

1.2 Perform all excavations of every description of whatever substances encountered and to the depths required for installation of the work.

1.3 During excavation, stack material suitable for backfilling in an orderly manner a sufficient distance from the banks of the trenches to prevent slides or cave-ins. Remove all excavated material not required or suitable for backfill, or waste as directed. Control grading to prevent surface water from flowing into excavations and remove any water accumulating therein by pumping.

1.4 Use open-cut grading and make trenches of the necessary width for proper installation of the lines with banks as nearly vertical as possible.

1.5 Grade the bottom of trenches accurately to provide uniform bearing and support for conduit or duct on undisturbed soil at every point along its entire length.

16K.2 BACKFILLING

2.1 Carefully backfill trenches with earth, sandy clay, sand and gravel, safe shale or other approved material free from large clods of earth or stone, deposited in thoroughly and carefully rammed 6-inch layers. Do not use blasted rock. Compaction with water will be permissible and will be a requirement when so directed. Re-open any trenches improperly filled or where settlement occurs to the depth required for proper compaction, the refill, mound over and smooth off.

2.2 Backfill open trenches across roadways or other areas to be paved as specified above except that the entire depth of trench shall be backfilled in 6-inch layers; each layer moistened and compacted to a density of not less than 95 % Standard Proctor in such manner as to permit the rolling and compaction of the filled trench together with the adjoining earth to provide the required bearing value and permit paving of the area immediately after backfilling is completed. Along all other portions of the trenches, grade the ground to a reasonable uniformity and leave the mounding over the trenches in a uniform and neat condition.

16K.3 INSTALLATION OF UNDERGROUND PLASTIC CONDUIT

3.1 Plastic conduit approved for direct burial (Schedule 40) may be used in or under slab-on-grade or for underground branch circuits if local codes permit. Minimum size is 3/4 inch.

3.2 Install exterior conduits 24 inches below finished grade unless noted to the contrary. Assemble and install raceways in accordance with manufacturer's instructions. Make joints with couplings and solvent cement. Fabricate bends of 30 degrees or more with factory-made elbows, or make field bends with proper heating equipment. Bends showing signs of overheating or flattening are unacceptable. Ream ends of all conduit before joining.

3.3 Snake plastic conduit in trench, from side to side, with a complete cycle every 40 feet to allow for expansion and contraction. Maintain this configuration during backfilling.

3.4 Where conduit turns up out of earth, or floor slabs, change from plastic to rigid galvanized steel conduit below grade. Do not extend any plastic conduit above grade. Wrap all steel conduits and fittings buried in earth as specified elsewhere herein.

16K.4 INSTALLATION OF UNDERGROUND STEEL CONDUIT

4.1 All steel conduit in earth shall be rigid galvanized steel conduit. Wrap such conduit with 3M Company 0.020 inch thick No. 51 "scotchwrap" vinyl plastic tape, half lapped to give a double thickness wrap. Remove all oil, grease and dirt from conduit with a suitable solvent, and clean and dry conduit before wrapping. If conduit is pre-wrapped in the shop and then cut and joined on the job, wrap all joints on the job, overlapping pipe wrapping 3" on both sides of joints.

16K.5 INSTALLATION OF BUILDING RACEWAYS

5.1 All wiring of every description shall be run in conduit or electrical metallic tubing unless noted or specified otherwise. Conduits may be run exposed in machinery and electrical rooms and unfinished areas. All other conduits shall be run concealed unless otherwise noted. All exposed runs shall be installed parallel to the surface of the building in a neat and orderly manner.

5.2 Types: All conduits installed on roofs shall be rigid galvanized steel conduits. Above grade interior conduits shall be electrical metallic tubing. Conduits installed below grade in slabs or buried in earth shall be PVC or rigid galvanized steel. Ent is not allowed.

