Underground Distribution Specification – Rev 0

1. GENERAL

All construction work shall be done in accordance with the staking sheets, plans and specifications, and the construction drawings. The minimum embedment depth for primary distribution conduit is 48-inches from top of conduit to finish grade.

The 2017 or latest edition of the National Electrical Safety Code (NESC), ANSI C2, shall be followed, except where local regulations are more stringent, in which case local regulations shall govern.

2. TRENCHING

All trenching depths specified are minimum as measured from the final grade to the top surface of the conduit. The routing shall be as shown on the staking sheets and plans and specifications unless conditions encountered are such that changes are necessary to accomplish the work. In such event, the Owner and Engineer shall be notified promptly. The Contractor will plan for and provide equipment and manpower to provide the duct bank trench, according to the specifications) along the route specified, including in areas noted as rock digging. The trench widths specified are minimum and should be increased as necessary to obtain the required depths in loose soils.

All excavations will be braced or laid back as required by OSHA safety regulations.

Care shall be exercised to minimize the likelihood of water flow causing trench damage and reduction in trench depth. If water flow occurs, the trench must be cleared to the specified depth before installing the duct bank.

All trenches shall follow straight lines between staked points as much as possible. Secondary and service trenches shall extend in a straight line from takeoff points wherever possible. The trenches shall be dug so that the bottom has a smooth grade. Large rocks, stones and gravel in excess of 1 inch shall be removed from the bottom of the trench. Where this cannot be done, a 6-inch bed of sand or clean soil shall be placed in the bottom of the trench.

Construction shall be arranged so that trenches will be left open for the shortest practical time to avoid creating a hazard to the public and to minimize the likelihood of trench collapse due to other construction activity, rain, accumulation of water in the trench, etc. Trenches shall be backfilled immediately following the installation of conduit. Trenches shall be completed each day to minimize the length of trench open overnight or on weekends. All open trenches shall be fenced with warning fabric if left overnight or over a weekend.

The Contractor shall be required to commence compaction activities immediately as the trench is being backfilled. When field conditions dictate that backfill must be performed in lifts, compaction efforts will take place concurrently with the backfill operations. The backfill operation is to be completed within 100 feet of the conduit installation or excavation.

During trench excavation, the Contractor may encounter the presence of groundwater. The Contractor shall maintain facilities on site to remove all groundwater from the trench and keep water at least 12 inches below the trench bottom. The Contractor shall take all necessary precautions to prevent groundwater from entering the conduit system. All open ends of the conduit shall be properly plugged and sealed. No extra payment will be made for groundwater control operations or for protecting the conduit system from the intrusion of water.

3. DIRECTIONAL BORING

Directional boring installations shall verify the minimum embedment depth below final grade is met. Construction shall be coordinated to avoid blocking roads, driveways, and business entrances with assembled duct bank prior to installation. Directional boring shall be performed to ensure the final grade does not settle at the location of the installed duct bank. Bore spacers are to be used as required. Mud created during directional boring is to be removed from the site.

4. CONDUIT

Contractor shall carefully ream ends of all conduit lengths after cutting to eliminate sharp burrs. Contractor shall cap ends of all conduits before backfilling is done and clean out all conduits immediately after backfilling is finished. Contractor shall cap all conduits after cleaning where conduits are to be left empty by this contract.

Conduit will be installed as near as possible to the routing indicated. Location can be shifted if required without interference with any equipment. Where routing of conduit is not indicated, Contractor shall route in conformance with this specification.

Rigid Polyvinyl Chloride (PVC) Conduit or roll pipe is to be used in direct buried applications. Bury conduits to the depth indicated. Terminate PVC conduits in a bell end inside of the riser cable shield. Conduit runs shall be straight runs between points. Where project conditions don't allow for straight runs the conduit run shall consist of very large shallow radius bends. There shall be no more than 270 degrees of conduit bends in any conduit run. Conduit shall maintain the separation indicated on the drawings. All joints shall be watertight with cement compound furnished by conduit manufacturer. Make all open conduit ends watertight with suitable sealer.

Conduits shall be graded to drain toward one or both terminal points of the duct run. The slope shall not be less than 2 inches for every 100 feet of length. After trench bottom has been finished to grade, lay conduit, then carefully backfill trench in layers.

5. MINIMUM BENDING RADIUS OF CONDUIT

Conduit sweeps shall be installed so the conductor minimum bending radius is not exceeded.

6. DUCT BANK

Conduit and duct systems shall be of the type specified in the drawings and shall meet the requirements herein. Conduits shall be joined in such a way as to prevent solid matter from entering the joints. Joints shall form a continuous smooth interior surface between joining conduit sections so that cable will not be damaged when pulled past the joint.

No duct / conduit system shall be covered with backfill until approval is obtained from the Owner's Technical Representative.

"Pulling In" Rope:

1. PVC: minimum size ¼".
2. Breaking strength: minimum 1200 pounds.
3. Install one pulling rope in each conduit.
4. Leave 10 foot of spare rope in at the risers.

Conduit Spacers shall be used to provide conduit separation as specified on the drawings. Spacers shall be the standard manufactured product. They shall be located at five foot intervals.

7. INSTALLING CONDUIT DUCT BANK

The conduit shall be inspected carefully by the Contractor as it is off-loaded and unpacked.

