BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G73.418.3
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AT&T Co Standard

PRESSURE TESTING
LEAK LOCATION METHODS
TIME-PRESSURE CURVES

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1. GENERAL

1.01   This is a new section which describes the Time-Pressure Curves Method of leak location in cables maintained under pressure. This method is applicable in the final location of large, medium and small leaks in underground and buried cable.

1.02   Time-Pressure Curves provide an accurate method of correcting for the drop in pressure and change in gradient shape, due to loss of gas through the leak, during the interval of time required to take a set of pressure readings for leak location purposes.

1.03   Starting on one side of the leak, the pressures are measured along the cable toward the leak and at several valve points beyond. The time is recorded for each measurement. The process is repeated three times, the direction of travel being the same for each set of measurements. This provides four pressure readings at each valve point made at one-half to one hour intervals.

1.04   These readings are plotted on a graph to show the variation of pressure with time at each valve point. From this graph the pressures at all valve points at a particular time can be determined for use in plotting a leak location gradient.

1.05   Time-pressure curves require an elaborate measuring procedure initially; however, verified measurements are obtained and, the behavior of the gradient over a period of time is known. This reduces the number of unknown factors that must be considered in analyzing the possible causes of irregularities in the shape of the plotted gradient.

2. PROCEDURE IN MAKING TEST

2.01   The Time-Pressure Curves Method should not be employed without first taking a preliminary set of pressure readings to obtain an approximate location of the leak. Temporary close-spaced valves should then be installed so as to obtain three easily accessible and evenly spaced valve points on each side of the leak.

2.02   Sufficient time should be allowed after the installation of the valves to assure that the cable pressure has stabilized before starting the test. If the preliminary measurements indicate that the cable pressure is low, the cable should be charged to a higher value when the temporary valves are installed. Higher cable pressures will result in steeper slope gradients and improve the accuracy of the leak location.

2.03   The procedure in making the test is as follows. Starting at the third valve point on one side of the leak, measure the pressure at each valve to the third valve point on the other side of the leak. Record the time of each measurement to the nearest minute. Repeat the measurements three times so as to obtain four sets of readings. The direction of travel along the cable should be the same for each set.

2.04   Plot the measurements on Form E-1017 or similar graph paper using the horizontal scale to plot time in minutes. Generally, a convenient time scale is obtained by allowing 10 minutes for each one-half inch block.

2.05   Plot the pressure values for each valve separately and connect the four points with straight lines before proceeding with the next valve. The result will be a series of curves showing the variation of pressure with time for each valve point.

2.06   If the changes in pressure during the test are caused solely by the loss of gas through the leak, the rate of pressure decrease will be about the same at all valve points and the time-pressure curves will be approximately parallel. A pressure measurement that is in error will be evident since it will be out of line with the other readings at the same valve point. A measurement that is obviously in error should be discarded in drawing the time-pressure curves.

2.07   Lack of parallelism or other irregularities in the time-pressure curves is an indication of temperature changes, leaky connections, unequalized pressure, or other disturbances in the pressure gradient. In this case, the cause of the irregularity should be determined and the test repeated under stable conditions.

2.08   If the leak in question is very small, there may be no measurable decrease in pressure during the time required to take the four sets of readings. In this situation, the time-pressure curves will be horizontal straight lines which will nevertheless be helpful in verifying the accuracy and dependability of the measurements.

2.09   If the time-pressure curves appear consistent, select a time when the curves are parallel and draw a vertical line on the graph for this time. Pick off the pressure values for each valve for this time and plot a leak location graph. Repeat this procedure for one or two other selected times. The indicated leak location will be the average of the leak intersections obtained from these gradients.