5.3 Connections: Use lengths of flexible metal conduit, not less than 12" long at final connections to all motors, controls and other devices subject to movement because of vibration or mechanical adjustment. Use flexible metal conduit also at connections to recessed lighting fixtures, and elsewhere as required. In damp or wet locations, and where installed outdoors, use liquid flexible metal conduit.

5.4 Penetrations: Wherever raceways pass through floors, walls, partitions, etc., carefully fill any space between the outside of the raceway and the building material to prevent passage of air, water, smoke, and fumes. Filling material shall be fire resistive and, in general, similar to the basic building materials through which the raceway passes.

16K.6 CONDUIT SUPPORTS

6.1 Support Spacing: Use minimum spacing as directed by National Electrical Code, but space hangers more closely where required by conditions.

6.2 Individual Conduits: Support conduits running vertically or horizontally with galvanized malleable iron one-hole clamps. Carry individual supported horizontally conduits 1-1/4" and larger on Kindorf No. 150 or Steel City No. C-149 hangers. Use non perforated strap iron as hanger material. Where conduits smaller than 1-1/4" are installed above non-removable type ceilings, they may be supported on ceiling runner channels.

6.3 Multiple Conduits: Where multiple raceways are run horizontally at the same elevations, they may be supported on trapezes formed of sections of Unistrut angle iron or channels suspended on rods or pipes. Size trapeze members including the suspension rods for the number size and loaded weight of the conduits they are to support. Space them as required for the smallest conduit supported.

16K.7 INSTALLATION OF OUTLET BOXES

7.1 Usage: provide at each outlet or device of whatever character a metal outlet box in which conduits shall terminate.

7.2 Boxes Recessed In Construction: Cast metal boxes.

7.3 For Wall Switches, Receptacles and Communications Use: Use 4"x4" size with proper square cornered tile wall cover, plaster cover, or finishing plate, except where construction will not permit or the device requires a larger box.

7.4 Boxes for Exposed Work: Cast metal boxes.

7.5 Boxes for Outdoors: Cast metal boxes with gasketed covers.

16K.8 WIRE PULLING

8.1 Wire Pulling: Provide suitable installation equipment for pulling conductors into raceways or conduits. Use ropes of polyethylene, nylon or other suitable material to pull in conductors. Attach pulling lines to conductors by means of woven basket grips or by pulling eyes attached directly to conductors. All conductors to be installed in a single conduit shall be pulled in together.

8.2 Cable Lubricants: All cable lubricants shall be UL listed, and shall be certified by their manufacturer to be non-injurious to the insulation on which they are used.

16K.9 INSTALLATION OF BUILDING WIRE (600 VOLTS AND UNDER)

9.1 Feeders: Run all feeders their entire length in continuous pieces without joints or splices, insofar as practical.

9.2 Sizes: No wire shall be smaller than No. 12 except for signal or control circuits, and except for individual lighting fixture taps as permitted by the National Electrical Code.

9.3 Identifying Tags: Nonferrous; stamped to clearly identify each circuit. Securely fasten tags to all cables, feeders and power circuits in pull boxes, lighting, power and distribution panelboards, etc.

9.4 Bundling Conductors: Bundle all conductors in panelboards, cabinets and the like, using marlin twine lacing or nylon straps made for the purpose. Bundle conductors larger than No. 10 in individual circuits. Bundle smaller conductors in larger groups.

16K.10 MOUNTING HEIGHTS

10.1 Where mounting heights are indicated on the drawings, the device shall be installed with the centerline of the device at the indicated height.

10.2 In general, devices which are shown to be installed at counters or other millwork, unless noted. Wall switches shall be installed on the strike side of the door as finally hung.

