Home", Jan. 1996; and "Controlling Metallic Mercury Exposure in the Workplace A Guide for Employers", Feb. 1996, New Jersey Dept. of Health, Occupational Disease & Injury Services, Box 360, Trenton, NJ 08625-0360, tel. 609 984-1863.