People first. Safety always.

Document Title:

38 kV Transmission Lines Custom Steel Poles Specifications

Document Type:	Document No.:
50 - MATERIAL SPECIFICATION	**4750.50.331**

Department:	Version:	Effective Date:
Transmission Engineering	V03	03/06/2026

For other, specify here

Shared document with: Select one

Select the Departments impacted by the document (If apply)

For other, specify here

Author
Oscar E Venegas Hermina, P.E. (Lic. #23125)
Supervisor, Transmission Engineering Standards

Reviewer
Jose M Castillo Colon, P.E. (Lic. #28784)
General Engineer, Transmission Engineering Standards

Approver
Reinaldo Baretty, P.E. (Lic. # 16712)
Director, System Standards and Engineering Records

Signature and Date: 03/06/2026

Signature and Date: 03/06/2026
Jose Castillo Colon (Mar 6, 2026 12:50:57 AST)

Signature and Date: 03/06/2026

Management Approval (If apply)

Approver
Name, Position

Signature and Date:

8

Related/Referenced Documents

4751.07.001 LUMA Transmission Design Criteria Document & Manual

Version History

Version	Date	Revision
01	10/06/2023	First Version Issue
02	09/11/2025	Changes in document format to meet required format from 4700.080 V04 Engineering Standards and Specifications Cover Page Template. The document was assigned a new document number by Engineering Records. Pole lengths were changed for guy support / embedded steel poles.

03	03/06/2026	• Clarified details for design and fabrication on poles thought the document. • Clarified on delivery requirements to LUMA warehouse or designated site by LUMA. • Actualized the owner for review and approval of pole design: Transmission Engineering Standards in LUMA. • Removed 30', 36', 40', 41', 45' steel poles from Section 11. • Removed steel pole layouts and consolidated pole loading from Section 11.4 in table format in Section 11.3. • Removed Section 11.4.

Contents

1. Scope

This specification covers the minimum requirements of LUMA for design, materials, fabrication, welding, galvanizing, inspection, and shipment of steel poles to be used in the construction of 38 kV transmission lines.

The requirements of this specification are to be considered additive to other requirements found in related industry standards such as ASTM, ANSI, NESC and ASCE among others.

The reference to specifications of organizations such as ASTM, ISO, EN (European Norm) together with drawings and loading diagrams shall be considered part of this specification. Referenced specifications shall be the latest edition, unless specially stated otherwise. Manufacturers must be ISO-9001 certified.

All requirements of this specification and the related industry standards shall be followed unless specific written exception has been submitted for consideration and approval by LUMA. The approval of the document for such exceptions shall be obtained prior to the start of fabrication and shall become permanent part of the manufacturer's project files.

LUMA will provide the manufacturer with the structure loads, dimensional requirements and weight limitations. The manufacturer will reply with design calculations, pricing, fabrication, installation drawings and on acceptance of these terms, manufacturer shall provide the proposed poles, anchor bolts and associated hardware.

2. Design Fabrication Standards

Design, materials and fabrication of steel poles shall be in accordance with latest edition of international Codes and Standards listed hereafter:

ASCE /SEI 48-19	:	Design of Steel Transmission Pole Structures
ASTM A6	:	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A572	:	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM F 3125	:	Standard Specification for High Strength Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength
ASTM A354	:	Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
ASTM A123	:	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	:	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ATM A385	:	Practice for Providing High Quality Zin Coating (Hot-Dip
ASTM A615	:	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A780	:	“Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
AWS D1.1	:	Structural welding code – Steel
EN 10025	:	Hot rolled products of structural steels
EN 10149	:	Hot-rolled flat products made of high yield strength for cold forming
EN 10080	:	Steel for the reinforcement of concrete

ISO 898	:	Mechanical properties of fasteners made of carbon steel and alloy steel
EN ISO 10684	:	Fasteners – Hot dip galvanized coatings
EN ISO 15614	:	Specification and qualification of welding procedures for metallic materials
ASNT	:	American Society of Non-destructive Testing
EN ISO 9606	:	Qualification Testing of Welders – Fusion Welding

3. Material

3.1. General

All material supplied shall conform to ASTM Specification A-6 “General Requirements for Delivery of Rolled Steel Poles, Shapes, Sheet Piling and Bars for Structural Use” or equivalent EN standard, unless herein modified.

3.2. Poles, Arms, attachment Plates and Brackets

The material shall conform to ASTM A-572, S460M EN 10.025-4 or S500MC EN 10149. The steel shaft shall be high strength, low alloy, structural steel, Grade 65 (min.) or equivalent EN standard.

Silicon content in high strength steel shall be controlled to produce a galvanized finish that is uniform in appearance and without dark discolorations. The steel used for the pole shaft and arms shall have a silicon content less than 0.06%.

All structural plate material, and weld consumables furnished shall be mill-certified.

The tensile strength of any steel that is welded shall be limited to the requirements of ASTM A6.

3.3. Base Plates (when required)

The base plate material shall have minimum yield strength equal to or greater than the value used in design calculations. Material shall conform to ASTM A-572 or EN10025.

The tensile strength of any steel that is welded shall be limited to the requirements of ASTM A6.

3.4. Anchor Bolts (when required)

Anchor bolts shall be used in self-supported structures.

The supplier shall furnish all the anchor bolts, nuts and assembly templates/rings for the pole on order.

Anchor bolts cages shall be delivered un-assembled.

Material shall conform to ASTM A-615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement" or ASTM F1554 with a minimum yield strength of 75,000 psi or EN 10080, and at minimum shall be mill certified to meet the requirements of 15 ft-lbs (20J) absorb energy of impact at a temperature of @ -20°F (-29° C) in the longitudinal direction using the Charpy V-notch Test described in ASTM A370 and A673.

