

OWNER

Structural Steel, Canopy and Pipe Supports



Document No.: [REDACTED] SPC-SPC-004

Rev. A, Issued for Review

Date: September 29, 2026

Project: [REDACTED] [REDACTED]



TORUS

[REDACTED] [REDACTED], [REDACTED] County, [REDACTED]

ISSUE SUMMARY AND APPROVAL

This page records each issue of SPC-SPC-004. The preparer, reviewer and approver sign for each revision.

Rev.	Date	Issue purpose	Description
A	2026-09-29	Issued for Review	First issue

Contributors

Rev.	Discipline	Prepared by	Reviewed by	Approved by
A	Specifications			

SECTION PC-SPC-004

STRUCTURAL STEEL, CANOPY AND PIPE SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes detailing, fabrication, galvanizing, delivery and erection of:

1. The SK-110 meter skid sunshade canopy, nominally 48 ft x 14 ft, with its columns, bracing, purlins and roof deck, where the skid vendor does not supply it.
2. Pipe supports for all above-grade piping, to PIP-DWG-006, Typical Pipe Support Details, MEC-CAL-005, Pipe Support Spans and Support Load Schedule, and PIP-DWG-001 to PIP-DWG-003, Piping General Arrangement, with the bottom of pipe 18 to 36 in above grade.
3. Platforms, stairs, ladders, crossovers and handrails at V-101, the PR-101 closure, the H-101 firebox and the control valve station, where shown.
4. Miscellaneous steel: instrument stands, cable tray supports, sign posts and bollards.
5. Pipe support components: shoes, guides, anchors, slide plates, wear pads, U-bolts, clamps and dielectric isolation pads. Welding to pressure piping is governed by SPC-SPC-007.
6. Field touch-up of galvanizing.

B. Related sections: SPC-SPC-003, Cast-in-Place Concrete (foundations and grout); SPC-SPC-006, Piping Fabrication and Installation; SPC-SPC-007, Welding; SPC-SPC-010, Above-Ground Painting (painting of items not galvanized); SPC-SPC-015, Cathodic Protection; SPC-SPC-017, Mechanical Equipment Setting.

C. Work by others:

1. Structural design, by the EOR in STR-CAL-003, Meter Skid Canopy Steel Design, and STR-CAL-002, Foundation Design; pipe support loads in MEC-CAL-004, Piping Flexibility and Stress Screening.
2. Steel integral to Owner-furnished skids (the SK-110 base, FG-101 and the H-101 saddles), by the vendors. The Contractor shall erect and bolt it under SPC-SPC-017. If the SK-110 vendor supplies the canopy, this section governs its field erection only.

1.02 REFERENCES

A. Codes and standards:

1. AISC 360-22, Specification for Structural Steel Buildings; AISC 303-22, Code of Standard Practice for Steel Buildings and Bridges; AISC 207-20, Certification Standard for Steel Fabrication and Erection.
2. RCSC Specification for Structural Joints Using High-Strength Bolts (2020).

3. AWS D1.1/D1.1M:2020, Structural Welding Code - Steel.
4. ASCE 7-22, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
5. ASTM A992, A36, A572 Grade 50, A500 Grade C, A53 Grade B; ASTM F3125 Grade A325; ASTM A563 Grade DH; ASTM F436; ASTM F1554.
6. ASTM A123, A153 and A780 (galvanizing and its repair); ASTM A384 and A385 (warpage and fabrication for galvanizing); ASTM A653 and A792 (roof deck sheet).
7. NAAMM MBG 531, Metal Bar Grating Manual.
8. MSS SP-58-2018, Pipe Hangers and Supports, which now incorporates the former MSS SP-69.
9. ASME B31.8-2022, paragraphs 834 (supports and anchorage for exposed piping) and 835 (anchorage for buried piping).
10. 29 CFR 1910 Subpart D, Walking-Working Surfaces; 29 CFR 1926 Subparts M, R and X.

B. Project documents: GEN-RPT-002, Design Decisions Register; GEN-DB-001, Basis of Design (wind 108 mph, Exposure C, HOLD H-06); STR-CAL-003, Meter Skid Canopy Steel Design; PIP-DWG-006 and MEC-CAL-005, pipe supports; MEC-CAL-004, Piping Flexibility and Stress Screening; PIP-DWG-001 to PIP-DWG-003, Piping General Arrangement; MEC-DS-005, VS-101 Vent Stack; MEA-CAL-001, Ultrasonic Meter Sizing and Meter Run Design; CP-CAL-001, Cathodic Protection Design; ELE-CAL-005 and ELE-DWG-004, Grounding; ELE-CAL-006, Lightning Risk Assessment and Protection Design.

