 TORUS	· Owner SHUTDOWN VALVE ACTUATORS, SOLENOID VALVES AND POSITION SWITCHES	Document No.	INS-DS-006		
		Revision / Date	A · September 29, 2026		
		Issue purpose	Issued for Review		
		INSTRUMENTATION AND CONTROLS · SHUTDOWN VALVE ACTUATORS, SOLENOID VALVES AND POSITION SWITCHES			
Rev.	Date	Revision description	Prepared	Reviewed	Approved
A	2026-09-29	Issued for Review			

NOTES

1. This datasheet covers the self-contained electro-hydraulic spring-return actuators of SDV-101, SDV-102, SDV-103 and SDV-165; the electric spring-return actuator of SDV-106; the analyzer sample solenoid valve SDV-141; valve limit switches; and position switches on manual valves. Valve bodies are on the process and mechanical valve datasheets.
2. Controlling documents:  GEN-DB-001, Basis of Design;  INS-LST-001, Instrument Index;  INS-LST-002, I/O List;  INS-LST-003, Alarm and Trip Setpoints;  SAF-SRS-001, Safety Requirements Specification;  INS-RPT-001, Control Philosophy and Functional Narrative;  INS-DWG-002, Typical Loop Diagrams.
3. Values marked typical are budgetary. The vendor shall confirm them with its proposal and final data (HOLD H-15).
4. Units are US customary. Pressures are gauge unless stated as absolute. Operating cases C1 to C7 are defined in  GEN-DB-001, Section 6; normal conditions are case C2, maximum operating conditions the envelope of C1 to C7, and design conditions those of  GEN-DB-001, Section 7.
5. The SDV-102 closing stroke of 4.0 s or less is a SIF-01 requirement.  PRO-CAL-009, Overpressure Protection System Hydraulic Analysis, shows that with the 1,225 psig trip the process safety time is 8.9 s and a 4 s stroke, with the 0.5 s trip delay and 1.5 s total detection, holds the peak to about 1,264 psig, 26 psi under the 1,290 psig limit of 49 CFR 192.201; the longest acceptable stroke is 7.4 s. A 3 s stroke was not specified because of the surge a faster closure would cause. Proof test acceptance is 4.0 s, with a travel alarm at 5 s. The vendor shall confirm the 4 s stroke without valve slam.
6. Electro-hydraulic actuators were selected over gas-powered actuators because they vent no natural gas (40 CFR 60 Subpart OOOOb) and need no instrument gas supply at an unmanned site.
7. Solenoids are de-energize-to-trip and all safety outputs are normally energized, so loss of UPS power closes every SDV.
8. Actuators are mounted and tested by the valve vendor. The actuator vendor shall supply the torque sizing sheet for review by the engineer of record.

GENERAL

Table 1-1: General Data

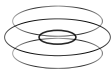
Item	Value	Item	Value
Project	 County, 	Service	120 MMSCFD gas receipt into the receiving pipeline operator's 
Form content	ISA-20; tag numbers to ISA-5.1	Electrical codes	NFPA 70 (2023) Articles 500 and 501; API RP 500
Safety instrumented tags	IEC 61511 and IEC 61508	Sour service	Not required; sweet gas, H2S 4 ppmv maximum (NACE MR0175 not applied)

SITE CONDITIONS

Table 1-2: Site and Environmental Conditions

Item	Value	Item	Value
Ambient design temperature	-5 °F to 110 °F	Electronics rating	-40 °F to 158 °F (-40 °C to 70 °C)



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Item	Value	Item	Value
Solar radiation	1,000 W/m ² ; sunshades where exposed	Elevation and atmosphere	1,150 ft MSL; 14.10 psia
Wind and ice	108 mph (ASCE 7-22, Exposure C); 0.5 in radial ice (HOLD H-06)	Area classification	Class I, Division 2, Group D in process areas; Division 1 within 5 ft of vents and relief outlets (Volume 6 area classification drawing)
Temperature class	T3 minimum (natural gas autoignition about 900 °F)	Enclosure	NEMA 4X (IP66) minimum; 316 SS or copper-free aluminum (below 0.4 % Cu), epoxy coated
Instrument power	24 VDC from the station UPS (GEN-DB-001, Section 9.8) unless noted		

TAG SCHEDULE

Table 1-3 lists every tag in  INS-LST-001 that references this datasheet, and Table 1-4 gives the process conditions at each tag.

