

Maximum Allowable Pullback Force Report

ASCE MOP 108 Pullback Force & Minimum Bend Radius Analysis

PROJECT NAME

Demo - Case #1

CLIENT

ABC Pipeline

CALCULATED BY

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DATE

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HDD PULLBACK FORCE & MINIMUM RADIUS ANALYSIS

Maximum Allowable Pullback Force and Minimum Combined Radius Report
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1. EXECUTIVE SUMMARY

ALLOWABLE PULLBACK FORCE

1,350,224 lbs

Maximum Safe Pullback Force During HDD Installation

1.1 Input Parameters

Parameter	Symbol	Value	Unit
Pipe Outside Diameter	OD	26.000	inches
Wall Thickness	wt	0.500	inches
Pipe Grade	-	API 5L X60	-
SMYS	S	60,000	psi
Radius of Curvature	R	1,750	feet
Bending Factor of Safety	F.S.(b)	0.90	-
Pullback Factor of Safety	F.S.(p)	0.90	-
Young's Modulus	E	29,500,000	psi
Max. Operating Pressure (MAOP)	MAOP	800	psig
Installation Temperature	T_inst	70	°F
Operating Temperature	T_oper	120	°F

2. MAXIMUM ALLOWABLE PULLBACK FORCE

2.1 Pullback Force Results

Parameter	Formula	Value	Unit
Cross-Sectional Area	$\pi \times (OD - wt) \times wt$	40.06	in ²
Maximum Bending Stress	$(E \times c) / (R \times F.S.)$	20,291.01	psi
Allowable Pullback Stress	$(F.S. \times SMYS) - Sb_{max}$	33,708.99	psi
Allowable Pullback Force	Spall $\times$ As	1,350,224	lbs

3. MINIMUM COMBINED RADIUS

3.1 Minimum Radius Results

Parameter	Value	Unit
D/t Ratio	52.00	-
Allowable Bending Stress (Fb)	39,519.46	psi
Hoop Stress (Sh)	20,800.00	psi
Thermal Stress (St)	-9,587.50	psi
Minimum Installation Radius	808.67	feet
Minimum In-Service Radius	1,070.85	feet

MIN. INSTALLATION RADIUS

808.67 ft

Bending stress only — governs allowable bore curvature during pullback.

MIN. IN-SERVICE RADIUS

1,070.85 ft

Combined bending, hoop & thermal stress — governs operating condition.

4. CONCLUSIONS AND RECOMMENDATIONS

Analysis Conclusions

- The maximum allowable pullback force for the 26.000" OD × 0.500" WT pipe is 1,350,224 lbs.
- The bending stress at the specified radius of curvature (1,750 ft) is 20,291.01 psi.
- The minimum installation radius (bending only) is 808.67 feet.
- The minimum in-service radius (bending + hoop + thermal) is 1,070.85 feet.
- The D/t ratio is 52.00.

Installation Recommendations

1. Do not exceed 1,350,224 lbs pullback force during installation.
2. Maintain bore path radius of curvature above 809 feet during installation.
3. Ensure in-service combined radius does not fall below 1,071 feet.
4. Monitor pullback forces continuously during the pullback operation using calibrated equipment.
5. Verify bore path geometry meets minimum radius requirements before initiating pullback.
6. Account for buoyancy effects and friction in total pullback force calculations for the specific bore profile.

Key Design Parameters Summary

Pipeline Specification:	26.000" OD × 0.500" WT
Material Grade:	API 5L X60 (SMYS: 60,000 psi)
Allowable Pullback Force:	1,350,224 lbs
Min Installation Radius:	809 ft
Min In-Service Radius:	1,071 ft