1.03 DEFINITIONS

- A. Rest: a support that restrains downward movement only, with a shoe and slide plate.
- B. Guide: a support that restrains lateral movement and allows axial movement.
- C. Line stop: a support that restrains axial movement.
- D. Anchor: a support that restrains all translations, and rotations where shown.
- E. Adjustable stand: a threaded pipe stand with a saddle, for small lines and valves.
- F. Isolation pad: a non-conductive pad between pipe and support that prevents metallic contact.

1.04 SUBMITTALS

- A. The Contractor shall submit the items in Table 1-1.

Table 1-1: Submittal Schedule

No.	Submittal	Timing	Action
004-01	Fabricator and erector qualifications: AISC certification under AISC 207, or an equivalent quality program acceptable to the Owner	With the bid, confirmed 14 days after award	Owner approval

No.	Submittal	Timing	Action
004-02	Shop and erection drawings and connection details. Connections marked “by fabricator” shall be designed by the fabricator’s professional engineer, with sealed calculations	21 days before fabrication	EOR approval
004-03	Pipe support schedule and details (type, tag, line number, elevation, isolation pad type) cross-referenced to PIP-DWG-006	21 days before fabrication	EOR approval
004-04	Welding procedure specifications (prequalified or qualified under AWS D1.1) and welder qualification records	14 days before welding	Owner approval
004-05	Mill certificates for all structural steel and bolts, traceable to heat	At delivery	Owner review
004-06	Galvanizing certificates with coating thickness	At delivery	Owner review
004-07	Product data for isolation pads, slide plates and U-bolt liners: dielectric strength, compressive strength, temperature range, friction coefficient	21 days before fabrication	EOR approval
004-08	Erection plan: sequence, temporary bracing and lifting (critical lifts under SPC-SPC-001)	14 days before erection	Owner review
004-09	Bolt pretension verification records, where pretensioned joints are specified	Within 48 hours	Owner review
004-10	As-built survey of pipe support top-of-steel elevations and locations	Before pipe is placed on supports	EOR review
004-11	Roof deck and fastener data for the canopy	21 days before fabrication	EOR approval

1.05 QUALITY ASSURANCE

- A. The fabricator and erector shall be certified under AISC 207 or shall operate an equivalent quality program accepted by the Owner.
- B. Welders shall be qualified under AWS D1.1 Clause 6 for structural welds, and under SPC-SPC-007 for any weld to pressure piping.
- C. Hold and witness points are listed in 3.07 and compiled in SPC-SPC-019.

1.06 MEASUREMENT AND PAYMENT

- A. Pay items are listed in Table 1-2. Miscellaneous steel (instrument stands, bollards, sign posts and cable tray supports) is incidental to the pay item of the system it serves.

Table 1-2: Structural Steel Pay Items

Pay item	Unit	Measurement and inclusions	Exclusions
04.01 Meter skid canopy	Lump sum	Detailing, fabrication, galvanizing, delivery and erection of the complete canopy, including roof deck and grounding connections	Canopy foundations (03.01); vendor-supplied canopy materials (erection only is included)
04.02 Pipe supports	Each, by type	Each support of types PS-R1, PS-R2, PS-G1, PS-LS1, PS-A1, PS-AS1, PS-U1 and PS-T1 complete, including shoe, isolation pad, slide plates, guides, U-bolts, and wear pad welding and NDE where welded	Support foundations (03.02)
04.03 Platforms, stairs and crossovers	Lump sum	Complete, including grating, handrails, ladders and gates	