Table 1-3: Tag Schedule

Tag	Service	P&ID	Range or set	System	JB	Area classification
SDV-101	Station inlet shutdown valve (actuator, solenoid, limit switches ZSO/ZSC-101)	 PRO-DWG-101	Open / closed	Safety PLC	JB-101S	Class I, Division 2, Group D
ZSO-101	SDV-101 open limit switch (integral)	 PRO-DWG-101	None	Safety PLC	JB-101S	Class I, Division 2, Group D
ZSC-101	SDV-101 closed limit switch (integral)	 PRO-DWG-101	None	Safety PLC	JB-101S	Class I, Division 2, Group D
SDV-106	V-101 liquid outlet shutdown valve, upstream of LCV-104	 PRO-DWG-102	Open / closed	Safety PLC	JB-101S	Class I, Division 2, Group D
ZSC-106	SDV-106 closed limit switch (integral)	 PRO-DWG-102	None	Safety PLC	JB-101S	Class I, Division 2, Group D
ZSO-103C	HV-103C not-closed position switch to RTU (HAZOP)	 PRO-DWG-102	None	BPCS RTU/PLC	JB-101	Class I, Division 2, Group D
SDV-141	Analyzer sample inlet shutoff at B-101 wall (F&G action)	 PRO-DWG-104	Open / closed	Safety PLC	JB-140S	Class I, Division 2, Group D (B-101 interior)
ZSO-158C	HV-158C bypass open position switch (heater mode confirmation)	 PRO-DWG-105	None	BPCS RTU/PLC	JB-150	Class I, Division 2, Group D
ZSC-158C	HV-158C bypass closed position switch	 PRO-DWG-105	None	BPCS RTU/PLC	JB-150	Class I, Division 2, Group D
SDV-165	Fuel gas shutoff, H-101 branch only (closes on ESD I-01 and BMS trip I-06)	 PRO-DWG-106	Open / closed	Safety PLC	JB-101S	Class I, Division 2, Group D
ZSC-165	SDV-165 closed limit switch	 PRO-DWG-106	None	Safety PLC	JB-101S	Class I, Division 2, Group D
ZSO-131A	HV-131A open position switch (FCV switchover permissive)	 PRO-DWG-107	None	BPCS RTU/PLC	JB-130	Class I, Division 2, Group D
ZSO-131B	HV-131B open position switch (FCV switchover permissive)	 PRO-DWG-107	None	BPCS RTU/PLC	JB-130	Class I, Division 2, Group D
ZSO-132A	HV-132A open position switch (FCV switchover permissive)	 PRO-DWG-107	None	BPCS RTU/PLC	JB-130	Class I, Division 2, Group D
ZSO-132B	HV-132B open position switch (FCV switchover permissive)	 PRO-DWG-107	None	BPCS RTU/PLC	JB-130	Class I, Division 2, Group D



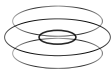
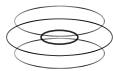
 TORUS	[REDACTED] [REDACTED] - Owner SHUTDOWN VALVE ACTUATORS, SOLENOID VALVES AND POSITION SWITCHES				Document No.	[REDACTED] INS-DS-006
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Tag	Service	P&ID	Range or set	System	JB	Area classification
SDV-102	OPSS shutdown valve, stroke 4 s or less	[REDACTED] PRO-DWG-107	Open / closed	Safety PLC	JB-130S	Class I, Division 2, Group D
ZSO-102	SDV-102 open limit switch (integral)	[REDACTED] PRO-DWG-107	None	Safety PLC	JB-130S	Class I, Division 2, Group D
ZSC-102	SDV-102 closed limit switch (integral)	[REDACTED] PRO-DWG-107	None	Safety PLC	JB-130S	Class I, Division 2, Group D
SDV-103	Station outlet shutdown valve	[REDACTED] PRO-DWG-108	Open / closed	Safety PLC	JB-130S	Class I, Division 2, Group D
ZSO-103	SDV-103 open limit switch (integral)	[REDACTED] PRO-DWG-108	None	Safety PLC	JB-130S	Class I, Division 2, Group D
ZSC-103	SDV-103 closed limit switch (integral)	[REDACTED] PRO-DWG-108	None	Safety PLC	JB-130S	Class I, Division 2, Group D

