

Hydrostatic Volume & Pressure Change

Sensitivity of Test Volume and Pressure to Temperature & Pressure Perturbations

PROJECT NAME

Demo - Case #1

CLIENT

ABC Pipeline

CALCULATED BY

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DATE

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HYDROSTATIC VOLUME & PRESSURE CHANGE

Volume/Pressure Sensitivity During Hydrostatic Test
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1. EXECUTIVE SUMMARY

INITIAL TEST VOLUME (VO)
73,293.54 gallons
Exposure Ratio: 1.000 | Pipe ID: 8.249 in

Pipe Data

Outside Diameter (D):	8.625 in
Wall Thickness (e):	0.188 in
Inside Diameter (d):	8.249 in
Total Length:	5 ft
Exposed Length:	5 ft

Material Properties

EL (liquid):	0.0009 /deg F
K (bulk modulus):	68,000 psi
EC (pipe):	0.000006 /deg F
E (elastic mod):	30,000,000 psi

2. VOLUME RESPONSE

Response	Value	Unit
$\Delta t = 50.0\text{ }^{\circ}\text{F}$ (full line)	3232.245	gal
$\Delta t = 50.0\text{ }^{\circ}\text{F}$ (prorated)	3232.245	gal
$\Delta P = 1.0\text{ psig}$	1.1850	gal

3. PRESSURE RESPONSE

Response	Value	Unit
$\Delta V = 1.00\text{ gal}$	0.844	psig
$\Delta t = 1.0\text{ }^{\circ}\text{F}$ (full line)	54.551	psig
$\Delta t = 1.0\text{ }^{\circ}\text{F}$ (prorated)	54.551	psig

Derived Quantities

Quantity	Value	Unit
Compliance (1/K + d/eE)	1.6168e-5	1/psi
Net Cubical Expansion (EL – 3·EC)	8.8200e-4	1/°F

Key Formulas

$$V_0 = (\pi/4) * d^2 * L * 12 / 231 \quad [\text{gal}]$$

$$dV = dt * (EL - 3 \cdot EC) * V_0 \quad [\text{gal}]$$

$$dV = dP * V_0 * [(1/K) + (d/(e \cdot E))] \quad [\text{gal}]$$

$$dP = dV / (V_0 * [(1/K) + (d/(e \cdot E))]) \quad [\text{psig}]$$

$$dP = dt * (EL - 3 \cdot EC) / [(1/K) + (d/(e \cdot E))]$$