

Blowdown Thrust Force Report

API 520 Method

PROJECT NAME

Demo - Case #1

CLIENT

ABC Pipeline

CALCULATED BY

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DATE

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BLOWDOWN THRUST FORCE

API 520 Method — Conservative Thrust Estimate

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1. EXECUTIVE SUMMARY

TOTAL THRUST FORCE

5,803.0 lbf

(25.81 kN) | Fm = 3,216.0 lbf | Fp = 2,587.0 lbf

Valve & Pipe

Valve Type:	Plug
Outside Diameter:	4.500 in
Wall Thickness:	0.237 in
Inside Diameter:	4.026 in
Valve Throat Area:	8.911 in2

Operating Conditions

Temperature:	60.0 deg F
Pressure:	500 psig
Specific Heat Ratio (k):	1.270
Molecular Weight:	17.40 g/mol
Discharge Coeff (Kd):	0.975

Intermediate Calculations

Parameter	Value	Unit
Compressibility Factor (Z)	0.9563	-
Gas Constant (C)	344.13	-
Critical Pressure Ratio (Rcp)	0.5512	-
Critical Pressure (Pc)	275.6	psig
Critical Temperature (Tc)	-1.9	deg F
Mass Flow Rate	287,861.5	lbm/hr
Mass Flow Rate	79.962	lbm/sec

2. FORCE ANALYSIS

Force Component	Value (lbf)	Value (kN)
Force due to Momentum (Fm)	3,216.0	14.31
Force due to Pressure (Fp)	2,587.0	11.51
Total Thrust Force (F = Fm + Fp)	5,803.0	25.81

3. CONCLUSIONS AND RECOMMENDATIONS

Calculation Summary

Total thrust force on plug valve: 5,803.0 lbf (25.81 kN)
Momentum contribution: 55.4%
Pressure contribution: 44.6%
Method: API 520 — conservative, no 10% PRV overpressure applied

Design Recommendations

1. Design blowdown piping supports to accommodate the total thrust force of 5,803.0 lbf
2. Verify tie-in anchor capacity exceeds the calculated reaction force
3. Confirm valve specifications (body rating, flow coefficient) match design pressure of 500 psig
4. Review blowdown stack vent direction to prevent injury and equipment damage
5. Coordinate with process safety to validate gas properties at operating conditions