Table 1-4: Process Conditions

Tag	Normal P and T	Maximum operating P and T	Design P and T
SDV-101	1,050 psig / 70 °F	1,150 psig / 45 to 120 °F	1,440 psig / -20 to 150 °F
ZSO-101	1,050 psig / 70 °F	1,150 psig / 45 to 120 °F	1,440 psig / -20 to 150 °F
ZSC-101	1,050 psig / 70 °F	1,150 psig / 45 to 120 °F	1,440 psig / -20 to 150 °F
SDV-106	1,050 psig / 70 °F (liquid, gas on blow-by)	1,150 psig / 120 °F	1,440 psig / -20 to 150 °F
ZSC-106	1,050 psig / 70 °F	1,150 psig / 120 °F	1,440 psig / -20 to 150 °F
ZSO-103C	1,050 psig / 70 °F	1,150 psig / 45 to 120 °F	1,440 psig / -20 to 150 °F
SDV-141	Sample at probe-regulated pressure (Volume 2) / 70 °F	Probe regulator set (Volume 2)	Tubing rating 316 SS 3/8 in
ZSO-158C	1,050 psig / 70 °F	1,150 psig / 45 to 120 °F	1,440 psig / -20 to 150 °F
ZSC-158C	1,050 psig / 70 °F	1,150 psig / 45 to 120 °F	1,440 psig / -20 to 150 °F
SDV-165	1,050 psig / 70 °F	1,150 psig / 120 °F	1,440 psig / -20 to 150 °F
ZSC-165	1,050 psig / 70 °F	1,150 psig / 120 °F	1,440 psig / -20 to 150 °F
ZSO-131A	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
ZSO-131B	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
ZSO-132A	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
ZSO-132B	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
SDV-102	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
ZSO-102	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
ZSC-102	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
SDV-103	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F



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Tag	Normal P and T	Maximum operating P and T	Design P and T
ZSO-103	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F
ZSC-103	950 psig / 45 to 70 °F	1,180 psig (PIC-134 clamp); 1,225 psig OPSS trip / 19 to 120 °F	1,440 psig / -20 to 150 °F

ACTUATOR DUTY

Table 1-5 sets the stroke times and functions of each shutdown valve.

Table 1-5: Actuator Duty Schedule

Tag	Valve	Closing stroke	Opening stroke	Partial stroke test	Function	Local station
SDV-101	NPS 12 Class 600 full-bore ball	20 s maximum	60 s maximum	Optional	SIF-02, ESD	HS-101
SDV-102	NPS 12 Class 600 full-bore ball	4.0 s maximum	60 s maximum	Required, quarterly, through SY-102	SIF-01, ESD	HS-102, key reset
SDV-103	NPS 12 Class 600 full-bore ball	20 s maximum	60 s maximum	Optional	ESD	HS-103
SDV-106	NPS 2 Class 600 ball, electric spring-return actuator	5 s maximum	30 s maximum	No	SIF-03, SIF-04	HS-106
SDV-165	NPS 2 Class 600 ball	5 s maximum	30 s maximum	No	ESD	HS-165
SDV-141	3/8 in tube, 316 SS solenoid valve	1 s	1 s	No	Fire and gas action	None

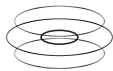
Note 1: All valves fail closed on spring. Every solenoid is 24 VDC and energized to hold the valve open.

