BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G73.205.4
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PRESSURE TESTING
ALTITUDE CORRECTION FOR ORDINARY MEASUREMENTS

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1. GENERAL

1.01 This is a new section that outlines the methods employed to convert pressure measurements made at different elevations to their equivalent values at a common elevation for comparison.

1.02 These methods are applicable only in correcting pressure measurements taken with instruments such as the 3-1/2-inch gauge and mercury manometer.

1.03 In using precision measuring instruments, such as the Wallace and Tiernan Aneroid Manometer which is read to the nearest .001 pound, the elevations of the cable at valve points and altitude corrections must be determined to greater accuracy than is shown in this section. Appropriate methods of correcting readings made with precision instruments are covered in another section of the practices.

2. MEASUREMENT OF ELEVATION

2.01 In order that pressure measurements made at different elevations can be converted to their equivalent values at a common elevation, the elevations of all valve points in a gas section must be determined. In general, this should be done whenever there is a difference in elevation of about 150 feet or more between the highest and lowest valve point in the gas section.

2.02 The elevation of each valve point should be determined to an accuracy of plus or minus 10 feet by use of a surveyor's level or hand level, or by other approved instruments such as precise altimeters.

2.03 When determining elevation of a buried cable gas section in mountainous country, it is desirable to obtain the elevation of each cable marker along the route in addition to the elevation at valve points. These marker elevations are shown on the plant records in order that they will be available for gas pressure maintenance purposes.

2.04 When temporary valves are installed for leak location measurements, the elevations of the temporary valves should be determined at that time by surveyor's level, hand level, or precise altimeters. The known elevation of a regular valve point or marker can be used as the base and starting point of the survey.

2.05 If the elevation of a regular valve point or marker is not known, an assumed elevation can be used as the base and starting point for the survey of elevations for the leak location measurements.

3. CORRECTION FOR DIFFERENCES IN ALTITUDE

3.01 Pressure measurements made at different elevations may be converted to their equivalent values at a common elevation by the use of Table 1, or by the use of the B Pressure Testing Rule. Instructions for the use of the rule are printed on its face.

3.02 The altitude correction which is applied should always be based on the difference in elevation between the valve point where the pressure is measured and a base elevation equal to that of the lowest valve point in the section of cable under test. The altitude correction is added to the pressure readings taken at valves above the base elevation in order to obtain the equivalent pressure at the base elevation. The reverse is true when determining the correct charging pressure to use at a charging valve above the base elevation of a section. In the latter case the altitude correction is subtracted from the nominal charging pressure in order to obtain the proper regulator setting at that valve.

3.03 The values of altitude correction given in Table 1 as well as the B Pressure Testing Rule, are based on cable pressures at 60° F., and normal sea level atmospheric pressure of 15.0 pounds. The corrections will differ slightly at other cable temperatures and atmospheric pressures. For all practical purposes, however, the cable pressures given in Table 1 and on Scale E of the B Pressure Testing Rule, may be considered to

be the measured cable pressures regardless of cable temperature or atmospheric pressure.

ALTITUDE CORRECTION
(ADD TO PRESSURE MEASURED AT HIGHER VALVE POINT)

Difference in Altitude - Feet	Cable Pressure (Pounds Per Sq. In.)									
	1	2	3	4	5	6	7	8	9	10
20	0	0	0	0	0	0	0	.01	.01	.01
30	0	0	0	0	0	.01	.01	.01	.01	.01
40	0	0	0	.01	.01	.01	.01	.01	.01	.01
50	0	0	0	.01	.01	.01	.01	.01	.02	.02
60	0	0	.01	.01	.01	.01	.01	.02	.02	.02
70	0	0	.01	.01	.01	.01	.02	.02	.02	.02
80	0	0	.01	.01	.01	.02	.02	.02	.02	.03
90	0	0	.01	.01	.01	.02	.02	.02	.03	.03
100	0	.01	.01	.01	.02	.02	.02	.03	.03	.03
200	0	.01	.02	.02	.03	.04	.05	.05	.06	.07
300	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10
400	.01	.02	.04	.05	.06	.08	.09	.10	.12	.13
500	.01	.03	.04	.06	.08	.10	.11	.13	.15	.17
600	.01	.03	.05	.07	.10	.12	.14	.16	.18	.20
700	.01	.04	.06	.09	.11	.14	.16	.18	.21	.23
800	.01	.04	.07	.10	.13	.15	.18	.21	.24	.27
900	.02	.05	.08	.11	.14	.17	.21	.24	.27	.30
1000	.02	.05	.09	.12	.16	.19	.23	.26	.30	.34

Note: Correction for differences in elevation not shown above may be obtained by adding the corrections for two or more of the differences in elevation to obtain the desired total.

Table 1

3.04 The following is an example in the use of Table 1: Assume that there is a small leak in a section of cable and that appreciable differences in altitude exist between the valve points which must be read to secure a gradient. Pressure readings are secured and elevations obtained for the valve points. A table is prepared similar to the following, and these data are entered in Columns (1), (2) and (3).

Valve No.	Observed Pressure Reading	Elevation of Instrument In Feet	Diff. In Altitude from Base*	Altitude Correction	Corrected Pressure Reading
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6
1	8.00	1780	190	.05	8.05
2	7.74	1845	255	.07	7.81
3	7.48	1775	185	.04	7.52
4	7.48	1715	125	.03	7.51
5	7.73	1660	70	.02	7.75
6	8.05	1590	0	—	8.05

*Base Elevation 1590 Feet

3.05 Valve No. 6 has the lowest elevation (1590 feet). For convenience, this is selected as the base elevation. The difference in elevation between the valves and this base are then entered in Column 4.

3.06 The altitude correction is then determined for each Observed Pressure (Col. No. 2) and Altitude (Col. No. 4) and entered in Column No. 5. For example, the observed pressure at Valve No. 1 is 8.00 pounds and the altitude from the base is 190 feet. In Table No. 1, the altitude correction for 8.00 pounds and 100 feet is .03 pound, and for 90 feet is .02 pound which gives a total of .05 pound. This value is entered in Column No. 5 and then added to the Observed Pressure of 8.00 pounds to give a Corrected Pressure (Col. No. 6) of 8.05 pounds. The corrections for the other valves are obtained in a similar manner.

3.07 When the observed pressure falls between two columns and the difference in the altitude correction in the two columns is .01 pound, use the correction value in the column nearest the pressure reading. For example, if the pressure is 7.40 pounds and the difference in altitude is 300 feet, use .07 pound (see Table 1) as the correction.

3.08 When the observed pressure falls between two columns and the difference in the altitude correction in the two columns is .02 pound or greater, it is necessary to interpolate between the two values to determine the altitude correction. For example, if the observed pressure is 8.50 pounds and the difference in altitude is 500 feet, use an altitude correction of .14 pound as being halfway between the values of .13 for 8 pounds and .15 for 9 pounds.