

**SECTION 02582 (33 71 16.13):  
PRE-STRESSED CENTRIFUGAL-CAST CONCRETE UTILITY POLES**

**PART 1        GENERAL**

**1.1        SCOPE AND QUALIFICATIONS**

- A.        Design, fabricate, and deliver pre-stressed centrifugal-cast (spun-cast) Concrete Poles for transmission line.
  - 1.        Pole Quantity: One (1), 115 kV transmission pole, 90 foot with 20-foot setting depth. Pole AP17A.
  - 2.        Pole Quantity: One (1), 115 kV transmission pole, 95 foot with 23-foot setting depth. Pole FS31.
  - 3.        Pole Quantity: One (1), 115 kV transmission pole, 95 foot with 25-foot setting depth. Pole FS33.
  - 4.        Pole Quantity: One (1), 115 kV transmission pole, 115 foot with 28-foot setting depth. Pole FS32 will be a three (3) way switch structure.
- B.        The Manufacturer must be an established company which within the last two years has produced poles of similar height, strength, and application for delivery to a Florida utility. The Manufacturer shall be responsible for the means, methods, techniques, sequences, and procedures of fabrication.
- C.        Three (3) way switch manufacturing drawings, with mounting details, shall be supplied to the low bidder when they become available after the bid opening.

**1.2        SECTION INCLUDES**

- A.        This Section is a purchase specification which includes general requirements of the Manufacturer, and covers the minimum requirements for the design, materials, fabrication, and delivery of Concrete Poles.
- B.        Concrete Poles furnished under this Section shall be complete including pole shafts, through-holes, grounding conductors and connections, and provisions for handling and lifting.
- C.        This Section is supplemented by Load Case Tables and by Drilling Detail Drawings contained in the Bidding Documents.

**1.3        RELATED SECTIONS**

- A.        The requirements of the Bidding Documents apply to work in this Section as if incorporated herein.

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1.4 REFERENCES

The design, materials, fabrication and testing of the Concrete Poles furnished under this Specification shall be in accordance with applicable portions of the requirements and/or recommendations of the following standards, codes and guidelines, latest revision.

- A. ACI 318, Building Code Requirements for Structural Concrete and Commentary
- B. IEEE C2, "National Electric Safety Code" (NESC)
- C. ASCE-PCI (1987), "Guide for the Design and Use of Concrete Poles", JR 257
- D. ASCE-PCI (1997), "Guide for the Design of Prestressed Concrete Poles", JR 412
- E. ASTM A416/A416M, Specification for Low-Relaxation Seven-Wire Steel Strand for Prestressed Concrete
- F. ASTM C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- G. PCI MNL116, Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products

1.5 DEFINITIONS

Owner	Utility Commission City of New Smyrna Beach, Florida 200 Canal Street P O Box 100 New Smyrna Beach, Florida 32168 Phone: (386)-424-3040 Jameson Parker, P.E. e-mail: <a href="mailto:jparker@ucnsb.org">jparker@ucnsb.org</a>
Engineer	Fred Wilson & Associates, Inc. Jacksonville, FL 32207 Phone: (904)-398-8636 Freeman Bass, P.E. Email: <a href="mailto:Freeman@fredwilson.com">Freeman@fredwilson.com</a>
Manufacturer	The Concrete Pole Fabricator
ACI	American Concrete Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
IEEE	Institute of Electrical and Electronics Engineers
PCI	Prestressed Concrete Institute

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butt	Synonymous with “base” when referring to the large end of a tapered pole shaft
First-Crack	The moment at which the concrete just begins to crack due to exceeding the tensile strength of the concrete on the tension face of the pole
p-delta	The effect of the vertical loads causing secondary moments due to their deflected position under transverse load
taper	The total increase of pole shaft diameter measured in inches per foot of length
tip	Synonymous with “top” when referring to the small end of a tapered pole shaft
Ultimate	The loads (moment, shear, vertical force, torsion) corresponding to the point at which the pole fails
Zero-Tension	The moment at which a crack resulting from First Crack load re-opens (second crack)

1.6 SUBMITTALS

- A. A pre-bid conference is not anticipated.
- B. The Bidder shall submit with their bid, the estimated shipping date of the materials. This may be used in the bid evaluation and award of the bids, with preference given to shorter overall lead times.
- C. No exceptions to this Section will be permitted without written approval of the Owner.
- D. After award, the Manufacturer shall provide electronic copies of the following documents for each different pole type and height to Owner and their engineering firm representative for review and evaluation in accordance with the Contract Documents. Use US standard units of measurement and English language for text.
  - 1. Design Calculations
  - 2. Detailed and dimensioned Fabrication Drawings (Shop Drawings)

The Manufacturer shall submit Adobe PDF copy of the required Submittals by e-mail for review and approval by the Owner. Review by the Owner or their engineering firm representative is for determining conformance with this Section and its Attachments. It does not relieve the Manufacturer of responsibility for the accuracy of dimensions and structural detailing.