SPECIFICATION

Table 1-6: Specification

Item	Requirement
Actuator type	Self-contained electro-hydraulic: integral electric motor and pump, reservoir, spring-return scotch-yoke quarter-turn, fail closed. No natural gas or instrument gas is used
Operation	The pump strokes the valve open against the spring and the energized dump solenoid holds it open. De-energizing the solenoid (safety output off, loss of 24 VDC or cable break) dumps the oil and the spring closes the valve
Pump motor power	SDV-101, 102 and 103: 480 V, 3 phase, 60 Hz. SDV-165: 120 VAC or 24 VDC. Loss of motor power does not affect closing. Feeders by Volume 6
SDV-106 actuator	Electric spring-return, fail closed, powered from the 120 VAC UPS (ELE-CAL-003); the motor opens the valve and charges the spring; the safety PLC opens a de-energize-to-trip interposing relay to close it
Dump solenoid	24 VDC, low power (8 W), Class H coil, continuous duty, on the UPS; one solenoid SY-102 on SDV-102 as specified in SAF-SRS-001, typical, vendor to confirm (HOLD H-15)
Closing stroke	Per Table 1-5, measured from solenoid de-energize to closed limit switch, at -5 °F ambient and 1,440 psig differential; hydraulic speed control adjustable and lockable
Torque sizing	Spring end torque at least 1.5 times the valve vendor's maximum breakaway torque at 1,440 psig differential after 10 years of spring relaxation; hydraulic torque at least 1.5 times breakaway at minimum pump pressure (HOLD H-15)



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Item	Requirement		
Partial stroke test, SDV-102	The safety PLC pulses SY-102 for a timed interval to move the valve 10 to 15 % and return; travel confirmed by a partial stroke limit switch or position transmitter; a genuine demand always overrides the test; quarterly interval as credited in SAF-CAL-001		
Limit switches	Open and closed: NAMUR inductive sensors or sealed reed switches in an explosion-proof switch box, two SPDT minimum, beacon indicator; set at 95 % open and 5 % closed		
Local control station	Explosion-proof station with CLOSE pushbutton (normally closed contact to the safety PLC) and RESET/OPEN-PERMIT pushbutton; HS-102 reset key operated. A valve reopens only when the safety PLC permits		
Manual override	Hydraulic hand pump for opening during commissioning, with lockable isolation		
Hazardous area rating	Class I, Division 1, Group D for motor, solenoids and switch box, T3 minimum; NEMA 4X		
Environmental	Hydraulic fluid with -40 °F pour point; reservoir heater with thermostat; spring coated against corrosion		
SIL capability	SDV-101, 102 and 106 actuator and solenoid assemblies IEC 61508 certified SIL 2 capable, with FMEDA and safety manual; failure rates to confirm SAF-CAL-001 (HOLD H-15)		
Diagnostics	Pump run-time monitor and low oil pressure or level switch to the RTU; stroke time recorded by the safety PLC on every trip and partial stroke		
SDV-141	Direct-acting two-way normally closed solenoid valve, 316 SS body, 3/8 in tube, Cv 0.3 minimum, 24 VDC, energize to open; closes on B-101 gas high-high or loss of power		
Position switches on manual valves	ZSO-131A/B, ZSO-132A/B, ZSO-158C and ZSC-158C: explosion-proof NAMUR inductive switches on bracket and target kit fitted to the gear operator, SPDT		
Tagging	Safety instrumented tags (PT-133A/B/C and all safety final elements): yellow stainless plate engraved with the tag and SIF number, and yellow cable markers. Other tags: 316 SS plate, 1/8 in engraved characters, wired to the instrument		
Inspection and testing	Factory functional test with the valve: five full strokes with stroke time at design differential, torque certificate, solenoid response and limit switch setting; SIL documentation		
Documentation	Dimensional drawing, wiring diagram, hazardous location certificate, calibration certificate, IEC 61508 certificate and safety manual for safety instrumented tags, installation and maintenance manual and spare parts list, all as searchable PDF; torque sizing sheet; hydraulic schematic		

OPEN ITEMS

Table 1-7: Open Items

HOLD	Item	Responsible party
H-15	Valve torques, actuator model, stroke times and failure rates	Valve and actuator vendors
TBV	Pump motor voltages and feeders	Volume 6

