**SECTION IV**
**SPECIFICATIONS FOR INSTALLATION**
**BID NUMBER 240803**

# Contents

## SECTION 1 – GENERAL

### 1.1 – General

All construction practices shall meet the provisions of the Washington state electrical constructions code, the national electric safety codes and all regulations governed by federal, state, county and district regulatory bodies. The following construction practices are general guidelines only, as they do not cover every possible situation and/or “one of a kind” installations. Consult with District Engineer and all necessary specifications prior to installation. All construction work shall be done in a thorough and workmanlike manner, in accordance with the unit specification drawings and specifications.

Poles, guys, pads, vaults, or other structures shall be placed in locations determined by the Engineer and staked by the Engineer, as shown on the drawings and structure lists. Poles, guys, etc. shall not be erected in any other location without prior approval of the Engineer.

The Contractor shall be responsible to ensure correct horizontal and vertical locations of the electrical and communications facilities. Before excavation for poles, guys or other structures begins, at least two offset reference points shall be set to preserve the exact location of the original stake.

## SECTION 2 – TRANSMISSION

### 2.1 – Poles

For wood poles, **See Section 3.1.0**. For fiberglass poles see manufacture specifications.

### 2.2 – Insulators

Care shall be exercised in handling and erecting insulators and in assembling suspension units to ensure that all cotter keys are in place.

Transmission structures shall have five (5) 10-inch bells per suspension string unless otherwise specified.

### 2.3 – Conductors – “See Section 3.6”

## SECTION 3 – PRIMARY OVERHEAD

### 3.1 – Wood Poles

In distributing poles, extra-heavy, choice, close-grained poles shall be reserved for angles, crossings, and deadends.

### 3.2 – Pole Installation

The minimum setting depths for poles shall be as follows:

| Pole Length (Feet) | Setting Depth (Feet) |
|---|---|
| 35 | 6.0 |
| 40 | 6.0 |
| 45 | 6.5 |
| 50 | 7.0 |
| 55 | 7.5 |
| 60 | 8.0 |
| 65 | 8.5 |
| 70 | 9.0 |
| 75 | 9.5 |
| 80 | 10.0 |
| 85 | 10.5 |
| 90 | 11.0 |
| 95 | 11.0 |
| 100 | 11.0 |

Pole holes shall be approximately 8 inches larger than the butt diameter of the pole, and shall be at least as large at the bottom as at the top.

All poles shall be set in alignment, except on line angles, and plumb. At line angles, where suspension construction is used, poles shall be offset on the bisector of the angle so that conductors will hang directly over the point of intersection or in line with the tangent in both directions. All poles shall be plumb after conductors are strung. The pole sweep, if any, shall be in the plane of the line.

In backfilling, holes shall be thoroughly tamped the full depth. Backfill shall be banked up around each pole. After completion of the job, holes shall be inspected and any settlement refilled.

At all pole locations, imported selected backfill is required. Backfill material to be 5/8” – 7/8” minus crushed rock, with fines. All water standing in pole holes shall be removed before setting and tamping poles. Backfill shall be free from sod, grass, weeds, and all other similar organic materials. Backfill shall be tamped to a dry density not less than the natural in-place dry density of the surrounding earth and thoroughly tamped the full depth. Earth shall be banked up around each pole. After completion of job, holes shall be inspected and any settlement refilled.

The tops of poles shall not be cut except under very exceptional conditions and upon approval of the Engineer. Under no circumstances shall the butt of any pole be cut.
All unused holes in wood poles shall be plugged, using treated wood dowel pins. For holes in used poles where the hole has been enlarged, the hole will be treated with preservative compound.

All wood poles shall be treated and wrapped before backfilling and tamping. Install "pole toppers" according to manufacturer's instructions on all wood poles to be reinsulated.

### 3.3 – Bolts

Pole-through bolts must be of proper length. (Lengths shown on Drawings are for maximum conditions.) Through bolts, when installed in the structure, shall extend at least 1/2-inch and not more than 2-1/2 inches beyond the nuts. No cutting of any bolt shall be allowed.

### 3.4 – Spring - Lock Washers

A lock washers shall be installed with each nut, eye-nut, or other fastener on all bolts or threaded hardware such as insulator pins, upset bolts, double arming bolts, etc.