PART 2 PRODUCTS

2.01 STRUCTURAL MATERIALS

A. Materials shall be Contractor-furnished, except a canopy furnished by the SK-110 vendor, and shall meet Table 2-1.

Table 2-1: Structural Materials

Item	Material
W-shapes	ASTM A992, Fy 50 ksi
Plates, angles, channels and bars	ASTM A36, or A572 Grade 50 where shown
Hollow structural sections	ASTM A500 Grade C
Structural pipe for support posts	ASTM A53 Grade B or API 5L Grade B, new. Reclaimed line pipe only with EOR approval and material test reports
Bolts	ASTM F3125 Grade A325 Type 1, hot-dip galvanized, with galvanized A563 DH nuts and F436 washers; 5/8 in minimum diameter, 3/4 in for primary connections
Canopy roof deck	22 gauge minimum, galvanized G90 (A653) or AZ55 (A792), profile per STR-CAL-003, fastened to the manufacturer's uplift schedule for 108 mph, Exposure C
Grating	Galvanized welded steel bar grating, 1-1/4 x 3/16 in bearing bars at 1-3/16 in centers (19-W-4), serrated, banded, with at least four saddle clips per panel
Stair treads	Grating with abrasive nosing, 1-1/4 in bearing bars, to MBG 531
Handrail	1-1/2 in Schedule 40 pipe; top rail 42 ± 3 in, midrail 21 in, toe plate 4 in; 200 lb in any direction (29 CFR 1910.29)

2.02 PIPE SUPPORT COMPONENTS

- A. Slide plates shall be 1/8 in virgin PTFE bonded to a steel backing, running against 10 gauge 304 stainless steel, with a design friction coefficient of 0.1. Graphite-impregnated bronze shall be used above 250 °F; none is expected.
- B. Isolation pads between pipe and support shall be fiberglass-reinforced composite or an equivalent non-conductive, non-absorbing material with a dielectric strength of at least 300 V/mil, water absorption of 0.5 % or less, compressive strength of at least 30,000 psi, a service range of -20 to 180 °F and UV resistance. Pads shall be contoured to the pipe outside diameter, at least 1/4 in thick, and extend at least 1 in beyond the support contact on each side.
- C. U-bolts shall be ASTM A36 or A307 rod, hot-dip galvanized, with a factory-applied non-conductive PVC or nylon sleeve, an isolation pad under the pipe, and double nuts.
- D. Welded wear pads shall be plate of the same material and SMYS as the run pipe (PIP-SPC-001), as 180° or 120° saddles, with the thickness and length of PIP-DWG-006 and a 1/4 in NPT vent hole.
- E. Clamp-on wear saddles, composite or steel with an elastomeric or composite liner, are preferred to welded pads wherever the stress analysis allows, because they avoid welding on pressure piping.

PART 3 EXECUTION

3.01 FABRICATION

- A. Steel shall be fabricated to AISC 360 and AISC 303. Cut edges shall be free of notches deeper than 3/16 in and ground smooth. Thermal cutting is allowed, with re-entrant corners radiused at least 1/2 in.
- B. Holes shall be drilled, or punched in material no thicker than the bolt diameter plus 1/8 in. Bolt holes shall not be thermally cut. Standard holes shall be 1/16 in larger than the bolt unless slotted holes are shown.
- C. Contact surfaces exposed to weather shall be seal welded or gapped for galvanizing drainage, and hollow members shall be vented and drained, under ASTM A385, with locations agreed with the galvanizer.
- D. Welding shall follow AWS D1.1 with a prequalified or qualified procedure. No welding shall be done after galvanizing without EOR approval and A780 repair.
- E. Each piece shall carry an erection mark matching the erection drawings, applied after galvanizing, and each pipe support its support tag.

3.02 GALVANIZING

- A. All structural steel, pipe supports, grating, handrail and hardware shall be hot-dip galvanized after fabrication, fabrications to ASTM A123 and bolts and hardware to ASTM A153 or F2329. For structural shapes and plate 1/4 in and thicker, the A123 coating grade is 100 (3.9 mils).
- B. Uncoated or damaged areas may be repaired only within the A123 limits: no single area wider than 1 in, and a total no greater than 0.5 % of the accessible surface or 36 in² per ton, whichever is less. Repair shall be by zinc-rich paint of at least 65 % zinc by weight in the dry film, or zinc-based solder, under ASTM A780, to a thickness 50 % greater than the required galvanizing thickness but not more than 4.0 mils for paint. Larger areas shall be rejected and regalvanized.
- C. Galvanized steel shall not be placed in contact with soil. Posts in soil shall be encased in concrete to 6 in above grade.

3.03 ERECTION

- A. Steel shall be erected to the approved erection plan and 29 CFR 1926 Subpart R, with temporary bracing kept until permanent bracing and connections are complete.
- B. Base plates shall be set on leveling nuts or shims and grouted under SPC-SPC-003 after alignment is accepted.
- C. Bolted joints shall be snug-tight to RCSC unless the drawings designate pretensioned or slip-critical joints. Pretensioned joints shall be installed by the turn-of-nut method of RCSC Table 8.2, with pre-installation verification in a tension calibrator of three bolts of each lot each day.
- D. Before field welding to galvanized steel, zinc shall be removed 1 to 2 in back from the weld, and the area repaired under ASTM A780 after welding. Ventilation and fume control shall be provided for zinc fumes.
- E. Erection shall meet the tolerances of Table 3-1, based on AISC 303 Section 7.13 and tightened for pipe supports.