The diameter of the bar shall be 2-1/4" (#18 J) and round enough so that a fuller thread can be cut or rolled. Each bolt shall be furnished with three (3) heavy hex nuts conforming to ASTM A563 DH or A194 2H, galvanized in accordance with ASTM A153 and tapped oversize per ASTM A563.

Anchor bolts shall have a minimum threaded length of 12 inches or equal to the sum of the base plate thickness plus the depth of two nuts (one below the plate one on top) plus one bolt diameter plus (4) inches, whichever is larger. The threading of anchor bolts shall be in accordance with ANSI-UNC-2A classification. The thread area plus 6 inches of the top of the bolts shall be partial hot deep galvanized according to ASTM A-153 or EN ISO 10684.

For the purpose of alignment, the supplier shall furnish steel templates, one (1) top and one (1) bottom for each pole, suitable for the installation of the anchor bolts in the foundation.

The bottom of the anchor bolts shall have a threaded length sufficient for attaching the bottom template with the corresponding nuts.

3.5. Fasteners

All connection bolts shall be galvanized hex-head conforming ASTM F3125 or A354 Grade BC or ISO 898. Fabricated fasteners shall conform to ASTM F 1554 Grade 105. Bolts shall hot dipped galvanized to ASTM A-153 or EN ISO 10684. Nuts shall conform to ASTM A563 Grade DH and tapped oversize in conformance with A563 or ISO 898 for galvanized finishes.

The Supplier shall furnish all the required bolts, nuts, and washers (if required) for the installation of all parts of the steel poles, plus 5 percent extra.

4. Design Requirements

4.1. Language and Units

- All correspondence, literature, drawings, and markings shall be in the English language.
- Dimensions and tolerances shall conform to ANSI Y14.5M. Dimensions shall be in the U.S. customary units. If fabricating in SI units, both U.S. and SI units shall be shown on the drawings. Conversion dimensions shall be 1 inch = 25.4 mm. Conversion dimensions may be rounded off to the nearest 1/32 of an inch (0.794 mm), provided the rounded dimension falls within the design limits.

4.2. Design Code

The structures shall be designed in accordance with SEI/ASCE-48-19, Design of Steel Transmission Pole Structures.

4.3. Analysis Method

The pole designs shall include second order (non-linear) analysis including structure loadings resulting from displacements due to deflection.

4.4. Pole Cross-section

The pole shaft shall have a dodecagonal shape.

4.5. Helicopter Lift Requirement

Helicopter lifting provision shall be included in the design for each pole section. The overhead ground wire "thru-vang provision" or similar connection points are acceptable for this purpose, given it is structurally checked.

4.6. Design Limitations

- Maximum base diameter limit, see section 11.2 Steel Pole Summary Table.
- Maximum section length limit is 50 feet.
- Maximum number of sections allowed shall be 4.
- Minimum plate thickness for all pole shaft components shall be 3/16 inch.

4.7. Deflection Requirements

Deflections shall be limited to 8 % of the above ground height under intact Hurricane loading case or the minimum bending moment loading case as specified in section 11.3.

Arms shall be designed so that the end of the arm is at the specified height and a positive inclination under a loading of initial conductor tension, 80°F, no wind, and no overload factors. Arms shall not deflect vertically more than 12 inches at the end of the arm under any loading condition.

Camber: Shall not be used unless specified on the LUMA structure drawings.

4.8. Connection Designs

The connections for vangs, brackets, or stiffeners attached to the pole shaft, shall be designed to distribute the loads sufficiently to protect the wall of the pole from local buckling. Through-thickness stresses shall be limited to 36 ksi for all grades of steel per ASCE-48, section 6.3.3.1.

The w/t ratio limit shall not exceed 35.

All multi-section poles shall be slip-jointed, or flanged connected as required by design.

Slip jointed connections are limited by 100 kips design axial load in compression.

Flanged connections shall be used when the pole is subject to uplift during loading or where the design axial loads exceed 100 kips in compression.

The edge of each flange permanently match-marked to indicate alignment during structure erection.

Any alternate connection method shall be pre-approved by the LUMA Transmission Engineering Standards.

The connections of poles designed using a single applied load at 2 feet from the top of the pole shall be specified in section 11.2 Steel Pole Summary Table, by LUMA. Where design tensions are not identified, the conductor ring plates must be designed for a maximum tension of 15 kips and the thickness shall not exceed 3/4". Where design tensions are not identified, the overhead ground wire pole cap ring plate must be designed for a maximum tension of 12 kips and the thickness shall not exceed ½ inch. Refer to section 12.0 of this document for additional details.

Base plate and anchor bolt designs shall match the pole base cross section's full (100%) moment capacity. All arm connections must be designed to resist 100% moment capacity of the arm shaft at the bracket connection along each of following two axis: vertical and then longitudinal.

4.9. Design Calculations

Manufacturer shall submit design calculations and data with the quotation for each pole type and height. Design calculations shall contain information specified below:

- A summary page including pole top and bottom diameter, height and length, weights, file name, weight, anchor bolt circle diameter and quantity of bolts, length of bolts, base reactions.
- The controlling loads and loading case.
- General dimensions, including butt and tip diameters, wall thickness, taper, weight of the pole, and the center of gravity.

- Drawing showing structure configuration, dimensions, weights, etc. and stress diagrams or computer printout of maximum loading, indicating the loading condition that controls.
- Ultimate moment, maximum stress, and the neutral axis in each ten (10) foot section of the pole, at the attachment points, and at the ground line.
- Maximum design unit stresses in compression, tension, shear, bearing, and bending for pole, arms, base plate, flange plate, anchor bolts, and connection bolts. Indicate limiting slenderness ratio values used in design.
- Maximum ground line reactions - overturning moment, horizontal shear, and vertical loading - uplift or bearing.
- Maximum and normal deflection for each load case.
- Guy tensions with overload factors.
- Maximum stresses of all arms, braces, cross arms, and their connections.
- Wind load shall be applied in a direction that produces the worst case loading on the structure.
- Pole shall be designed to withstand all shipping and construction loads (including lifting loads). Pole lifting requirements shall be furnished by the manufacturer and pre-approved by LUMA.