### 3.5 – Torque Requirements

Hardware and bolts shall be securely installed and tightened to a degree that fully compresses, but does not deform, spring washers. Hardware that does not require the use of spring washers shall be tightened to a degree that ensures mounting of clips, brackets or other components.

### 3.6 – Overhead Conductors

Installation of conductors and accessories shall be done in accordance with manufacturer's recommendations.

Conductors may be strung by either conventional or tension stringing as specified by District Engineer.

3.6.1 – Care & Handling

- Care shall be exercised to avoid kinking, twisting, or abrading the conductor or overhead ground wire in any manner. Conductors or overhead ground wires shall not be trampled on, run over by vehicles, or dragged over sharp objects. The wire on each reel shall be inspected for cuts, kinks, or other injuries. Injured portions or crooked or imperfect splices in either the conductor or overhead ground wire shall be cut out and the wire re-spliced.
- Conductors and overhead ground wires shall be pulled over suitable rollers or stringing blocks properly mounted on the pole or cross arm to prevent binding while stringing.
- Installation of conductors and accessories shall be done in accordance with manufacturer's recommendations.

3.6.2 – SAG

- Conductors and overhead ground wires shall be sagged in accordance with sag and tension charts or tables furnished by District Representative. The sag of all conductors after stringing shall be in accordance with the conductor manufacturer's recommendations, except that a maximum increase of three (3) inches of the specified sag in any span will be acceptable; provided, however, that required clearances are obtained; under no circumstances will a decrease in the specified sag be allowed. (*See Drawings 1a, 1b, and 1c for minimum clearance requirements per District, State and NESC regulations*) Sagging by sighting between targets or use of "dynamometer" is recommended. For existing conductors, the existing sag and tension shall be maintained.
- The air temperature at the time and place of the stringing shall be determined by a certified etched-glass thermometer. The temperature at which the conductor is sagged in and the spans in which sags are measured shall be recorded and the information given to District Engineer.

3.6.3 - Tension Stringing

- Conductors may be strung by controlled-tension method, using neoprene-lined (or approved equal) double bull-wheel type tension stringing equipment. The equipment shall have groove sizes that will in no way damage the conductor. It shall be of a type capable of maintaining preset tensions and pulling speed. Sufficient continuous tension shall be maintained to keep conductors clear of ground or obstructions that could damage conductor or that could be damaged by conductor. Sheaves shall be designed and used so that the pulling line does not damage the sheaves or deposit foreign matter in the liner that may damage the conductor or cause foreign matter to be deposited on the conductor.

**3.7 – Taps & Jumpers**

Jumpers and other leads connected to line conductors shall have sufficient slack to allow free movement of the conductors. Where slack is not shown on the Drawings, it will be provided by at least two (2) bends in a vertical plane, or one in a horizontal plane, or the equivalent. In areas where Aeolian vibration occurs, special measures to minimize the effects of jumper breaks shall be used as specified.

All leads on equipment such as transformers, reclosers, etc. shall be a minimum of #6 copper conductivity. Aluminum jumpers shall not be used to connect to an unplated bronze terminal.

All bolted connections to equipment (cutouts, reclosers, regulators, sectionalizers, etc.) shall be made with copper jumper of the equivalent size as the load size conductor.

**3.8 – Splices**

There shall not be more than one splice per conductor in any span, and no splice shall be located within 10 feet of the conductor support.

**3.9 – Insulators**

Care shall be exercised in handling and erecting insulators and in assembling suspension units to ensure that all cotter keys are in place.

With pin-type insulators, the conductors shall be tied in the top groove of the insulator on tangent poles and on the side of the insulator away from the strain at angles. Pin-type insulators shall be tight on the pins; and on tangent construction, the top groove must be in line with the conductor after tying in.

**3.10 – Clamps & Connectors**

Utmost care shall be exercised in installing parallel groove clamps. The contact surface of the clamp and the wire shall be clean and bright. A steel brush shall be the principal cleaning medium. These same precautions for cleaning shall apply to the conductor before splicing.

All jumpering to existing lines shall be accomplished with the existing line energized, except where prior arrangements are made with District Engineer/Supervisor in charge.

Ampact®-type connectors shall be used for all jumper connections unless otherwise specified.