Submittals will be marked with any comments and returned to the Manufacturer by e-mail within ten business days after receipt, if possible. Poles shall not be fabricated until the required Design Calculations and Shop Drawings are reviewed and approved with “No exceptions noted” or “Approved as noted”.

- E. Design Calculations: Design and structural calculations showing that the design requirements have been met shall be prepared, signed and sealed by a Registered

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Professional Engineer, in the State of Florida, experienced in pre-stressed concrete design. Submittal shall include, in addition to the previously stipulated items:

1. Minimum test concrete compressive strength at 7 days and at 28 days.
2. Ultimate concrete compressive strength used in the design, and basis for correlation between cylinder test values and the design value.
3. Moments, section modulus, and stresses at the ground line, and in 5-foot increments along the pole shaft.
4. First-Crack, Zero-Tension, and Ultimate moment ratings.
5. Maximum pole-top deflection resulting from each load case, including foundation rotation.

F. Fabrication Drawings: Fabrication drawings shall include:

1. Dimensions and details of pole shaft, including tip and butt diameters, inside and outside tapers.
2. Location and size of through-holes.
3. Quantity and size of reinforcing steel.
4. Ground conductor details.
5. Identification plate details.
6. Fabrication tolerances.
7. Pole weight and center of gravity.
8. The location of the dunnage supports to be used when the pole is stored horizontally.
9. The single pickup point for use in raising the pole to a vertical position and for handling in setting operations.
10. The double pickup point for lifting and handling the pole in the horizontal position.

1.7 PROJECT RECORD DOCUMENTS

- A. Final Design Calculations and final Fabrication Drawings shall be provided to the Owner and the engineering firm representative, reflecting submittal review comments and any corrections made during the fabrication process.

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1. Provide drawings in DXF format and in Adobe PDF format suitable for printing on 11x17 paper.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. The Concrete Poles shall be delivered on or before the week of March 1, 2021.
- B. Delivery of all Concrete Poles will be to each specific structure locations along the Field Street and Airport lines transmission right of way.
  1. The specific delivery location of the FS31, FS32, FS33, and AP17A is approximately 500 to 1000' feet east of North Glencoe Road along the "New Smyrna Beach Multi Use Trail" west of Colony Park Road and Otter Blvd.
  2. The Owner's installation Contractor will plan, schedule, and coordinate the pole delivery with the Manufacturer on the Owners behalf.
  3. The Manufacturer shall communicate the Contractors delivery schedule to the Owner's Representative and the Owners Engineering Representative. Their contact information is listed in section 1.05 of these purchase specifications.
  4. Unloading will be performed by the Owner's Installation Contractor.
- C. The Manufacturer shall allow five (5) hours "turn around" time for unloading each Concrete Pole.
- D. Untimely delivery, either ahead of or behind agreed upon delivery schedules, shall not be a cause for a claim to the Owner for any costs incurred by the Manufacturer.
- E. The Owner will reimburse the Manufacturer for storage charges if delivery is extended by the owner more than thirty (30) calendar days beyond the end of the delivery window established in the purchase order, at the unit price provided in the bid form, per pole per week.

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**PART 2 PRODUCTS**

**2.1 MANUFACTURER**

A. The following Manufacturers have been determined to meet the intent of these specifications. Products of equivalent quality, dimensions, and features may be acceptable, at the Engineers discretion, if they comply with all requirements specified.

1. Valmont Utility
2. StressCrete Group

**2.2 DESIGN DATA**

- A. The Engineer has prepared Drawings for each Pole with Load Case Tables, Loading Tree and Bolt Hole Drilling Details that contain design load case information and that depict the intended pole application and configuration. See attachment "A" for drawings.
- B. Soil Borings were performed at certain locations along the pole line. The Engineer has used the soil parameters to determine the required pole embedment depth based on a preliminary computation of the ground-line reactions. Embedment depth is subject to adjustment after award.
- C. The pole design for structures FS31, FS32, and FS33 shall be based upon 954 ACSR, code name "Cardinal" conductor. The pole design for structure FS17A shall be designed based upon 795 AAC, code name "Arbutus" conductor.
- D. The manufacturer/supplier for the three (3) way switch will be determined by the Owner prior to the fabrication of pole FS32. Switch manufacturing drawings, weights, and mounting details, will be supplied to the successful bidder.