Manufacturer shall submit PLS-POLE model design files for each structure type and height with the quotation.

Final design calculations shall be submitted for approval before fabrication commences, together with the shop drawings. After approval one electronic file with the drawings in AutoCAD and PDF shall be sent for LUMA's files. All drawings shall include a unique identifying order number. Final design calculations and input files shall be included on an electronic file for LUMA's use.

The manufacturer is responsible for the design.

4.10. Vibration Consideration

The manufacturer shall evaluate and take the necessary measures to minimize the potential for vibrations caused by wind-induced vortex shedding of structure members. The manufacturer shall provide dampers or spoilers as required to eliminate vibrations or specific recommendation for avoidance of vibration that can lead to fatigue.

4.11. Anchor Bolt Design

The length of the anchor bolts shall be the minimum length required to develop the necessary bond in concrete per the ASCE 48-19. Only 1 anchor bolt length shall be used on each pole. All anchor bolts shall be the same length within each anchor bolt cage.

The concrete to be used on foundations shall have a minimum compressive strength of 4000 psi at 28 days. To be used as general reference.

The bottom template shall be kept to a minimum size and used only for alignment purposes.

Anchor bolts shall be in accordance with requirements of ASCE-48-19, Section 9.3.

Anchor bolts shall be located equally spaced in a circle about the center of the structure, unless otherwise approved by the LUMA Transmission Engineering Standards.

No welding is permitted on anchor bolts or templates.

Anchor bolt design shall account for an allowable total foundation rotation of 2°.

5. Fabrication

5.1. General

Fabrication of steel poles, anchor bolts, bolts, nuts, and hardware shall conform to the applicable standards of the ASTM, AISC, AWS, NEMA and ASCE/SEI 48 (latest edition) or EN equivalent except as otherwise specified herein.

All fabrication and galvanizing facilities utilized for LUMA Transmission pole structures shall be qualified by the LUMA Transmission Standards team prior to fabricating.

LUMA or its representative shall have access to the manufacturing plant for inspection.

LUMA shall be immediately notified by the manufacturer of any changes to the notification schedule or manufacturing and galvanizing facilities.

5.2. Fabrication Drawings

After a PURCHASE ORDER has been issued and before fabricating any poles, manufacturer must furnish "For Review", fabrication drawings of the poles containing all the information specified in this section. Poles shall not be manufactured until the fabrication drawings have been reviewed and comments submitted in writing by the LUMA Transmission Engineering Standards.

The drawings shall include dimensions for all attachments (vangs, brackets, jacking nuts, climbing details, etc.), their referenced orientation and location on the structure.

Arms shall use bolted connections to the pole.

Overhead ground wire and insulator attachments on the pole shaft or its arms shall be shown on drawings.

All connecting parts shall be marked for identification with a welded plate and these markings shall be clearly shown on approval fabrication drawings.

The fabrication drawings shall also include the following:

- Name plate information.
- Location, type and size of welds and bolts.
- Clearly distinguish between shop and field welds and bolts.
- Clearly identify the quantity and location of long seam welds.
- Pole layout and details showing hole locations, orientation, dimensions, size, and positioning.

- Attachment and joist points
- Pole specification data including reference drawing number, working and ultimate moments, C.G., I.D. and O.D. at the top and bottom, and tip and butt thickness at top and bottom.
- Shop detail drawings applicable to design and/or detail (and to changes when fabricating to LUMA details) are to be forwarded to the LUMA transmission engineer in Adobe PDF or CAD/DXF format for approval prior to fabrication. Drawings shall include the following general assembly information:
    - Weight schedule – basic structures and sections
    - Bill of material
    - Member mark numbers
    - Member dimension
    - Member quantities
    - Bolt and nut size, length, and quantities
    - Anchor bolt details and setting data
    - Ground-line reactions
    - Grounding Connections or Loading Criteria

Upon approval by LUMA, the manufacturer shall provide final sealed drawings on LUMA's title block with drawing numbers furnished by LUMA.

The thickness of any structural member shall not be less than 3/16 inch unless otherwise specified.

5.3. Welding

All welding shall be performed by welders, welding operators, and tackers certified for the type of welding to be performed.

All welding shall be performed by certified operators using procedures in accordance with Section 5, AWS D1.1 or equivalent EN ISO 15614 and EN ISO 9606.

All welder performance certification records, weld procedures specifications, and weld procedure certifications records shall be developed and properly maintained in accordance with the applicable requirements of AWS D1.1 Structural Welding Code – Steel.

Records of welding procedure and welding operator test results shall be kept for five years by the Supplier and shall be available for review by LUMA.

Longitudinal seams in the female slip-joint area and Base plate shall be complete penetration welds. Longitudinal seams in other areas shall be checked versus resulting hoop stresses generated in these areas.

Arm bracket joints, and post-insulator bracket joints welds shall be full penetration or equivalent ninety percent partial penetration with a fillet overlay to develop the full strength of the arm shaft. The post insulator bracket welds shall be designated to carry the specified loading requirement without any permanent damage.

Backing bars, when utilized, shall follow the requirements of AWS D1.1 and be seal-welded to the pole shaft. The butt joints of backing bars shall be 100% penetration welds and shall be made to occur in the middle of a flat rather than the bend lines of pole shaft.

Base plate, flange plate, and arm shaft to bracket joints shall be complete joint penetration welds. All flange connections shall be shop fitted and preassembled after fabrication of pole to assure proper fit and alignment.

Longitudinal welds in pole section shall meet requirements of ASCE-48-19, sections 6.3.4, 6.3.5, 6.4.1 and 7.2.3.