Ends of all conduits will be sealed against water at all times prior to termination. Sealing will be accomplished with approved conduit caps or plugs.

The following conduit shall be used for this installation:

4" schedule 80 or 4" roll pipe
2" schedule 80 or 2" roll pipe

8. BACKFILLING

The first 6 inches of trench backfill shall be free from rock, gravel or other material which might damage the conduit duct bank. In lieu of cleaning the trench, the Contractor may (at his option) place a 6-inch bed of clean sand or soil under the cable and 6 inches of clean soil or sand above the conduit. Cleaned soil backfill when used shall contain no solid material larger than 1 inch. The first 10 inches of backfill material placed in the trench above the shading material for the conduit shall not contain rocks larger than 3".This soil layer shall be carefully compacted so that the conduit will not be damaged. Trench run material may be used for the remainder of the backfill.

Backfilling shall be completed in such a manner that voids will be minimized. Excess soil shall be piled on top and shall be well tamped. All rock and debris shall be removed from site and any damage to the premises repaired immediately.

Compaction requirements will be rigid for all trenching. Contractor must be prepared to backfill and compact in lifts not to exceed 12 inches. A drop hammer and other compaction equipment as required shall be kept with each excavation crew. 95% of Standard Proctor (maximum density) is the minimum requirement for all compaction on this project.

The Contractor will be responsible for using the appropriate compaction equipment and techniques to obtain the specified trench density. To achieve the desired density, the Contractor may need to make adjustments to: (1) type of equipment used, (2) backfill lift thickness, and (3) moisture conditioning of backfill material. No extra payment will be made for any adjustments needed by the Contractor to achieve the specified densities.

With the exception of requiring drop hammer and other compaction equipment for each excavation crew, the Owner and Engineer will not dictate the method of compaction to be used. If unusual or non-typical compaction conditions exist, the Contractor shall immediately notify the Owner and Engineer before proceeding with compaction activities.

Wheel rolling is not considered to be an adequate compaction technique to meet the desired density of 95% (Standard Proctor - maximum density) and will not be allowed.

Pieces of scrap conduit or other material remaining after installation shall not be buried in the trench as a means of disposal.

Magnetic warning tape shall be installed with backfill at a depth of 12" below grade. Warning tape pricing shall not be included in the trenching unit prices.

9. Warning Tape:

A warning tape shall be installed one foot below grade.

The 6 inch wide warning tape shall be inert plastic film 4 mils thick with a tensile strength of 30 pounds per 6 inch wide strip. The tape shall be red with a continuous "CAUTION ELECTRIC BURIED BELOW" printed message repeated every 36 inches. The tape shall be colored in accordance with American Public Works Association (APWA) recommended color code for marking buried lines of all types. The tape shall be Terra Tape Standard 250 manufactured by Reef Industries, Inc or an approved equal.

10. CABLE INSTALLATION

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified at each terminal by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal.

To eliminate confusion on work associated with cable terminations, splices, etc., all underground cable shall be painted or taped prior to installation. The cable shall be painted on the reels and allowed to dry to avoid smearing. The type of paint to be used shall be Krylon 1813 Yellow, 1901 Blue, and 2101 Red.

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

The cable shall be inspected carefully by the Contractor as it is removed from the reel in pulling operations to be certain that it is free from visible defects. The Contractor and Owner shall decide upon corrective action when defects are discovered.

Ends of all cables will be sealed against water at all times prior to termination. Sealing will be accomplished with black tape and Scotch Kote.

Cables shall be continuous between terminations. Splices shall be a cause for rejection.

11. MINIMUM BENDING RADIUS OF CABLE

The minimum bending radius of primary and secondary cable shall not be less than the manufacturer's recommendation. In all cases, the minimum radius specified is measured to the surface of the cable on the inside of the bend. No cable bends shall be made within 6 inches of a cable terminal base.

12. RISER POLE

Wire tails for three phase primary risers will be equal to the height of the pole.

13. PRIMARY CABLE TERMINATIONS

Prefabricated terminations shall be installed in accordance with the manufacturer's instructions at all primary cable terminals. Terminations shall be suitable for the size and type of cable that they are used with and for the environment in which they will operate. Any indication of misfit, such as a loose or exceptionally tight fit, shall be called to the Owner's attention. The outer conductive surface of the termination shall be bonded to the system neutral. A heat-shrink or cold-shrink sleeve shall be installed to seal between the body of the termination and the cable jacket.

14. SPECIAL PRECAUTIONS FOR CABLE TERMINATIONS

A portable covering or shelter shall be available for use when terminations are being prepared and when prefabricated terminations are being switched. The shelter shall be used as necessary to keep rain, snow and windblown dust off the insulating surfaces of these devices. Since cleanliness is essential in the preparation and installation of primary cable fittings, care shall be exercised to prevent the transfer of conducting particles from the hands to insulating surfaces. Mating surfaces shall be wiped with a solvent, such as denatured alcohol, to remove any possible accumulation of dirt, moisture or other conducting materials. Silicone grease shall be applied afterwards in accordance with the manufacturer's recommendations. Whenever prefabricated cable devices are opened, the un-energized mating surfaces shall be lubricated with silicone grease before the fittings are reconnected.