



ECalPro Instrumentation Control Valve Sizing – Liquid Service

Cv / Kv per ISA-75.01.01 · isa-75.01.01:2012

TAG FV-204A	PROJECT Demo – Crude Stabiliser	P&ID PID-204-03	REV A	DATE 2026-06-16
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REQUIRED CV (OVERALL STATUS: FAIL)

190.76 Cv

Sub-critical: service ΔP is below the choked limit.

$\sigma=1.33$ – likely damaging cavitation; review trim/ Δp staging.

Required opening 76% within the 20–80% band.

KV 165	SIZING ΔP 460 kPa	Σ (CAVITATION) 1.326	OPENING 76 %
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Inputs

Volumetric flow, Q	360 m ³ /h
Inlet pressure, P ₁ (abs)	6.8 bar(a)
Outlet pressure, P ₂ (abs)	2.2 bar(a)
Vapour pressure, P _v (abs)	0.701 bar(a)
Critical pressure, P _c (abs)	221.2 bar(a)
Density, ρ	965.4 kg/m ³
Valve diameter, d	150 mm
Pressure-recovery factor, FL	0.9
Valve style modifier, Fd	0.46
Rated Cv	250

Results [clause-cited]

Flow coefficient, Cv	190.76	ANSI/ISA-75.01.01 §7.2 / Eq.1–5 (incompressible)	Flow coefficient, Kv	165	
Choked flow	No	IEC 60534-2-1 choked liquid flow	Liquid critical-pressure ratio, FF	0.9442	ANSI/ISA-75.01.01 §7.3 FF critical pressure ratio
Service ΔP	460 kPa		Choked ΔP	497.19 kPa	
Sizing ΔP	460 kPa		Piping geometry factor, FP	1	
Valve Reynolds number, Re _v	2966953		Cavitation index, σ	1.326	ISA-RP75.23 cavitation index σ

Methodology & assumptions

- Liquid sizing per isa-75.01.01:2012 (IEC 60534-2-1 MOD): $C = Q / (N1 \cdot FP) \cdot \sqrt{((p_1 / p_0) / \Delta P_{\text{sizing}})}$; $C_v = K_v / 0.865$.
- Sizing ΔP is the lesser of service ΔP and choked $\Delta P_{\text{choked}} = (FLP / FP)^2 \cdot (P_1 - FF \cdot P_v)$.
- FF (liquid critical-pressure ratio) = $0.96 - 0.28 \cdot \sqrt{P_v / P_c}$.
- Piping geometry factor FP and Reynolds factor Fr correct for fittings / non-turbulent flow.
- Cavitation index $\sigma = (P_1 - P_v) / \Delta P$; cautions/fails per ISA-RP75.23 screening bands.
- All inputs SI/absolute; unit conversion occurs only at the I/O boundary.

Document control

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Basis & responsibility: results are computed from the cited standard editions and the inputs above. This report is an engineering aid; the responsible engineer must verify all inputs, assumptions and governing-standard applicability before use in design or construction.