Design Standard

Electrical Utility Raceway

This section specifies the construction of an electrical utility raceway system. See also the Medium-Voltage Electrical Service & Distribution design standard.

All acronyms are per NEC.

Detailed specifications as follows:

**PART 1 - ELECTRICAL UTILITY DUCTBANK**

1.01 All electrical utility ductbanks shall be encased in reinforced red concrete.

1.02 All conduits shall be PVC, RGS or ¼ inch thick Fiberglass / RTRC.
   
   A. All RGS shall be PVC wrapped with 40 mil PVC tape.

1.03 All Power Distribution conduits shall be 6-inch trade size (all conduits between manholes except for controls power or communications conduits).
   
   A. The minimum number of power distribution conduit between manholes shall be the greater between 4 or required conduits plus 33% spare.

1.04 Conduits between the last manhole and a transformer shall be 4-inch trade size. (except for controls power or communications conduits).
   
   A. Vertical conduit into transformer shall be PVC.
   
   B. Conduits to transformer shall include more than 50% spare conduits.

1.05 Controls power or communications conduits shall be 2 inch
   
   A. All ductbank sections shall have two (2) conduits for Controls power and/or communications.

1.06 All bends shall have minimum 48 inch radios.

1.07 All bends over 30 degrees shall to be of RTRC, RGS or IMC.

1.08 Maintain 3 inch minimum spacing between conduits.

1.09 Provide conduit chairs to maintain spacing every 4 ft.
   
   A. Conduit chair system shall not create a shear point on conduit. i.e. cannot be a sheet of material with cutouts for conduits.

1.10 Provide #4 rebar parallel to conduits in each corner.

1.11 Provide #3 rebar stirrups every 4 feet.

1.12 Provide a minimum of 3 inches concrete around the exterior of conduits.

1.13 Concrete shall have a minimum compressive strength of 2,500 psi at 28 days.
1.14 Concrete encasement shall be red using red oxide cement.
1.15 Concrete shall not be pour so as to create a cold joints that are shear points.
1.16 Ductbank and manhole systems shall slope away from the building and toward manholes with sumps at a minimum of 4 inches per 100 feet (0.33%).
1.17 Maintain 30 inches of cover from conduits to grade.

PART 2 - ELECTRICAL UTILITY MANHOLES

2.01 Manhole shall be place every 400ft unless noted otherwise.
2.02 Manholes shall be precast concrete.
2.03 Manholes shall have a minimum inside of 10ftx10ft and with a minimum of 8ft tall.
   A. Manholes that plan for an underground switch shall be minimum 12ft x 12ft.
2.04 Manholes shall include thin-wall knock-outs on every wall.
2.05 Manholes shall have a set of nonmetallic cable racks anchors set into all walls.
2.06 Manholes shall be set on a stabilizing sand bed.
2.07 Manhole lids shall be 4” above final grade.
2.08 Manholes lids shall have a minimum of a 42” hole opening.
   A. Where feasible Manholes shall have an equipment access opening.
   B. Where Underground switch is planed equipment access opening is mandatory.
2.09 Iron castings for manhole rings and covers shall conform to ASTM A48, Class 30, and be traffic rated.
2.10 All electrical manhole covers shall be labeled with ‘ELECTRIC’ on the top of them.
2.11 Manholes shall include a Hot-dip Galvanized 18 inch wide ladder anchored to floor and wall.
2.12 Ladder ups will be mounted in the center of every ladder.
2.13 Manholes shall include a minimum of four (4) sets of nonmetallic long support arms for each cable rack anchor set.
2.14 All manholes shall have a minimum of two (2) 5/8” by 10ft grounding rods and a 4/0 ground ring.
   A. Ground ring shall wrap around perimeter of interior of the manhole approximately 42 inches from bottom, and anchor directly in to manhole walls.
Ground rods shall be tied to ground ring.
All metallic parts in manhole shall be grounded to ground ring.

2.15 All manholes shall have a sump pit that is a minimum of 1 ft deep, and 18” x 18”.
   A. Metal Grate shall be included in sump pit.

2.16 Unless noted otherwise: All manholes will have sump pumps installed in them.
   A. Sump pump shall be minimum of 1/3 Hp with wide angle float.
   B. Sump pumps shall include all required circuity to be fully operational.
   C. Sump pump shall include a 2” discharge line with a disconnecting union and check valve.
   D. Sump pump discharge shall go to nearest hidden grassy area unless directed otherwise by UES.

PART 3 - ELECTRICAL UTILITY DUCTBANK TO MANHOLES CONNECTION

This section describes dead end changes to the duct bank as the conduits open to an open space; most commonly this is a manhole or vault. To simplify, descriptions below shall assume a manhole, however all similar openings shall apply.

3.01 A minimum of 10 feet of duct bank entering ductbank shall be either ¼” thick Fiberglass / RTRC conduit or RGS conduit.
   A. The conduits shall enter with either preformed bell ends or attached bell ends.
   B. Attached bell ends shall either be fiberglass/RTRC or Sch 80 PVC.
   C. All conduits (bell ends) shall be cut off flush with the wall in the manholes.

3.02 Ductbank reinforcing rebar shall be drilled and anchored into manhole.
   A. Ductbanks tying into open window shall have rebar turn 90 degrees into wall of manholes.
   B. Ductbanks tying in to manhole wall shall anchor rebar by fully pass though manhole wall and setting in epoxy. Ductbanks tying in this style shall double anchoring rebar by adding midpoint rebar on all four sides of ductbank.
   C. Anchoring in rebar shall extend a from manhole a minimum of 5ft into ductbank.