## SECTION 4 – GUYING & ANCHORING

### 4.1 – Guying General

- Guys shall be installed in locations specified by District Engineer. Points of attachment to poles shall be as shown on Construction Drawings.
- Guys shall be installed before conductors or overhead ground wires are strung.
- A 1:1 slope for guy leads is recommended for deadend structures.
- Guying assemblies include down, span and sidewalk types. A push brace consisting of a pole and attached fittings may be used in place of tension wire guying only where tension guying is impossible by reason of location or rights-of-way.
- A guy marker shall be used on all down guys exposed to vehicular or pedestrian traffic.
- Re-tension guys where guy insulators installed, and install new guy guards if existing guards are damaged.

### 4.2 – Anchor Installation

Holes for anchors shall be dug in locations staked by the Engineer. Anchor rod shall be in line with the strain and so installed that approximately 8 inches of the rod shall remain out of the ground. Under no circumstances shall the eye of the rod be covered. Holes shall be backfilled and tamped in the same manner as for pole holes.

Shear pins - Helix-type power-driven screw anchors shall be installed in such a manner that the following number of shear pins are sheared on installation, and then sheared a second time to verify installation strength:

12 pins for an 18M down guy
8 pins for an 10M down guy

Anchor Extensions - In no case will more than one 7-ft. and two 3-1/2 ft. extensions be used. If the extensions are used and the required number of pins are not sheared, anchor and rods shall be removed and a larger size anchor shall be installed.

Anchor Selection - If soil conditions do not allow screw anchor to be properly installed, a deadman anchor, as determined by the District Representative, will be installed. Re-tension guys where guy insulators installed and install new guy guards if existing guards are damaged.

## SECTION 5 – TRENCHING: EXCAVATION, BACKFILL, & SHORING

### 5.1 – General

It is the intent that the primary, secondary, telecommunications, and illumination conductors/conduits be placed in a common trench, insofar as practicable. Trench widths shall not be less than as shown on the plans, and not wider than practicable for the installation. Trench depths shall be sufficient to provide the minimum cover from the top of the conduits to the surface of the ground as shown or directed in the Specifications

Any area where District personnel must enter the trench shall be excavated in accordance with chapter 296-155 WAC of the Washington State Safety Code. In general, the code

requires excavated material be at least 2' from the edge of the trench and any trench over 4' deep be sloped, shored, sheeted, or otherwise adequately protected.

### 5.2 – Specification Drawing

The trench shall be excavated to the specifications shown on *drawings #3, #4*, unless otherwise approved by a district representative. *See Drawing #4b* for trench excavation layout and typical separation to communication and water utilities for subdivision lots.

### 5.3 – Excavation & Backfill

The bottom of all trenches shall be smooth; uniform; and free of all loose rock, stone, other sharp objects, and foreign material, hand-fill where large rocks are encountered and as directed by the District Representative.

The initial six (6) inches of fill over conduit shall be sand, carefully selected from excavate materials and placed with due care to prevent damage or as approved by District Representative.

Where needed, trenches having abrasive bottom characteristics, or where conduits are racked into a multilevel duct bank, three (3) inches of sand cushion below the duct bank and three (3) inches of sand cover above the duct bank shall be used in addition to the normal backfill.

All excess excavated material from all trenches shall be loaded and removed from the site without contaminating existing finished subgrade material.

No trash, including food waste, food containers, and construction materials, will be placed in trenches.

### 5.4 – Backfill Material

Backfill material shall be required for the main line trench under existing or future pavement where 95% compaction cannot be maintained

### 5.5 – Compaction

All trenches will require mechanical tamping with suitable impact vibrator (wacker) and/or impact vibrator attached to the backhoe. Compacting with the backhoe's bucket may only be used on the finish grade. Mechanical tamping shall be done in accordance with the District Specifications or as directed by the Engineer. A typical trench will require mechanical compaction in 3 lifts.

### 5.6 – Road Crossings

All open-cuts to road crossings or driveways shall consist of the following:
(See Drawing #5 for dimension details)

- Control Density Backfill (CDF) under all roads, including road shoulders, shall be coordinated and installed.
- Contractor shall provide steel plate shall be placed over all open-cuts overnight.

- If asphalt plant is closed, periods of construction performed during winter months, remove three (3) inches of CDF and install cold-mix asphalt. The installation of the cold mix shall be performed no later than one (1) week after the CDF has been installed.
- If asphalt plant is open, install patch as approved.

