

 TORUS		· Owner STATION OUTLET CHECK VALVE CKV-171		Document No.	MEC-DS-007
				Revision / Date	A · September 29, 2026
				Issue purpose	Issued for Review
MECHANICAL · STATION OUTLET CHECK VALVE CKV-171					
Rev.	Date	Revision description	Prepared	Reviewed	Approved
A	2026-09-29	Issued for Review			

NOTES

CKV-171 is the NPS 12 Class 600 check valve on line 12"-G-1040-A6 between SDV-102 and SDV-103 (P&ID  PRO-DWG-108). It prevents reverse flow from the receiving pipeline operator's trunkline (MAOP 1,200 psig, HOLD H-04) into the station, and it stops the outlet lateral from blowing down back through BDV-183; the lateral has its own blowdown, HV-172A. Common valve requirements are in  MEC-DS-006 and the piping class in  PIP-SPC-001. Gas properties were calculated with the GERG-2008 equation of state.

TYPE SELECTION

The Basis of Design,  GEN-DB-001, allows a piggable swing check or an axial nozzle check. TORUS selected the type on disc stability over the flow range. A conventional swing check needs a minimum line velocity to hold the disc fully open against its stop. Below it the disc floats, flutters and wears the hinge pin and seat.

Crane TP-410, swing check minimum velocity for full disc lift

$$V_{min} = 35\sqrt{\bar{v}} \quad V = \frac{\dot{m}}{\rho A}$$

Here $\bar{v}$ is the specific volume in ft³/lb and $A = 0.7854 \text{ ft}^2$ for the 12.000 in bore of NPS 12 × 0.375 in pipe. The pressure at CKV-171 is the trunk pressure plus 5 psi. The temperature is 40 °F with the heater on, or the isenthalpic temperature across the control valve with the heater off. Table 1 shows the result for each operating case.

Table 1: Swing Check Full-Lift Check by Case

Case	Flow (MMSCFD)	P (psig)	T (°F)	ρ (lb/ft ³)	V (ft/s)	V_{min} (ft/s)	Swing disc fully open
C1	120	755	40.0	3.140	27.5	19.75	Yes
C2	90	955	65.7	3.777	17.2	18.01	No
C3	10	955	58.5	3.872	1.9	17.79	No
C4	120	1,005	116.5	3.435	25.2	18.88	Yes
C5	120	755	40.0	3.140	27.5	19.75	Yes
C6	120	755	19.8	3.383	25.6	19.03	Yes
C7, rich gas	120	855	45.0	3.957	23.3	17.60	Yes

Note 1: In case C2, $\bar{v} = 1 / 3.777 = 0.2648 \text{ ft}^3/\text{lb}$ and $V_{min} = 35\sqrt{0.2648} = 18.01 \text{ ft/s}$, against a line velocity of 17.2 ft/s. Full lift at C2 conditions needs about 94 MMSCFD.

Note 2: The rich gas of case C7 is two-phase at 855 psig and 40 °F. The check was run at 45 °F, the first single-phase temperature. The heater setpoint for the rich case is to be verified by Process (TBV).

A swing disc would therefore float at normal flow (C2) and at turndown (C3). TORUS selected an axial-flow nozzle check, spring assisted, for three reasons. First, a nozzle check with a spring chosen by the vendor for this flow range stays stable when partly open. Second, on an SDV-102 trip or a station shutdown the axial disc closes on a short stroke before the flow reverses, so it does not slam against the trunk pressure. Third, pigging through CKV-171 is not required: the station has no outlet pig launcher, and a future inspection of line 1042 would use a temporary launcher at the IJ-102 riser, which is downstream of CKV-171. The piggable swing check was rejected for the flutter it would suffer below about 94 MMSCFD. If the Owner requires a piggable valve, the alternate is a full-opening API 6D swing check with external counterweight and hydraulic damper, accepting partial lift at normal flow. The P&ID label "piggable" on  PRO-DWG-108 should be revised to match.



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DATASHEET

Table 2: CKV-171 Data

Item	Requirement	Item	Requirement
Tag and quantity	CKV-171, 1	Line	12"-G-1040-A6
Location	X 200 ft, Y 90 ft ( , horizontal, flow east	Standard	API 6D check valve, ASME B16.34
Type	Axial-flow nozzle check, non-slam, spring assisted	Size and class	NPS 12, Class 600
Ends	RF flanged to ASME B16.5, 125 to 250 microinch AARH	Face-to-face	33.0 in, ASME B16.10 long pattern
Design	1,440 psig at -20 to 133 °F; 1,420 psig at 150 °F	MDMT	-20 °F
Reverse differential	1,440 psi design against a depressed station (trunk MAOP 1,200 psig, HOLD H-04)	Flow range	10 to 120 MMSCFD
Body	ASTM A350 LF2 Class 1 forged or A352 LCC cast, Charpy at -50 °F	Disc, nozzle, diffuser	A350 LF2, 13 % Cr, 17-4PH
Seat	Metal to metal, Stellite 6 or equal hard facing	Spring	Inconel X-750 or 17-7PH
Cracking pressure	0.5 psi maximum	Full open	At or below 40 MMSCFD at 950 psig and 60 °F (vendor to confirm by sizing)
Pressure drop	1.5 psi maximum at 120 MMSCFD, case C5 (755 psig, 40 °F, 27.5 ft/s)	Closing	Closes before flow reverses; vendor to state closing time and reverse velocity for a sudden stop from 120 MMSCFD
Shell test	2,225 psig hydrostatic	Seat test	1,628 psig hydrostatic in reverse, 80 psig air; ISO 5208 Rate B or better
Coating	Three-coat external system per  SPC-SPC-010	Weight	2,100 lb typical (HOLD H-15)
Support	Pad under the body on pipe support type SV-1 ()	Documentation	API 6D data book, Cv and pressure-drop curve, spring data, closing-time analysis

Note 1: A short-pattern body would require a revision of isometric  PIP-DWG-014.

HOLDS

Table 3: Open Items

Hold	Item	Responsible
H-04	Trunkline MAOP and reverse-pressure case	Owner / receiving pipeline operator
H-15	Vendor sizing, weight and face-to-face	Vendor
TBV	Heater setpoint for the rich case C7	Process