3.03 An additional rebar stirrup shall be added to ductbank between 3" and 9" of manhole.

3.04 In order to ensure concrete leave no void against manhole, lightly Vibrate concrete for first 2ft of ductbank away from manhole. Only first 2 ft. DO NOT float the conduits.

PART 4 - DUCTBANK AND MANHOLE EQUIPMENT AND FINISHING
This section describes utility cable and other equipment as they are placed and or interact with the Electrical Utility Raceway System

4.01 All ducts shall be swapped before sealing or pulling cable and shall have 2500lbs mill tape in each conduit.

4.02 All empty ducts coming into manholes shall be sealed off.

4.03 All racks shall be as high as possible in manhole.

4.04 All cables shall be set on lowest open rack in manhole.

4.05 After entering all cables shall be warped around manhole one time before exiting (touching at least three walls).

4.06 All cables passing through manholes shall have fire taping and wrapped as 3 phase set with cloth taping (3M 77cloth tape or approved equal).

4.07 All cables passing through manholes shall be labeled with feeder number and bldg. numbers, cables should be marked with red and blue marking tape to identify the phases.

4.08 All cables shall be Tie wraps to supporting cable arms. Tie wraps shall be 3’ in length and ½” in width.

4.09 Any terminations in the manhole shall be supported between the rack in the manhole and as close the wall as possible.

4.10 All 600 amp T-bodies and 200 amp elbows shall have test points.

4.11 All switches shall be anchor down and set so that it can be operated from manhole lid opening.

4.12 Any positions on a switch that are not used shall have bushing inserts with dust covers and shall be grounded.

4.13 Manholes will be clean at the completion of the project.

PART 5 - DIAGRAMS

All diagrams are for general guidance representing expectations. Measurements and units are subject to change based on raceway system requirements
1. Concrete: Design Strength of 5500 PSI at 28 Days.
2. Steel Reinforcement: ASTM A-615 Grade 60.
3. Loading: Designed for HS-20 Loading.

GENERAL NOTES:
1. Different Height Tops and Bottoms are Available on Request.
2. All Weights Calculated with Solid Walls.
NOTE:
1. MANHOLE TO BE DESIGNED FOR H-20 LOADING.
2. SUBBASE FOR PLACEMENT OF MANHOLE TO BE STABILIZED WITH 12" OF CEMENT STABILIZED SAND TO PROVIDE LEVEL SOLID BEARING SURFACE BEFORE INSTALLATION OF MANHOLE.
3. ALL WINDOWS TO BE FURNISHED WITH SMOOTH OUTSIDE WALLS PROVIDING ADDITIONAL STRENGTH TO RESIST BREAKOUT DURING INSTALLATION.
4. MANHOLE COVER TO BE EMBOSSED "ELECTRIC".
5. MANHOLE TO BE INSTALLED SO AS TO PROMOTE NATURAL FLOW TO MANHOLE SUMP. GROUT MAY BE USED TO CORRECT IRREGULARITIES IN FLOOR, IF GROUT IS REQUIRED A RICH GROUT (3 SACKS) SHALL BE USED.
1'-6" TYP
1'-0" TYP
6" TYP
1'-0"
4'-0"
3'-0"
3'-0"
1'-0"
1'-0"
5'-0"
5'-0"
4'-0"
4'-0"
11'-2"
10'-0"
7"
7"
7"
7"
7"
7"
10'-0"
11'-2"
4'-0" X 4'-0" X 6"
BLOCKOUT W/ 6 1/2" X 1" RECESS
4'-0" X 4'-0" X 3'-6"
RISER W/ 3/8" COVER
UTILITY ANCHOR

PLAN VIEW OF TOP
SCALE: NONE

1 1/2" GROUND ROD HOLE

3'-0" X 3'-0"
OPENING

PLAN VIEW OF BOTTOM
SCALE: NONE
NOTES:
1. CLAMP BRACKET MAY BE ADJUSTED TO ACCOMMODATE RING GEAR A-D Dimensions 3-1/2" & 3-1/2".
2. BRACKET IS DESIGNED FOR RINGS 3-1/2" & 3-3/4" FINISHED.
LARGER RINGS WILL REQUIRE LARGER BOLTS.

VERSION 1.1.2021

Electrical Utility Raceway

TAP 120 V POWER SUPPLY
GROUNDING TYPE SINGLE RECEPTACLE IN FLOOR BOX

3/C TYPE SJ CORD WITH MOLDED ANGLE PLUG

CAST IRON GATE

CHECK VALVE

UNION

ALTERNATE PUMP DISCHARGE

2" DISCHARGE LINE

MOL FLOOR SLAB

SUMP PUMP 30 GPM @ 20' HEAD WITH AUTOMATIC SWITCH

2'-4" x 2'-4"

PRECUT SUMP
NOTES:
1. Ladders made using standard 12" panel spacing.
2. Welded construction.
3. Hit off galvanized after fabrication.

INSIDE FACE OF MANHOLE, TUNNEL OR BASEMENT WALL
STEEL/PVC ADAPTOR
GROUT ANY VOIDS AS REQ'D FOR WATERPROOFING
SPARE DUCTS TO BE PLUGGED
STEEL END Bell

DRILL & ADHERE #4 - 6 1/2" x 1/8" INTO CONCRETE WALL @ 12" O.C. MAX. (MIN. TWO DOWELS PER SIDE)

FLARE END OF DUCTBANK AS REQUIRED TO FILL WINDOW IN MANHOLES
WATERPROOF SEAL ALL AROUND - REF. ARCH'L SPECIFICATIONS

SCHEDULE 40 PVC
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