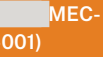
 TORUS	· Owner MONOLITHIC INSULATING JOINTS IJ-101 AND IJ-102			Document No.	MEC-DS-008
				Revision / Date	A · September 29, 2026
				Issue purpose	Issued for Review
MECHANICAL · MONOLITHIC INSULATING JOINTS IJ-101 AND IJ-102					
Rev.	Date	Revision description	Prepared	Reviewed	Approved
A	2026-09-29	Issued for Review			

NOTES

IJ-101 and IJ-102 are NPS 12 monolithic insulating joints. They electrically isolate the station from the Owner's upstream lateral (IJ-101) and from the outlet lateral and the receiving pipeline operator's trunkline (IJ-102), so that the station and the laterals can be cathodically protected independently per AMPP SP0169. The piping class is A6 of  PIP-SPC-001; the piping loads at the joints are reported in  MEC-CAL-004.

LOCATION AND SERVICE

Table 1: Joint Locations

Tag	Line	Location ()	Orientation	Exposure	Adjacent piping
IJ-101	12"-G-1001-A6, pig path	X 24.0 to 29.0 ft, Y 8 ft, centerline EL 1154.50	Horizontal, above grade at the top of the inlet riser	-20 to 150 °F	Upstream: Owner lateral riser (tie-in weld TI-01); downstream: pig path to PR-101
IJ-102	12"-G-1041-A6	X 220 ft, Y 150.0 to 155.0 ft, centerline EL 1153.62	Horizontal, above grade before the outlet riser	-20 to 150 °F	Downstream: 3R riser bend to the buried lateral 1042

IJ-101 is on the pig path, so it shall be full bore with no internal step larger than the pup bore tolerance.

DESIGN CALCULATION

The pups match the line: API 5L X52 PSL2, 12.750 in OD. The required wall follows the design formula with $F = 0.50$.

ASME B31.8, 841.1.1

$$t = \frac{PD}{2SF} = \frac{1,440 \times 12.750}{2 \times 52,000 \times 0.50} = 0.3531 \text{ in}$$

The 0.375 in pup gives a hoop stress of 24,480 psi (47.1 % SMYS) at 1,440 psig and 36,720 psi (70.6 % SMYS) at the 2,160 psig test. Its section properties are $A = 14.58 \text{ in}^2$, $I = 279.3 \text{ in}^4$ and $Z = 43.82 \text{ in}^3$.

TORUS specified the external design loads as the axial force and the bending moment that each produce a longitudinal stress of 72 % SMYS in the 0.375 in pipe, each acting together with 1,440 psig: $F = 0.72 \times 52,000 \times 14.58 = 546 \text{ kip}$ and $M = 0.72 \times 52,000 \times 43.82 = 137 \text{ kip-ft}$. This envelope was checked against the force in fully restrained buried pipe, the largest axial load a joint next to a buried line could see.

ASME B31.8, 833.2

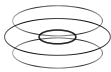
$$S_L = \nu S_h - E \alpha (T_2 - T_1)$$

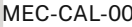
With $\nu = 0.30$, $E = 29.5 \times 10^6 \text{ psi}$ and $\alpha = 6.5 \times 10^{-6} / ^\circ\text{F}$, Table 2 gives the restrained force for each case. The downstream side of IJ-102 carries the 0.500 in lateral wall, so it was checked separately.

Table 2: Restrained Buried Pipe Axial Force

Case	Wall (in)	S_h (psi)	S_L (psi)	Axial force (kip)
Installed 60 °F, buried maximum 120 °F	0.375	24,480	-4,161	-60.7 (compression)

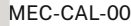


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Case	Wall (in)	S_h (psi)	S_L (psi)	Axial force (kip)	
Installed 60 °F, buried minimum 32 °F	0.375	24,480	12,713	185.3	
Installed 90 °F, buried minimum 32 °F	0.375	24,480	18,466	269.2	
Installed 90 °F, buried minimum 32 °F (IJ-102 downstream)	0.500	18,360	16,630	320.0	

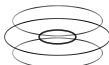
The 546 kip envelope exceeds the largest restrained force, 320 kip, by a factor of 1.7, and the actual loads from the stress screening in  MEC-CAL-004 are lower still.

DATASHEET

Table 3: Insulating Joint Data

Item	Requirement
Tags and quantity	IJ-101 and IJ-102, 2
Type	Monolithic weld-in insulating joint, factory assembled, not to be disassembled
Size and ends	NPS 12, butt weld both ends, ASME B16.25 bevel; pups API 5L X52 PSL2 with Charpy at -20 °F, 12 in minimum each side so field welds are clear of the insulating zone
Pup walls	IJ-101 both sides 0.375 in; IJ-102 upstream 0.375 in (line 1041), downstream 0.500 in (line 1042, )
Overall length	About 60 in, typical (HOLD H-15); isometrics  PIP-DWG-010 and  PIP-DWG-014 use 60 in
Design	1,440 psig at -20 to 150 °F (welded ends, no flange limit)
Design code	ASME BPVC Section VIII, Division 1, or ASME B31.8 with $F = 0.50$ on the body; body forging A694 F52 or A350 LF2 Class 1 with Charpy at -20 °F
External loads	546 kip axial and 137 kip-ft bending, each combined with 1,440 psig, without leakage or loss of dielectric properties; vendor to submit calculation or type test
Shop hydrostatic test	2,225 psig for 4 h minimum, above the field test of about 2,195 psig at the joint low points () MEC-CAL-003); vendor to confirm the joint accepts the station field test at up to 2,220 psig
Cyclic test	Pressure cycling type test 0 to 1,440 psig, 1,000 cycles minimum (typical)
Dielectric test	5 kV AC, 60 Hz, 1 min without breakdown, dry, before and after hydrostatic test
Insulation resistance	25 megohm minimum at 1,000 V DC, dry, before and after hydrostatic test
Internal lining	Dielectric epoxy, at least 6 in each side of the insulating element, 20 mil minimum, holiday tested; smooth bore (IJ-101 piggable)
Insulating materials	Glass-reinforced epoxy and elastomeric seals rated for dry natural gas and rapid gas decompression, -20 to 150 °F
External coating	Liquid epoxy or FBE over the whole joint, topcoat per  SPC-SPC-010 on site; no conductive paint across the insulating zone
Test leads	Two lugs each side; surge protection device across each joint by the cathodic protection and electrical designers, not in this purchase
Marking	Tag, flow direction, design pressure, test pressure, heat numbers, "DO NOT WELD BETWEEN MARKS"
Weight	750 lb each, typical (HOLD H-15)
Inspection	100 % RT of body welds, MT of pup welds, dimensional and bore check, records per 49 CFR 192



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INSTALLATION

Table 4: Installation Requirements

Item	Requirement
Welding	Weld in with the pups supported so no bending acts across the insulating element; field welds per  SPC-SPC-007 with 100 % RT
Electrical checks	Insulation resistance and potentials measured before and after welding and after the station hydrostatic test, per  SPC-SPC-015
Supports	Isolation pads at the supports each side of both joints ( SPC-SPC-004); no electrical bridging by supports, conduit, grounding or tubing across a joint

HOLDS

Table 5: Open Items

Hold	Item	Responsible
H-15	Vendor length, weight and load capacity	Vendor
H-16	Upstream lateral MAOP at IJ-101	Owner

Note 1: The solid-state decoupler bridging each joint and the test stations at IJ-101 and IJ-102 are specified in  CP-CAL-001, Cathodic Protection Design, and  CP-LST-001, CP Test Station Schedule.

