

Operating Stress Analysis

ASME B31.4 / B31.8 Operational Stress Evaluation

PROJECT NAME

Demo - Case #1

CLIENT

ABC Pipeline

CALCULATED BY

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DATE

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HDD OPERATING STRESS ANALYSIS

Engineering Analysis Report

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1. EXECUTIVE SUMMARY

COMPLIANCE STATUS

PASS

Max Shear Stress: 15,699 psi
Allowable: 15,750 psi (45% SMYS)

1.1 Analysis Summary

Pipe Properties

OD × WT:	12.750 × 0.250 in
Grade:	API 5L GR B
SMYS:	35,000 psi

Stress Results

Max Shear:	15,699 psi
Utilization:	99.7%
Status:	PASS

2. INPUT PARAMETERS

2.1 Pipe Specifications

Parameter	Value	Unit
Outside Diameter	12.750	inches
Wall Thickness	0.250	inches
Pipe Grade	API 5L GR B	-
SMYS	35,000	psi
Young's Modulus	29,500,000	psi

2.2 HDD Parameters

Parameter	Value	Unit
Depth Below Surface	100.00	feet
Water Table Depth	10.00	feet
Radius of Curvature	1,000	feet
R/D Ratio	941.18	-

2.3 Operating Conditions

Parameter	Value	Unit
Operating Pressure	720	psi
Construction Temperature	60.00	°F
Operating Temperature	80.00	°F
Temperature Differential	-20.00	°F

3. STRESS CALCULATIONS

3.1 Calculated Stresses

Stress Component	Formula	Value (psi)	Sign
Bending Stress (fb)	$(E \times D) / (24 \times R \times 12)$	15,672	Compressive (-)
External Hydrostatic	$(H - Hw) \times 0.4333$	54	N/A
Differential Pressure	Pop - Ph	666	N/A
Hoop Stress (fh)	$(\Delta p \times D) / (2 \times t)$	16,988	Tensile (+)
Thermal Stress (ft)	$E \times k \times \Delta T$	3,835	Compressive (-)
Longitudinal (flong)	$-fb + ft + 0.3fh$	14,411	Compressive (-)
Max Shear (fv)	$ fh - flong / 2$	15,699	N/A
Allowable Shear	$0.45 \times SMYS$	15,750	Limit

3.2 Compliance Check

Check Item	Actual	Allowable	Utilization	Status
Maximum Shear Stress	15,699 psi	15,750 psi	99.7%	PASS
R/D Ratio	941.18	> 100	-	OK

4. CONCLUSIONS AND RECOMMENDATIONS

Design Verification

- The HDD design meets all structural requirements
- Maximum shear stress is within allowable limits
 - The selected pipe grade (API 5L GR B) is adequate
 - Safety margin of 0.3% exists

Construction Recommendations

1. Maintain designed radius of curvature during drilling
2. Monitor drilling fluid pressures
3. Ensure proper pipe support during pullback
4. Verify ground conditions match design assumptions
5. Document as-built alignment for future reference

Key Design Parameters Summary

Pipe Specification:	API 5L GR B, 12.75" OD × 0.25" WT
Operating Pressure:	720 psi
Radius of Curvature:	1,000 ft
Maximum Depth:	100.00 ft