Each pole section shall be formed and welded with longitudinal seams.

Welding Inspection and Testing by manufacturer

- The manufacturer shall indicate and adhere to the welding procedures and processes to be used in the various joints or seams on their fabrication drawings.

- The manufacturer shall indicate the inspection methods which will be used to qualify welds and will furnish certified inspection reports when requested by LUMA Transmission Engineer. Records shall be kept for five (5) years by the manufacturer.
- Ultrasonic and visual inspection shall be performed on all complete joint penetration (CJP) groove welds.
- As a minimum, ultrasonic testing shall include longitudinal straight beam for lamination or laminar tearing adjacent to CJP groove welds in accordance with AWS D1.1 UT procedure, and all steel plates over 1 ½ inches thick in accordance with ASTM A435 as applicable to the manufacturer's established procedures.
- Nondestructive testing shall be performed with established procedures and qualified personnel in accordance with AWS D1.1 and ASNT-TC-1A.
- Nondestructive testing of welds and weld repairs shall not be performed until the base metal is at ambient temperature.
- Ultrasonic testing of post-galvanized baseplate to shaft welds for the detection of toe-cracks, shall not be performed until 48 hours after galvanizing. The manufacturer shall have an established procedure that demonstrates effective examinations of this type and shall be demonstrated as requested by LUMA.
- The acceptance/rejection criteria for nondestructive testing of CJP groove welds and adjacent areas shall be in accordance with AWS D1.1.
- All welding electrodes used for weld joints and deposited weld metals shall meet, as a minimum, an impact value of 15 ft-lb at -4°F as measured by the standard Charpy V-notch test. They shall equal or exceed the specified physical properties of the base metal being welded when tested with the applicable AWS specification for welding electrodes.
- Repair area of removed hot-dip galvanizing: When it is required to remove galvanizing to make a weld or other repair the manufacturer shall repair the galvanizing per following section of "Quality and Finish" in accordance with ASTM A780 Standard Practice for Repair of Damaged and

Uncoated Areas of Hot-Dip Galvanized Coatings. However, "hot stick" (zinc soldering) repairs will not be allowed for the repair of zinc coating on weld repairs.

Welding Inspection by LUMA

Independent non-destructive testing (NDT) may be performed by LUMA as approved by the LUMA Transmission Standard and/or LUMA Transmission Design Engineer, through a Third-Party NDT testing agency (PROFESSIONAL), hired and compensated by LUMA. The Professional shall have established procedures that demonstrate effective examinations of this type and shall be demonstrated as requested by LUMA or representative. Acceptance/Rejection shall be demonstrated with a qualified procedure by the Professional and determined by LUMA.

- Straight Beam Ultrasonic Testing (UT): Professional shall perform straight beam UT through the bottom of baseplates in accordance with AWS D1.1 (latest edition) and qualified procedures. Lamination testing shall be performed prior to any other testing and the results documented.
- Shear Wave Ultrasonic Testing (UT): Professional shall perform Code UT on (CJP) welds in accordance with AWS D1.1 (latest edition) and qualified procedures. Professional shall perform "informational" UT on galvanized baseplate-to-shaft CJP welds for longitudinal cracks in accordance with a qualified procedure using a 45° and 70° transducers. The acceptance criteria shall be zero cracks as demonstrated and established in accordance with the Professional's qualified and approved procedures, and the results documented and reported to the Owner.
- Magnetic Particle testing (MT) or Dye Penetrant Testing (PT): When weld base metal discontinuities or defects are detected by UT on the surface, Professional shall perform MT or PT on the detected indications and remainder of the baseplate to shaft weld for longitudinal cracks. In surface preparation for the NDT performed by the Professional, the manufacturer shall completely remove any galvanizing or coatings from the baseplate to shaft CJP weld and adjacent base metal at a minimum of 1" from the edge of the weld toe areas. When the manufacturer has notified the Professional of a crack removal, Professional shall perform MT or PT during the

excavation of crack repairs to validate complete removal of the crack prior to any welding on the repair area. The acceptance criteria shall be in accordance with AWS D1.1 (latest edition).

- Metal Hardness testing: Professional shall perform hardness tests on the baseplate to shaft CJP weld and the heat effected zones (HAZ) of the CJP weld on the baseplate and shaft sides. Acceptance/rejection criteria shall be per AWS D1.1 as a minimum. Metal hardness not to exceed 200 in Brinell scale.
- Repair area of removed hot-dip galvanizing: After the removal of galvanizing and crack repair by welding, the manufacturer shall repair the galvanizing in accordance with ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

5.4. Pole Shafts

- Cross section shape shall be the same over the entire pole shaft unless prior approval is obtained from the LUMA Transmission Engineering Standards. Taper shall in the range of 0.125 to 0.5 inches per linear feet. Any changes to shaft diameter shall be approved by the LUMA Transmission Engineering Standards. See Section 11.2 Steel Pole Summary.
- Shaft sections shall be pre-fitted for a telescoping type of assembly unless otherwise specified. The upper section at a joint shall telescope over the lower section by not less than 1-1/2 times the outer section diameter including the manufacturing tolerances. Structure sections shall be numbered to relate to the structure identification in the Bid Sheet and, at joints, both sections shall be clearly marked so that the related faces can be correctly matched in the field assembly.
- Eight (8) 1 inch diameter heavy hex-nuts per splice joint shall be welded (over holes on galvanized structures only) to accommodate a hydraulic jacking device for field assembly. Each section shall have two (2) pairs of nuts, each pair located diametrically opposite walls of the pole shaft. The nuts shall be spaced 30 inches from center to center, parallel to the long axis of the pole and located as to be clear of the section overlap and not less than 24 inches apart when the joint is fully telescoped. All nuts must be oriented so that two (2) flats are perpendicular to the long axis of the pole.