## SECTION 6 – VAULTS/PRE-CAST CONCRETE & FIBERGLASS STRUCTURES

### 6.1 - Excavation, Drainage, & Bedding

All structures shall be placed on a minimum of six (6) inches of ¾" minus crush rock or equivalent, compacted and tampered, extending a minimum of twelve (12) inches beyond the edge of the structure on undisturbed soil. Large rocks or other obstructions in the bottom of the excavation, which may cause damage to the structures, shall be removed and not used as backfill material.

Excess material obtained from structure excavation shall be removed from the construction area and disposed of by the Contractor.

### 6.2 - Backfill & Final Grade

Excavated material, if approved by District personnel, may be used as backfill. All other material will be subject to approval by a district representative. Bedding material shall be placed in sufficient quantity to protect the conduit. The typical requirement is 6"-inches above the conduit.

Mechanical tamping is required at all installations of the electrical structures.

Final grade: The elevation differences between the top of the slab and the final grade

| TYPE OF FINAL SURFACE | DISTANCE BELOW TOP OF SLAB |
|---|---|
| LANDSCAPED | 3" |
| PAVED SURFACE | 1" |

### 6.3 - Knockouts

All knock-outs should be grouted where conduit enters vault and the interior side should be finished smooth/flat.

### 6.4 - Base & Lid Assembly

Apply mastic tape between each vault section. (See Drawing #6)

### 6.5 - Conduits & Cable Racking

- All conduits entering the vault should consistently enter the exterior "left hand side" knockouts to facilitate "clockwise lay" of cable in the vault.
- All interior ends of conduits should be terminated with bell ends to protect conductor casing.
- All inactive conduit ends shall be closed with appropriate duct plugs to provide a reliable barrier against liquids, gases, dirt, silt and small animals.
- Conduit that are active with conductor, shall be sealed with conductor multi-cap and/or insulating foam.

- Prior to backfill material added, a uni-strut with 2-piece clamps or equivalent should be used to support conduit extending from the knock-out.
- All conduits within the vault should be secured to stanchions racks with tie clips.

**6.6 - Grounding**

Each vault piece is shall be bonded together using grounding lug and appropriate conductor size and material. (*See Drawing #6*)

**6.7 - Termination/Elbows**

All termination elbows shall be identified and labeled to districts policies. (*See Section 9*)

**6.8 - Housekeeping**

Inside of vaults shall be kept free of all lose materials including rocks, dirt, paper, discarded conduit materials, nuts and bolts, and all garbage.

**6.9 - Plant Number & Identification**

A red marking stake shall be driven into the ground below all grade vaults. (see labeling section for complete labeling instructions)

**SECTION 7 – PRIMARY UNDERGROUND**

**7.1 – Trenching –** See SECTION 5 for Details

**7.2 – Conduit & Cables**

Glue all PVC conduit joints according to manufacturer's instructions. Keep inside surfaces clean. Use cleaning mandrill prior to cable installation if necessary. Separate vertically arranged "crossings" by 12 inches of fill. Seal ends ("Jack Moon" seals at risers).

7.2.1 Cable Handling

- Store and transport all reels on flanges – not lying flat on side.

7.2.2 Cable Installing

- Pull using steel cable or pulling tape that will not "cut through" wall of PVC elbow.
- A dynamometer shall be used to ensure pulling tension does not exceed 1,000 pounds.
- Make smooth bends in cable.
- Use lubricant liberally.
- Seal ends of cable to keep moisture out of cable during construction.
- If basket grips are used for pulling, cut the pulling end of the cable well behind the area covered by the grip and discard the "spoil."
- De-reel from top of revolving reel.
- Make smooth bends in cable.
- Install temporary guides, tubes, sheaves, etc. as necessary to prevent cutting of cable on sharp edges.
- Use duct end-bells, conduit bushings, and rack saddles to prevent abrasion.

- Do not drag cable over sharp objects or allow cable to be driven over.
- Phases to be identified by end tags or color-coded tape.
- Installed cable shall not be tested via HIPOT.

**7.3 – Elbow & Termination**

- Install elbows according to manufacturer's instructions – use appropriate cleaning solvents.
- Nicks or scratches in the cable need to be buffed out with 240-grit nonconductive abrasive cloth.
- Wipe clean with solvent-dampened lint-free cloth. Do not pour solvents over cable.
- Use manufacturer's recommended crimping tools for all connections.
- Aluminum conductor shall be cleaned and brushed with oxide inhibitor in preparation for connector installation.
- Excess inhibitor shall be removed.