10.3 Unless otherwise noted on the drawings, or directed by the Owner, install devices at the following heights.

DEVICE	MOUNTING HEIGHT
Wall Switch	4'-0"
Receptacle	18"
Telephone Outlet	18"

10.4 Observe all ADA requirements when mounting devices in areas designated as "handicap".

SECTION 16L - SERVICE CONNECTIONS:

1. Verify power company services requirements for this project.

2. Pay all power company charges for the underground electrical service. Secure price from local utility company.

SECTION 16M - LOAD BALANCING:

1. The contractor shall carefully balance his electrical loads between the various phases. When the facilities are under use at their heaviest loading periods, tests shall be run on the "hot" conductors in each feeder to a panel and any unbalance shall be corrected to a point that no conductor's load shall be more than 10 % high or low (maximum unbalance of 20 %) in amperes.

SECTION 16N - SERVICE AND EQUIPMENT GROUNDING:

1. Provide adequate and permanent service neutral and equipment grounding in accordance with the National Electrical Code, and subject to the following additional requirements.

2. Connect the service ground and equipment ground to a common point within the metallic enclosure containing the main service disconnecting means. From the common point of connection of the service ground and equipment ground, run in conduit a combined service and equipment grounding conductor without joint of splice to the main water service pipe and connect it thereto with an approved bolted pressure clamp. Clean all contact surfaces thoroughly before connection, to assure good metal to metal contact. Bond the conduit to the grounding conductor at each end. Supplement the water pipe ground with an additional electrode which shall be 10' long by 3/4 inch diameter copper clad steel ground rod. Attach the electrode to the water pipe and to the service/equipment grounding conductor.

3. Size grounding conductors in accordance with National Electrical Code Tables 250-94 and 250-95.

4. The building structure steel frame shall be grounded to the building service ground electrode, using the conductor size specified in National Electrical Code Section 250-94 (a).

SECTION 16O - GROUNDING RACEWAYS:

1. Assure the electrical continuity at all metallic raceway systems, pulling up all conduits and/or locknuts wrench tight. Where the flexible metallic conduit is employed, provide a green-insulated grounding jumper installed in the flexible conduit. Install a separate green-insulated conductor in each nonmetallic conduit.

2. Provide grounding bushings on all service raceways terminating within panelboards, cabinets, and all other enclosures. Provide grounding conductors from such bushings to the frame of the enclosure and to the ground bus or equipment grounding strap. Size grounding conductors in accordance with NEC Table 250-95.

SECTION 16P - EQUIPMENT GROUNDING CONDUCTORS:

1. Provide a separate, green-insulated copper grounding conductor, with insulation of the same rating as phase conductors, for each feeder and for each branch circuit indicated. Install the grounding conductor in the same raceway with the related phase and neutral conductors, and connect the grounding conductor to pull boxes at intervals of 100 feet or less, to each raceway. Connect all grounding conductors to bare grounding bars in panelboards, and to ground buses in service equipment to the end that there will be an uninterrupted grounding circuit from the point of a ground fault back to the point of connection of the equipment ground and system neutral. Size all these grounding conductors per NEC Table 250-95.

SECTION 16Q - EQUIPMENT WIRING:

1. Connect complete for operation all items of heating and air conditioning, and all other electrical devices furnished by the Owner of under other Divisions of the specifications. Outlets of various types have been indicated at equipment locations, but no indications of exact location or scope of the work are shown on the drawings. Refer to the Owner and to the various Contractors for the work under the other Divisions for the scope of connections to equipment furnished by them and for the exact locations of all items.

2. Where disconnect switches or circuit breakers are not provided integral with control equipment for motors and other electrical apparatuses, provide and install all disconnect switches required by the National Electrical Code and/or as indicated.

SECTION 16R - TEMPERATURE CONTROL:

1. Completely connect for operation all items for temperature controls which require electrical connections, furnishing all wiring, conduit and labor. All control wiring, including thermostat wiring, shall be in conduit.

SECTION 16S - COMMUNICATION AND COMPUTER CIRCUITS:

1. Provide and install conduit to and outlet boxes for telephone outlets shown on drawings. Installation of the system will be by others.

2. Provide and install conduit and outlet boxes as required by Owner for computer system and security systems. Verify requirements with Owner.

3. Pull wires shall be installed in all computer and security system and telephone conduits.

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