Table 3-1: Erection Tolerances

Item	Tolerance
Column plumbness	1:500, not more than 1 in over the canopy height
Column base location	±1/4 in from grid
Canopy beam elevation	±1/4 in
Pipe support top of steel at the bearing point	+0 in, -1/4 in; galvanized steel shims up to 1/4 in allowed, beyond that a nonconformance
Pipe support location along the pipe axis	±1 in; guides and anchors ±1/2 in
Pipe support location transverse to the pipe	±1/4 in
Guide clearance, each side	Design gap ±1/16 in (typically 1/16 to 1/8 in per PIP-DWG-006)

Item	Tolerance
Platform level	1/4 in in 10 ft
Stair riser uniformity	1/4 in maximum variation in a flight

3.04 PIPE SUPPORTS

A. Supports shall be installed before the pipe is placed, and pipe shall not be sprung or forced to meet them. Temporary fabrication supports shall be removed before the hydrostatic test only when the permanent supports are complete and accepted.

B. Support types shall be the standard details of PIP-DWG-006, summarized in Table 3-2.

Table 3-2: Pipe Support Types

Type	Description	Typical use
PS-R1	Rest: welded or clamped shoe on a steel beam or concrete pedestal with PTFE and stainless slide plate	NPS 8 to 12 headers and runs
PS-R2	Rest: pipe on an isolation pad directly on steel	NPS 2 to 6
PS-G1	Guide: shoe with angle guides both sides at the design gap	Straight runs per the stress analysis
PS-LS1	Line stop: shoe with stop lugs welded to the shoe, not the pipe	Meter runs, to hold meter tube alignment, per MEC-CAL-004
PS-A1	Anchor: clamped or welded, per MEC-CAL-004	Riser bases and points next to the insulating joints
PS-AS1	Adjustable pipe stand with saddle and isolation pad	Valves NPS 2 to 12, low supports, meter tube supports where the vendor permits
PS-U1	U-bolt with non-conductive sleeve and pad	NPS 2 and smaller
PS-T1	Trapeze or small-bore rack	Instrument, fuel gas and drain small-bore piping

C. Supports on the SK-110 meter runs shall follow the skid vendor's drawings. No support shall be added, removed or shimmed on the meter tubes without the approval of the vendor and the measurement discipline, because support changes alter meter tube alignment and the strain on the ultrasonic meters (MEA-CAL-001).

D. Every pipe-to-steel and pipe-to-concrete contact on process piping between IJ-101 and IJ-102 shall have an isolation pad or non-conductive sleeve, unless CP-CAL-001 states otherwise, for two reasons: a grounded support in metallic contact would short the cathodically protected piping to ground and drain the protection current (SPC-SPC-015), and the pipe-to-support interface is a crevice where corrosion concentrates. Piping shall be grounded only through the designated bonds and the insulating joint surge protection of ELE-DWG-004.

E. The stainless steel vent piping (lines 1070 to 1077, 1160, 1161, 1170, the vent laterals and VS-101) shall not contact carbon steel or galvanized steel. It shall be supported on non-metallic isolation

pads, sleeved U-bolts with stainless hardware, or stainless shoes and clamps. Carbon steel attachments shall not be welded to stainless pipe, and zinc shall not contact stainless steel, because zinc can embrittle stainless steel if the joint is later heated. Supports for VS-101, NPS 8 x 25 ft with helical strakes on the top 8 ft, shall follow MEC-DS-005.

- F. Wear pads shall be welded to pressure piping only where shown, by qualified welders under SPC-SPC-007 during fabrication, examined by magnetic particle testing under SPC-SPC-008, and included in the hydrostatic test. No welding shall be done on piping after its hydrostatic test.
- G. Slide plates shall be installed with the PTFE face up on the support and the stainless face down on the shoe, clean, and centered so that the shoe stays on the PTFE through the full calculated thermal movement plus 1 in.
- H. Spring or special supports are not expected. If MEC-CAL-004 requires them, they shall be installed with travel stops locked until after the hydrostatic test, then set to their cold setting.
- I. Supports are designed for the water-filled weight of the piping. Temporary supports shall be added only where the hydrostatic test procedure of SPC-SPC-011 requires them.