- Each pole shaft section shall have lifting attachments and/or holes with the capacity to lift each pole section into a plumb position. This may be accomplished by either designating elements of the pole shaft as acceptable lifting points or by installing specific capable attachments and designating them on the drawings. Round lifting hole centerlines shall have a maximum edge distance of 6-inches from the top of the pole section and a minimum diameter of 2-inches. Where vertical slotted lifting holes are provided in pole walls, the clear distance from the top of the pole section to these holes may not exceed 4-inches. Unless otherwise required by the drawings, poles shall not be sealed. All poles shall have a vented pole top. The pole shall have a bolted metal top cap. The bolt diameter shall not be less than 1/2" and the cap will not exceed the pole top diameter by more than 1 inch.
- Base-plated poles shall have a free-draining base connection detail. Embedded poles shall incorporate a bearing plate with a center opening adequate for internal coating and drainage. The bearing plate shall have a hole at the center of plate not larger than 30% of the total base diameter.
- The poles shall have a fastening system between all pole sections to ensure sections will not come loose when lifted by the helicopter.

5.5. Steel Direct Embedded Structures

- Direct embedded structures shall be designed so that the embedded section will be as indicated on the drawings.
- Each pole shaft shall have provisions for bolted ground clamp, consisting of a plate capable of receiving a NEMA 2-hole pad or a ground lug attachment, located 30-inches above the ground line. The specific attachment number will be included on the structure drawing.
- Pole shafts shall include a steel bearing plate under the shaft walls having a minimum thickness of at least 3/16 inch.

- The guyed embedded poles shall have a thru pipe hole 1½" in diameter at 3'-0" above ground line. A bar inserted thru the pipe would permit rotating the guyed structure for alignment with the power line.
- The poles shall have a corrosion-resistant coating covering from 36 inches below to 24 inches above ground line. Both ends of the coating application shall be feathered to reduce potential of peeling off. This coat shall be a suitable below grade protection of galvanized surfaces and shall be applied as per the manufacturer instructions after galvanizing. The application thickness shall conform to the coating manufacturer instructions. Approved below-grade coatings are Corrocote Classic, Chemthane 2260, Rocathaan Hotspray or equivalent Polyurea approved by LUMA.
- Embedded Structures shall have a ground sleeve of 3/16 inches thickness, extending from 1 foot above ground level to 2 feet below ground level. Ground sleeve should not be considered for the final capacity of the structure.

5.6. Steel Anchor Bolted Structures

- The structures shall be supplied with base plates designed to match the strength of the structural member to which it is attached.
- Baseplates shall include a matching reference mark to aid in field proper orientation of the pole base section of the pole onto the anchor bolts according to the “V”-notch in the anchor bolt templates.
- Anchor bolt holes in the baseplates shall be of a diameter within the range of 3/8-inch to ½-inch larger than the anchor bolts with which they are used and shall be equally spaced within each quadrant.
- Each pole shaft shall have provisions for a bolted ground clamp consisting of a plate capable of receiving a NEMA 2-hole pad or a ground lug attachment located 18-inches above the base plate. The specific attachment will be included in the structure drawing. See details per pole.
- Welded spliced sections to fabricate a baseplate is not acceptable.

- The use of a backing or strapping bar on the exterior side of the shaft-to-base plate weld joint shall not be permitted.
- Anchor Bolts shall comply with ASTM F1554.

5.7. Anchor Bolt Cages

- Anchor bolts shall be located equally spaced in a circle about the center of the structure, unless otherwise approved by the LUMA Transmission Engineering Standards.
- Anchor bolt cages shall have at minimum four (4) anchor bolts, a bottom ring and a top template that will be used for field assembly and orientation prior to installation in the foundation as a unit.
- Anchor bolt templates shall include a reference marking (such as a notch or a weld) identifying the interior bisector angle on angle structures and the transverse axis on tangent structures. The reference marks on the template and the baseplate will be used along with field reference stakes marking the transverse axis of the structure to assure proper orientation of the anchor bolt cage and the structure. The template shall be of sufficient strength to support the weight of the anchor bolt cage during construction of the foundation.
- Welding of anchor bolts shall not be permitted unless otherwise approved by the LUMA Transmission Engineering Standards, and therefore shall be welded in accordance with AWS D1.4 (latest edition) “Structural Welding Code – Steel Reinforcing Bars”.

5.8. Climbing and Working Provisions

- Pole vendor shall provide fall protection anchorage in accordance with OSHA requirements.
- All 38 kV transmission line pole shafts shall include provisions for use of removable step bolts as noted on the LUMA’s drawings.
- Hole and Step bolt pattern shall comply as specified in section 12 per structure.
- Step bolts shall be spaced 18 inches center to center, staggered appropriate for climbing the pole easily on one of the longitudinal faces and marked up on drawings.

- Each step bolt (which is not a fall protection anchorage) shall be capable of withstanding a minimum of 450 pounds ultimate load, applied to the outer edge of the step bolt, without causing failure to the bolt or to the point of attachment.

5.9. Quality and Finish

- Quality control and manufacturing tolerances shall be such that there will be no problems encountered during field assembly of the finished product.
- The Supplier shall provide upon request procedures detailing the galvanizing process.
- For galvanized finish, steel shall be hot dip galvanized after fabrication is completed per the requirements of ASTM 123. Any exceptions to this process must be noted in the bid documents and are subject to rejection by the LUMA Transmission Engineering Standards. The galvanizing quality acceptance/rejection criteria shall be as specified in ASTM A123. Precautions shall be taken against embrittlement in accordance with ASTM A143.
- Repair area of removed hot-dip galvanizing: When hot-dip galvanizing is removed, the manufacturer is responsible to repair the area. Any repairs must follow the requirements of ASTM A780, “Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings”.
- Holes for structure assembly bolts shall be punched or drilled. Anchor bolt holes may be drilled, or oxygen or plasma cut.
- Fabrication should be complete prior to galvanizing. No bending or machining of structure members shall take place after galvanizing.
- The inside of tubular members shall be readily visible and accessible for post galvanizing cleaning and repair as needed.
- All drilling and punching shall be done with sharp drills and punches. Finished edges shall be clean cut and free from burrs and chips. Roughness of oxygencut surfaces shall not be greater than that defined by AWS D1.1.
- All holes shall be cylindrical and perpendicular to the principal surface. Slotting of improperly punched holes shall not be permitted.