**2.3 DESIGN CRITERIA**

A. Concrete Pole designs shall be prepared on the basis of the Design Data and the limitations contained in this Section. Poles shall be capable of withstanding the loads of all specified load cases, including secondary stresses induced from foundation movement and pole shaft rotation, plus the effect of vertical loads acting on the deflected pole shaft (the p-delta effect). In addition to the dead load of the wires, the deflected structure weight, applied at its centroid above ground, shall be included in the secondary moment calculation. These calculations shall be used to establish the Ultimate moment rating.

The transverse, longitudinal and axial wire loads shown in the load cases include overload capacity factors (OCF). Transverse loads shown in the load cases include the wind load acting on the wires; however, it is the responsibility of the Manufacturer to include the appropriate wind force applied to the pole shaft and components.

New Smyrna Beach, Florida is in the 125-mph zone for NESC Extreme Wind.

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- B. Concrete Poles shall be designed for direct embedment, in self-supporting or guyed applications. Two degrees shall be assumed as the rotation at the ground-line under the controlling load case. Unless otherwise specified, the total pole deflection shall not exceed 15% of the height above ground, including the rotation of the foundation.
- C. The pole analysis shall assume the maximum moment (point of fixity) to occur at a point 1/3 of the distance below the ground line. The reinforcing steel required at the point of fixity shall continue to within two feet of the butt.
- D. Elastic methods of analysis shall be used.
- E. Unless otherwise specified, poles shall be designed so that the First-Crack moment of the pole exceeds 40 percent of the Ultimate moment, and the Zero-Tension moment of the pole exceeds 28 percent of the Ultimate moment.
- F. Hauling and handling stresses shall be designed to be less than stresses corresponding to the First-Crack load.

2.4 DESIGN DETAILS

- A. The pole shaft shall be circular in cross section and shall have a uniform exterior taper of 0.216 inches per foot from the tip to the butt.
  - 1. Poles shall have a minimum pole top diameter of 13 inches and a maximum pole top diameter of 20 inches.
  - 2. Poles shall have a minimum wall thickness of 2.5 inches at any point along the shaft. The pole shall have sufficient wall thickness to withstand the forces induced by any connecting bolts.
- B. Poles shall be designed with a void in the center of the pole, consistent with strength requirements and weight reduction. Not less than the top and bottom 12 inches of each pole shall be solid and without voids, with the exception of a 1-inch diameter weep hole through the solid bottom.
- C. The Manufacturer shall provide preformed holes through each pole for each structure type as indicated on the Drilling Detail Drawings. Holes shall be cast using cast-in-place PVC pipe, and shall be perpendicular to the centerline of the pole, unless specified otherwise on the Drawings.
  - 1. The Manufacturer shall provide "cant" holes for handling. The Manufacturer shall provide lifting holes, or suitable flush inserts with removable lifting attachments may be cast into the pole.
  - 2. The Owner or their Contractor may furnish additional hole requirements to the Manufacturer during the Submittal process. Holes above a quantity of 20 will be accounted for at the unit prices furnished with the Bid.

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- D. Reinforcing Steel
1. Poles shall have reinforcing steel tendons for pre-stressing and spiral reinforcing steel throughout the entire pole length, as required to develop the pole strength.
  2. The minimum concrete cover between reinforcement and surfaces of the pole shall be 1.0 inch for pre-stressing steel and 0.75 inch for spirals.
  3. The minimum concrete cover between the spiral reinforcing steel and the holes cast at the time of manufacture shall be 1.0 inch.
  4. Except for spiral reinforcing steel and fabrication devices, both the transverse and longitudinal axes shall be clear of embedded steel for 1.5 inches on either side of the axes for the full length of the pole so that additional holes may be field drilled without interference. The value above may be reduced to 1 inch clear on either side of the axes for the top 10 feet of the pole if it would otherwise require an increase in the tip size.
  5. The end of each reinforcing steel tendons in both the top and butt shall be burned back a minimum of 1.0 inch. The resulting holes shall be thoroughly cleaned of any loose residue and completely filled with a non-shrink epoxy grout.
- E. A #2 AWG soft-drawn bare stranded copper ground conductor shall be imbedded in the concrete from the tip of the pole to below the ground line. This conductor shall be in continuous length, without splices or sleeves, and shall be connected to the reinforcing steel at both ends with an appropriate mechanical connector.
1. Bronze ground couplings to accommodate a ½"-13 threaded bronze grounding connector shall be provided on the face of the pole at locations as indicated on the Drawings. Suitable connectors and length of conductor shall be used to connect the internal ground conductor to the required ground couplings.