3. EXAMPLE

3.01 Application of the Time-Pressure Curves Method of leak location is illustrated by the following example:

TIME-PRESSURE CURVES
Data Sheet

Valve No. 1		Valve No. 2		Valve No. 3	
Time	Pressure	Time	Pressure	Time	Pressure
1:00 P.M.	7.83	1:08 P.M.	7.62	1:16 P.M.	7.29
2:00 "	7.69	2:08 "	7.48	2:16 "	7.15
3:00 "	7.55	3:09 "	7.34	3:18 "	7.01
4:04 "	7.41	4:13 "	7.20	4:23 "	6.87

Valve No. 4		Valve No. 5		Valve No. 6	
Time	Pressure	Time	Pressure	Time	Pressure
1:26 P.M.	7.23	1:35 P.M.	7.50	1:42 P.M.	7.68
2:26 "	7.09	2:34 "	7.36	2:43 "	7.54
3:27 "	6.95	3:37 "	7.22	3:46 "	7.40
4:32 "	6.81	4:44 "	7.08	4:50 "	7.26
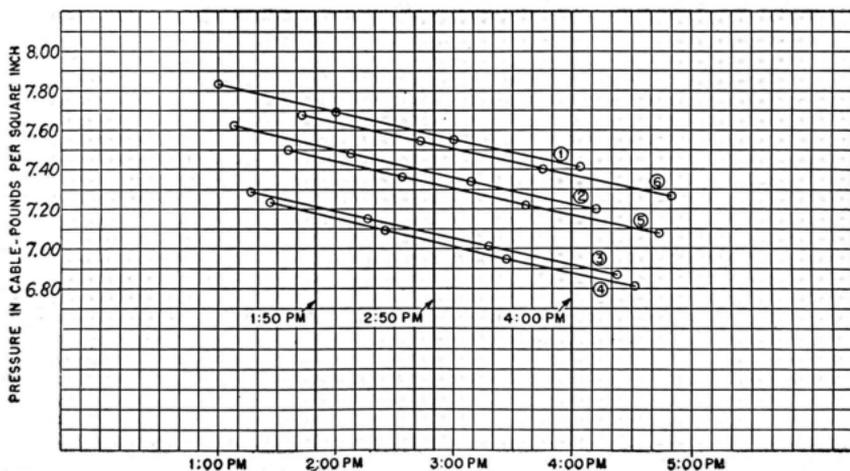
TIME—PRESSURE CURVES

SIMULTANEOUS PRESSURE VALUES
FROM TIME-PRESSURE CURVES

Valve Location		1:50 P.M. Pressure Values	2:50 P.M. Pressure Values	4:00 P.M. Pressure Values
Valve No. 1		7.71	7.58	7.42
" " 2		7.52	7.38	7.23
" " 3		7.21	7.07	6.92
" " 4		7.17	7.03	6.88
" " 5		7.46	7.32	7.17
" " 6		7.66	7.52	7.37
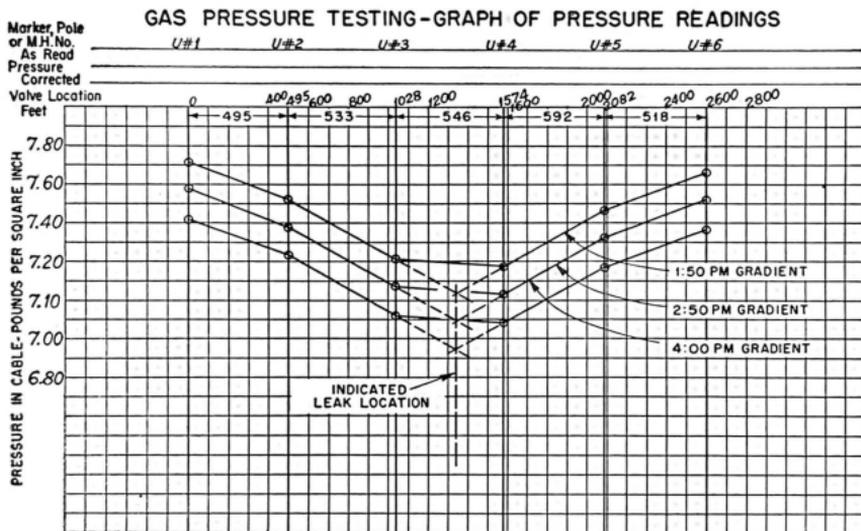
LEAK LOCATION GRADIENTS
FROM SIMULTANEOUS PRESSURE VALUES

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