- Plugging and welding improperly punched holes shall be kept to a minimum and pieces which, in the opinion of the LUMA, have excessive plugs and welds, shall be rejected from acceptance.
- All holes must be punched or drilled before galvanizing and the holes must be sealed after galvanizing with a removable plastic cap, to seal the pole to prevent water.
- Connections shall be arranged to minimize the eccentricity of loading on the member.
- The Supplier shall provide upon request a detailed inspection procedure and evidence that ultrasonic test is performed on base and flange plate welds after galvanizing.
- Each piece of steel shall be marked with a punched or raised weld bead identification mark prior to galvanizing. The mark shall be a minimum of 3/4 inches high. The mark shall be made such that it is clearly visible after galvanizing.
- The finished work shall conform to the tolerances set forth in these specifications and shall be sufficiently accurate to permit field erection without reaming and with only a moderate amount of drifting. Tolerances allowed on finished work shall conform to the following:
  - Pole and Arm:
  - Length +/- 1" (Single Section)
  - Member Straightness 3" per 100'
  - Holes on pole shaft, arm connections, attachment brackets or plates:
    - Diameter +/- 1/16"
    - Hole to Hole spacing +/- 1/16"
    - Hole to Hole alignment +/- 1/16"
  - Variation in overall trapezoidal width: +/- 1/16"
  - Slip joint length +/- 6"
  - Twist less than 1.5 degrees per 10 feet member length
  - Location of welded pieces: ± 1 % on lengths indicated on our approval drawings, except if there is slip joint between crossarms where a 6 in tolerance shall be added.
  - Ovalization:

The dimensional percentage noted for two measurements taken between two perpendicular diameters at slip joint level: less than 3 % [(Dmax-Dmin)/Dmaxi< 3 %]

- Base and Flange Plates:
  - Hole Diameter +/- 1/16”
  - Hole to Hole Spacing +/- 1/16”

- All material shall be free of permanent deformations, bends, twists, or kinks. Straightening of damaged material shall not be permitted except where specifically approved by the LUMA.
- Arm attachment plates and post-insulator supports shall be welded to the pole shaft. Arms shall be sealed at the tip with a bolt-on steel plate to prevent insect ingress.
- Assembly bolts are to be sized without allowances for flat washers, which are not to be furnished unless specifically requested. All bolts shall be furnished with hex-nuts unless otherwise specified. All bolts shall be of such a length that they pass entirely through the nut and have a minimum projection of three (3) threads. Assembly bolts must be supplied with a locking device (lock washer), as approved by LUMA.

5.10. Modifications

- Structures are to be fabricated in accordance with detailed drawings furnished by the manufacturer for approval of LUMA Transmission Engineering Standards Any modifications must be approved by LUMA Transmission Engineering Standards in writing.
- For fabrication only orders (engineering completed previously or by others), minor deviations in member layout to accommodate variations in shop practices will be permitted provided that these deviations do not materially alter the configuration of the structures and do not reduce the strength of the structures. When such deviations in member layout are made, drawings showing these deviations shall be submitted to LUMA Transmission Engineer for approval and the originals of such drawings shall become the property of LUMA upon completion of the order.

6. Identification

Each pole shall include (welded) one steel plate at 5 feet from the ground elevation or from the pole base plate with the following information clearly stated:

1. Manufacturer:
2. Manufacture Date:
3. Owner: PREPA
4. Purchase Order No.:
5. Moment at Base (Ft-k):
6. Shear at Base (Kips):
7. Axial Loat at Base (Kips);
8. Weight (lb):
9. Pole Length/Height (ft):
10. Pole Name

Each section shall be identified:

1. T=Top, M= Middle, B=Bottom
2. Pole Name –

   Example: T-38 kV-36-SS-DE
3. Purchase Order Number

Each arm shall be identified and Purchase Order Number:

1. C= Conductor, O= OHGW

2. Pole Name –

   Example: C-38 kV-36-SS-DE

3. Purchase Order

7. Galvanizing

The Supplier shall provide upon request procedures detailing the galvanizing process.

All steel work, including bolts, shall be hot-dipped galvanized in accordance with ASTM Specifications A-123, A-153 or EN ISO 10684.

Fabrication should be complete prior to galvanizing.

All holes must be punched or drilled before galvanizing and the holes must be sealed with a removable plastic cap, to seal the pole to prevent water.

The coating quality shall be determined as described in the ASTM A123 Standard.

The Supplier shall provide upon request a detailed inspection procedure and evidence that ultrasonic test is performed on base and flange plate welds after galvanizing.

The steel shall be suitable for hot dip galvanizing.

Hot dipped galvanizing process is required that every section of the pole shall be covered in single submersion end to end in a single bath.

8. Quality Control

The Supplier shall be ISO 9001 and ISO 14001 certified.

The manufacturer shall have an established quality management system with a quality program that will ensure conformance to the project requirements and this specification. All project related documentation that is required by the quality control program and project requirements shall be available to LUMA or

its representative upon request and kept in record retention by the manufacturer for a minimum period of five (5) years.

8.1. Certified Mill Test Reports

Mill test reports certificates shall be furnished for steel plates used for the fabrication of pole shaft, base plate, and all accessories where loads are applied. Certificate of conformity shall be furnished for bolts.

All project material test reports and documentation (inspection and test records) shall be kept for a period of five years and be available on request by LUMA for all material.