2.5 MATERIALS

- A. Materials used shall be in accordance with ASTM standards as referenced in the PCI Guide Specification.
- B. The Manufacturer shall maintain a system, including records, which allows verification that the concrete and reinforcing steel furnished meet the requirements specified. Certified mill test reports for steel shall constitute sufficient evidence of conformity when purchased. This information shall be provided to the Owner and the engineering representative upon request.
- C. Concrete
1. The Chloride content of the concrete mix, considering all ingredients, shall be 0.4 pounds per cubic yard or less.
  2. Four representative pairs of cylinders from each day's concrete pour shall be taken and tested per ASTM C39 as follows: 1 at 3 days; 1 at 7 days; 1 at 28



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days; and 1 spare. An electronic copy of the test reports shall be furnished to the Owner and their engineering firm. Concrete shall have a 7-day compressive strength of not less than 5,000 psi and a 28-day compressive strength of not less than 8,500 psi.

- D. Pre-stressing steel tendons shall conform to ASTM A416, Grade 270.
- E. The minimum diameter of the spiral reinforcing steel shall be 3/16-inch and the maximum design stress at ultimate load shall not exceed 60 kips per square inch. Spacing shall conform to the following:
  - 1. For a distance of three feet from the tip and butt of the pole, spirals shall have a maximum center to center spacing (pitch) of 1.75 inches but no less than 1.25 inches.
  - 2. If torsional loads are encountered, the pitch shall be adjusted, if necessary, to provide sufficient reinforcing in accordance with Section 11.6 of ACI 318.
  - 3. Closer pitch may also be required in the region below the ground-line to adequately resist the increased shear encountered in developing the resisting soil pressure.
  - 4. The maximum pitch throughout the remainder of the pole shall not exceed four inches.
- F. All inserts or attachments, if required, shall be non-corroding material.

**2.6 BIRTHMARK**

- A. A non-corroding identification plate (birthmark) shall be permanently affixed to an in-line face of each Concrete Pole, approximately 5 feet above the ground line.
- B. The plate shall be a minimum of 4 inches square with letters at least 0.25-inch high. Lettering may be stamped, engraved, or embossed on the plate and must be clearly legible.
- C. The birthmark shall contain as a minimum: the acronym "UCNSB", the Manufacturer's name or trademark, the month and year of manufacture, total pole length in feet, pole weight, pole structure number, designed pole set depth, and the ultimate ground-line moment capacity of the pole in foot-kips.

**PART 3 EXECUTION**

**3.1 FABRICATION**

- A. Fabrication shall be performed in strict compliance with the Shop Drawing details. Material substitutions or deviations from the approved drawings shall not be made without written approval by the Owner.

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- B. The pole shall have a smooth, uncolored finish with no cracks. Sharp edges shall be tooled to smooth. The outside surface along the length of the structure shall be troweled until all projections, depressions and irregularities have been removed and the entire surface has a smooth texture with neat lines.
- C. All small cavities and voids caused by air bubbles, honeycomb spots, etc., shall be cleaned, saturated with water and then carefully pointed with mortar. A small cavity is defined as one not larger than 1/2 inch in diameter or deeper than 1/4 inch. Larger non-structural cavities not exceeded 2 inches long shall be repaired by opening the damaged area on a 1 to 1 slope using a mechanical grinder, cleaning thoroughly and filling with a high-strength non-shrink concrete repair material. Poles with larger cavities shall be rejected.
- D. The manufacturer shall take necessary measures to prevent mold seam leaks that may occur during the spinning process. If excessive seam leaks are detected, the pole will be further inspected to ascertain whether sufficient quantity of cement paste has escaped to cause honeycombing or other damage to the wall. Poles exhibiting signs of honeycombing shall be rejected.
- E. The Manufacturer shall perform tests on the completed internal pole grounding system, connections and conductor, to ensure they remained properly connected during the manufacturing process and will perform as required in the field.