**7.4 – Cabinet Installation & Clearances**

All padmount junction boxes, transformers, fuse and switch cabinets shall be installed to allow access by District personnel and vehicles. The opening side of the device must have a minimum of 10 feet of clearance from any obstructions. (*See Drawing #2*)

**SECTION 8 – GROUNDING**

**8.1 – Overhead**

All new primary distribution poles shall have a pole ground installed. Ground rods, minimum size 5/8" x 8', shall be driven (8) eight feet deep next to poles.

Ground rods shall be driven next to poles in accordance with District specification contained herein unless otherwise specified.

**8.2 – Transformers & Line Devices:**

See Construction Assembly Drawings for details

**8.3 – Padmount:** See construction assembly drawings for details.

**SECTION 9 – LABELING**

**9.1 – Pole Numbers:**
(*See Drawing #7a*)

Use 1" aluminum, black on yellow numbers mounted in black plastic holders attached with 1-1/2" copper nails, four per holder.

**9.2 – Plant Unit Numbers:**
(*See Drawing #7b & #7c)*

Shall consist of 10 digits; the first four (4) digits are the township and range, mounted in a four character holder. The last six (6) digits, corresponding to the map numbers, are mounted below in a six-character holder.

### 9.3 – Pad mounted transformers, primary pedestals, equipment cabinet, & vaults

(*See Drawing #7d)*

Use 1” aluminum, black on yellow numbers mounted in aluminum holders attached with pressure sensitive foam adhesive. Surface shall be cleaned with solvent (cable cleaner), dried, and holder applied in temperature between 40 and 70 degrees Fahrenheit.
If surface is cold and/or wet, the cabinet may be carefully heated with a propane hand torch.

### 9.4 – Structures, Switching, or Protective Equipment

(*See Drawing #7a*)

Use 3” aluminum, black on yellow numbers mounted in aluminum holders attached with 1-1/2” copper nails, four per holder.

### 9.5 – Underground Sectionalizing Numbers

(*See Drawing #7a*)

The general objective is to be able to identify a cable at any part of the operation and be able to know the location of the next operating point where the cable could be finalized.

Numbers shall consist of six digits corresponding to the map number and an additional tag identifying, “*To Riser*”, “*To Trans*”, “*To Junct*” mounted in a seven character black plastic holder, attached to the cable using two uv resistant black tie wraps. The number identifies the plant unit number at the opposite end of the cable.

When more than one cable having the same source plant unit are located in one plant unit, the “*To Riser*”, etc., Tags shall be black on red, blue and white. If cables located in one plant unit have different source plant units, The “*To Riser*”, etc. tag shall be black on yellow.

When multiple cable/conduit runs exist between common vaults, riser or switch cabinets, add a four-character holder mounted end to end to each cable with black on yellow tag identifying “*To Riser*”, etc. followed by a circuit number beginning with #1. The riser will also have a four-character holder with circuit/conduit number.

Red, Blue, and White shall be used <u>only</u> to identify the cables with their source and not phasing.

Crew persons will assemble all numbers appropriate holders.

When inserting equipment in existing systems, it will be necessary to go to adjacent operating points and install tags as appropriate.

When installing color-coding to identify multi-phase conductors, crews shall “Ring Out” to prove identity.

Underground system shall not be left energized and placed in operation unless equipment and cable tagging is installed and has been verified as being accurate.

### 9.6 – Underground Sectionalizing Numbers

(*See Drawing #7a*)

The substation cable ends shall be tagged as defined in paragraph two (2) and (3) – "underground sectionalizing numbers" above. The pole risers or vault end shall be labeled "Line A", "Line B", etc., to match station riser followed by black on red, blue and white tag "To STA". The protective device number may be substituted for "Line A", Line B", etc. designation, (ex. B4230 followed by black on red, blue or white "To STA") when substation end terminates in pad mounted enclosure with no line designation.

## SECTION 10 – DRAWINGS

Drawings contained here illustrate items of text for typical installation, as they do not cover every possible situation and/or "one of a kind" installations. All installation must comply with NESC specifications and all regulations governed by federal, state, county and district regulatory bodies.

**Exhibit E – Construction Specifications**: details the complete construction of each different pole framing used in this project.