8.2. Control Plan

Nature	DESIGNATION	CONTROL	
		TYPE	FREQUENCY
Welds	All welds	Visual	100%
	Longitudinal welds at 100% penetration	Ultrasonic test	20%
	Circumferential welds at 100% penetration of pole shaft on base plate.	Ultrasonic test	20%
Dimensions	Pole sections and accessories	Dimensional	10%
Identification	Presence, position and orientation of markings on all pole elements and fittings.	Visual	Random Sampling
Galvanization	Thickness.	Magnetic gauge	10%
Packing	Quantitative control of packing and telescoping (if any) of shafts and their accessories.	Visual / Counting	100%

8.3. Inspection

The pole supplier shall allow LUMA or its representatives to verify that the finished products and materials supplied correspond to the requirements of these specifications.

LUMA shall have the option of performing partial or complete Supply Conformance Assessment (SCA) inspections as deems necessary. All sections of the manufacturer's plant concerned with the work shall be always open to LUMA or its representative while the work is being performed to allow the LUMA to make on-site inspections. The manufacturer shall advise the LUMA or its representative one week prior

to the beginning of fabrication of the LUMA's order. The manufacturer shall include an estimated completion date, including final surface preparation. The intent of this notification is to allow LUMA to exercise the option of factory inspection any time during fabrication. SCA inspector is to be allowed to inspect finish product and project documentation for acceptance of structures by LUMA.

The manufacturer shall formally notify LUMA two (2) weeks prior to the initial start of the project fabrication as contractually ordered with the location(s) of the manufacturing and galvanizing (if applicable) facilities.

8.4. Documentation

The manufacturer shall be responsible for retaining all LUMA documents such as design calculations and fabrication drawings for at least 5 years.

The manufacturer shall be responsible for the accuracy of all drawings and shall also be responsible for notifying the LUMA Transmission Engineering Standards. of any revisions made after furnishing the original drawings. Any errors or omissions in the detailed drawings shall be corrected by the manufacturer at the manufacturer's sole expense.

The manufacturer, by accepting a PURCHASE ORDER from LUMA, acknowledges that LUMA has the right to use the final shop fabrication detail drawings in any manner beneficial to LUMA, including use by other manufacturers in the fabrication of like structures for LUMA.

All calculations and drawings shall be submitted in both paper and electronic formats. Drawings shall be provided in AutoCAD format, and calculations may be submitted in Adobe PDF format.

Final shop fabrication detail drawings shall be submitted in Adobe PDF format with or prior to the delivery of the structures. These drawings shall show all the details necessary to fabricate the structures.

Review of drawings by LUMA shall not serve as a complete check but will indicate only that the structure appears to be in general conformance with the contract documents. Review of the drawings by LUMA does not relieve the manufacturer from responsibility for the correctness of the details on the drawings.

9. Packing and Shipping

Each part, assembly or sub-assembly shall be packed in such a manner as to minimize structural damage or damage to the galvanizing. Any part that arrives damaged shall be replaced by the manufacturer at no additional cost to LUMA.

Anchor bolts and templates may be shipped in advance and have nuts on the bolts to ensure proper fit and anchor bolt thread protection.

Shipments shall be accompanied by a packing list of all parts which will be identifiable by structure name and type.

Material should be delivered in open platforms, which are free of foreign material that could cause damage. Air circulation should be provided between the floor of the platform and the bundle. Proper bulk heading and suitable vertical and horizontal spacers should be used to prevent damage and facilitate unloading.

Pole delivery will not be accepted without LUMA's Transmission Engineering Standards approval.

Pole bolts will be delivered using UV resistance recipients or wooden cases adequately identified with its order number and pole belonging. Cardboard boxes and unidentified cases will not be accepted.

Bid price shall include costs for transportation, delivery, and trailers standby time of 10 working days at LUMA's Warehouse 05 in Palo Seco, Toa Baja or project site. Supplier shall notify LUMA at least 2 weeks prior to delivery of poles and hardware and shall submit a delivery schedule including dates and details of shipments. The supplier shall coordinate delivery to ensure safe unloading at the designated location.

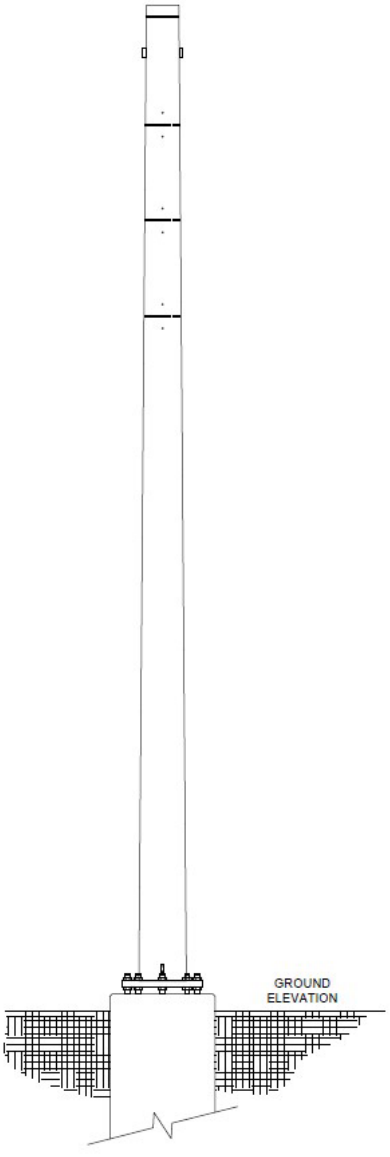
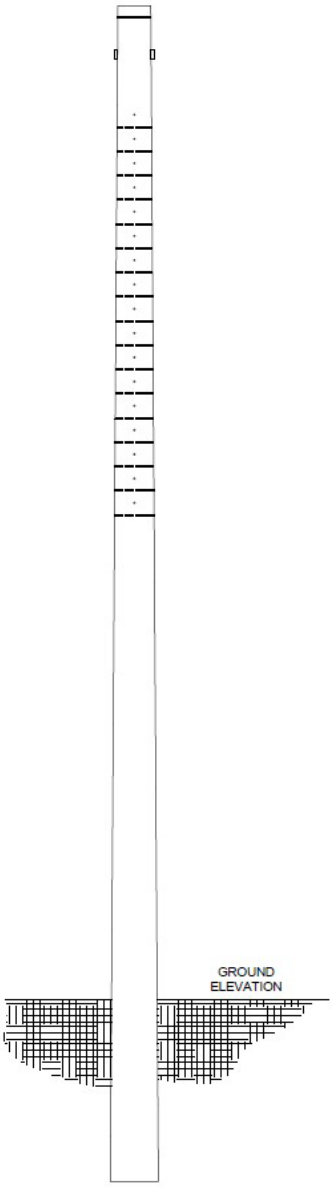
10. Failure to Meet Specifications