**3.2 MANUFACTURING TOLERANCES**

- A. Product tolerances shall be limited to the following:
  - 1. Overall length: + / - 2.0 inches
  - 2. Pole Diameter: + / - 0.25 inch
  - 3. Wall Thickness: Allowable variation along the pole shaft shall be not greater than +20%, with a maximum reduction in wall thickness of 0.25 inch, provided that minimum coverage over steel is maintained. Each pole shall be inspected for uniformity of inside appearance and wall thickness. Actual wall thickness measurements shall be taken on each pole and recorded. Wall thickness measurements shall be done by drilling pilot holes through the wall beginning two feet below the tip and continuing at ten-foot intervals on the longitudinal axis of the pole opposite the "bottom face" of the pole. The "bottom face" of the pole is defined as the face where the slurry settles after spinning of the pole is completed. Pilot hole locations may be adjusted to avoid cast in place items. Electronic copies of the wall thickness Report shall be provided to the owner and their engineering firm representative prior to pole shipment.
  - 4. Sweep: Sweep (the deviation of a pole shaft from straightness) will be allowed in one plane and one direction only. A straight line joining the edges of the pole at both the tip and the butt shall not be distant from the pole shaft surface at any point more than 0.375 inch for each ten feet of length between these two points. The Manufacturer shall record these measurements and supply electronic copies to the owner and their engineering firm representative before shipment.

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5. Reinforcement:  
Longitudinal: +0.25 inch for individual strands and + / - 0.125 inch for the centroid of a group of strands  
Spiral: + / - 25% spacing variance, with total quantity per foot maintained
  
6. Holes:  
Location of a group of bolt holes from pole tip: + / - 1.0 inches  
Distance between groups of bolt holes: + / - 1.0 inch  
Location of bolt holes within a group: + / - 0.125 inch  
Alignment with respect to centerline of pole: + / - 0.125 inch  
Bolt hole diameter: +0.125 / -0 inches of specified hole diameter
  
7. Report:  
The Manufacturer shall provide electronic copies of the above measurements to the owner and their engineering firm representative prior to pole shipment.

**3.3 INSPECTION AND QUALITY ASSURANCE**

- A. The Manufacturer shall have an active in-plant quality assurance program and perform regular checks and tests on the products made. The program shall cover the entire production process including the delivery of the product. Copies of test and inspection records shall be provided to the Owner and engineering firm representative upon request.
  
- B. The Owners' representative or authorized engineering firm representative shall have access to the work at all times for inspection wherever the Concrete Poles are in preparation or progress. The Manufacturer shall make reasonable provision for such access and inspection without additional cost to the Owner.

**3.4 PROOF TESTING**

- A. No strength proof tests will be required.

**3.5 PACKING AND SHIPPING**

- A. Plug all holes with removable plastic plugs.
  
- B. Poles and accessories to be stored temporarily in outdoor areas shall be raised above ground level and separated with spacers to allow free circulation of air to all surfaces. Blocking and spacers shall be of materials that are not harmful to the surfaces, shall span the full width of each bearing point, and shall be spaced such that there are no undue stresses imposed on the poles.
  
- C. All poles shall be carefully loaded for protection during shipment.
  
- D. Each shipment shall include a packing list identifying the poles in the shipment.
  
- E. The following information shall be marked on the pole shaft in legible, durable ink or paint, or may be cast into the pole. These marks shall be kept small but conspicuous.

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1. Dunnage points
2. Single and double pickup points
3. Support points to be used when the pole is transported
4. Pole structure number. This marking shall be placed on the butt and on the shaft within eight feet of the butt.

**3.6 DELIVERY INSPECTION**

- A. All materials will be subject to "Job Site Inspection". Poles and accessories shall be protected from damage during storage, shipping, and handling. Members that arrive damaged shall be repaired or replaced as determined by the Owner. Large cavities, superficial damage to the surface (including spalling due to holes drilled after casting), and abrasions shall be repaired to the satisfaction of the Owner's Representative.
- B. Material may be rejected at the time of the first inspection or at any time defects are found during the progress of the erection or installation. Inspection by the Owner or waiving of inspection shall not relieve the Manufacturer from the responsibility for furnishing products that conform to the requirements of this Section, nor invalidate any claim of the Owner because of defective or unsatisfactory material or workmanship.

END OF SECTION

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**ATTACHMENT "A"**

Transmission Loading Tree and Pole Drilling Details:

Pole Structure 17A

Pole Structure 32

Pole Structure 33

Pole Structure 31