3.05 CANOPY

- A. The canopy over SK-110 shall be built to STR-CAL-003 or the vendor's design, with the clear height and removable roof panels or open sides shown, so that a crane can lift out a meter spool or ultrasonic meter.
- B. Roof deck shall be fastened to the approved uplift schedule, with edge and corner zones at the increased density required for 108 mph, Exposure C (HOLD H-06).
- C. The canopy shall be bonded to the station grounding system under ELE-DWG-004, with lightning protection under ELE-CAL-006.
- D. Canopy columns shall not bear on the meter skid unless the skid vendor designed the skid for them.

3.06 PLATFORMS, STAIRS AND LADDERS

- A. Platforms, stairs and ladders shall comply with 29 CFR 1910 Subpart D. Stairs shall be at 30 to 50°, with uniform risers of 6-1/2 to 9-1/2 in, treads at least 9-1/2 in deep and a width of at least 22 in, with handrails on both sides where the stair is 44 in wide or more.
- B. Fixed ladders longer than 24 ft shall have a ladder safety system under 29 CFR 1910.28; none is expected. Ladder openings shall have self-closing gates.

3.07 FIELD QUALITY CONTROL

- A. The Contractor shall perform the following inspections and tests:
 - 1. Visual inspection of 100 % of welds to AWS D1.1 Table 8.1.
 - 2. Magnetic particle testing of 10 % of fillet welds on primary canopy connections, and ultrasonic testing of 100 % of complete joint penetration welds, if any.

3. Galvanizing thickness by magnetic gauge (ASTM E376 or D7091), five readings per member on 10 % of the members of each lot.
4. A check of 10 % of snug-tight bolts, and visual check of the turn-of-nut match marks on 100 % of pretensioned joints.
5. Isolation of each support on protected piping, before the hydrostatic test and before gas-in, by measuring the resistance between pipe and support steel with a 500 V or 1,000 V insulation tester, or by the isolation test of SPC-SPC-015, recorded on QF-04-04.
6. Survey of all pipe support top-of-steel elevations before pipe is placed.

B. The hold and witness points in Table 3-3 apply.

Table 3-3: Hold and Witness Points

ID	Activity	C	O	E	W	Record
HP-04-01	Shop drawings and pipe support schedule approved before fabrication	P	R	H	-	Submittals 004-02, 004-03
WP-04-02	Shop inspection of fabricated steel before galvanizing (first article of each support type)	P	W	-	-	QF-04-01 shop inspection
WP-04-03	Receiving inspection of galvanized steel for coating, damage and marks	P	W	-	-	QF-04-02
HP-04-04	Pipe support elevation and location survey accepted before pipe is set on supports	P	H	R	-	QF-04-03 support survey
HP-04-05	Isolation verified at all pipe supports on protected piping before the hydrostatic test	P	H	-	-	QF-04-04 isolation check
WP-04-06	Canopy erection complete: bolting and plumbness	P	W	-	-	QF-04-05 erection check
HP-04-07	Final pipe support walkdown after the hydrostatic test: shoes on slide plates, guide gaps, no pipe resting on unintended steel, spring settings if any	P	H	R	-	QF-04-06 support walkdown

3.08 ACCEPTANCE

A. The work is accepted when it meets Table 3-4.

Table 3-4: Acceptance Criteria

Parameter	Criterion	Method
Weld quality	AWS D1.1 visual and NDE acceptance criteria	Visual, magnetic particle, ultrasonic
Galvanizing thickness	ASTM A123 Table 1 minimum for the material category and thickness, as an average of readings	Magnetic gauge
Galvanizing repair	ASTM A780; thickness 1.5 times the requirement, 4.0 mils maximum for paint	Gauge
Erection	Within Table 3-1	Survey

Parameter	Criterion	Method
Isolation	1 megohm or more pipe to support, or a pass on the isolation test of SPC-SPC-015	Insulation tester
Slide plate engagement	Shoe fully on the PTFE at the installed position, with at least the calculated travel plus 1 in remaining	Measurement
Handrail	42 ± 3 in high; 200 lb test on a 5 % sample of posts	Measurement and load
Pretensioned bolts	Match marks show the required rotation; verification test passed	Visual; tension calibrator

END OF SECTION