Should any piece of equipment fail to meet the requirements of these specifications within the warranty period, it shall be optional for the LUMA Transmission Engineering Standards to accept or reject the pole or its appurtenances and direct the manufacturer to proceed at once with making alterations or furnish such new pole or parts as may be necessary to make it meet the warranty and requirements. All expenses of furnishing any replacement pole or parts shall be borne by the manufacturer.

11. Design Conditions

11.1. Structure Types

The following structure types are steel pole structures, designated as custom structure types for 38 kV transmission lines.

Self Support	Embedded
	

11.2. Steel Pole Summary

Item	Type	Structure Name	LUMA Doc. No.	WHS #	Pole Length (ft)	Height Above Ground (ft)	Max Bottom Diameter (in.)	Connection Design
1	Self Support	38 kV-65-SS - TAN/DE	4751.08.102	026-84515	65	65	40	Flange (See drawing for specific location)
2		38 kV-75-SS-TAN/DE	4751.08.103	026-84516	75	75	25	
3		38 kV-75-SS-HTAN/DE	4751.08.104	026-84517	75	75	40	
4		38 kV-90-SS-TAN/DE	4751.08.105	026-84518	90	90	40	
5	Embedded	38 kV 70 S13 TAN/DE	4751.08.111	026-84524	70	60	30	Slip Joint
6		38 kV 70 S21 TAN/DE	4751.08.112	026-84526	70	60	30	
7		38 kV 70 S35 TAN/DE	4751.08.113	026-84527	70	60	40	
8		38 kV 85 S20 TAN/ DE	4751.08.114	026-84528	85	73	40	
9		38 kV 85 S35 TAN/DE	4751.08.115	026-84529	85	73	40	

11.3. Steel Pole Loading

Item	Type	Structure Name	LUMA Doc. No.	WHS #	Pole Length (ft)	Height Above Ground (ft)	Minimum Bending Moment (kips-ft)
1	Self Supported	38 kV-65-SS - TAN/DE	4751.08.102	026-84515	65	65	5275
2		38 kV-75-SS-TAN/DE	4751.08.103	026-84516	75	75	3160
3		38 kV-75-SS-HTAN/DE	4751.08.104	026-84517	75	75	7190
4		38 kV-90-SS-TAN/DE	4751.08.105	026-84518	90	90	10740
5	Embedded	38 kV 70 S13 TAN/DE	4751.08.111	026-84524	70	60	760
6		38 kV 70 S21 TAN/DE	4751.08.112	026-84526	70	60	1250
7		38 kV 70 S35 TAN/DE	4751.08.113	026-84527	70	60	2040
8		38 kV 85 S20 TAN/ DE	4751.08.114	026-84528	85	73	1425
9		38 kV 85 S35 TAN/DE	4751.08.115	026-84529	85	73	2490

4750.50.331 V03 38 kV Transmission Lines Custom Steel Poles Specifications

Final Audit Report 2026-03-06

Created:	2026-03-06
By:	Oscar E Venegas Hermina (oscar.venegas@lumapr.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAPD8Z0b-CzB2lhLvhucLWLQhKG-oGR2Ok

"4750.50.331 V03 38 kV Transmission Lines Custom Steel Poles Specifications" History

Document created by Oscar E Venegas Hermina (oscar.venegas@lumapr.com)
2026-03-06 - 4:28:12 PM GMT

Document emailed to Oscar E Venegas Hermina (oscar.venegas@lumapr.com) for signature
2026-03-06 - 4:28:23 PM GMT

Email viewed by Oscar E Venegas Hermina (oscar.venegas@lumapr.com)
2026-03-06 - 4:38:09 PM GMT

Document e-signed by Oscar E Venegas Hermina (oscar.venegas@lumapr.com)
Signature Date: 2026-03-06 - 4:38:23 PM GMT - Time Source: server

Document emailed to Jose Castillo Colon (jose.castillocolon@lumapr.com) for signature
2026-03-06 - 4:38:28 PM GMT

Email viewed by Jose Castillo Colon (jose.castillocolon@lumapr.com)
2026-03-06 - 4:40:54 PM GMT

Document e-signed by Jose Castillo Colon (jose.castillocolon@lumapr.com)
Signature Date: 2026-03-06 - 4:50:57 PM GMT - Time Source: server

Document emailed to Reinaldo J Baretty (reinaldo.baretty@lumapr.com) for signature
2026-03-06 - 4:51:01 PM GMT

Email viewed by Reinaldo J Baretty (reinaldo.baretty@lumapr.com)
2026-03-06 - 4:57:22 PM GMT

Document e-signed by Reinaldo J Baretty (reinaldo.baretty@lumapr.com)
Signature Date: 2026-03-06 - 4:57:41 PM GMT - Time Source: server

Agreement completed.

2026-03-06 - 4:57:41 PM GMT