

V. UNDERGROUND CONDUIT SYSTEMS

NOTE: While it is often the practice to use DUCT and CONDUIT interchangeably, DUCT, as used herein, is a single enclosed raceway for conductors or cables; CONDUIT is a structure containing one or more DUCTS; and CONDUIT SYSTEM is the combination of CONDUIT, CONDUITS, MANHOLES, HANDHOLES, and/or vaults joined to form an integrated whole.

A. Routing

1. General

a. Conduit systems should be subjected to the least disturbance practical. Conduit systems extending parallel to other subsurface structures should not be located directly over or under other subsurface structures. If this is not practical, the rule on clearances, as stated in B below, should be followed.

b. Conduit alignment should be such that there are no protrusions which would be harmful to the cable.

c. When bends are required, the minimum radius shall be sufficiently large to prevent damage to cable being installed in the conduit.

RECOMMENDATION:

The maximum change of direction in any plane between lengths of straight rigid conduit without the use of bends should be limited to 5°.

2. Natural Hazards

Routes through unstable soils such as sand, shifting soil, etc., or through highly corrosive soils, should be avoided. If construction is required in these soils, the conduit should be constructed in such a manner as to minimize movement and/or corrosion or both.

3. Highways and Streets

When conduit must be installed longitudinally under the roadway, it should be installed in the shoulder or, to the extent practical, within the limits of the lane of traffic.

1. General

The clearance between a conduit system and other underground structures paralleling should be as large as necessary to permit maintenance of the system without damage to the paralleling structure. A conduit which crosses over another subsurface structure shall have a minimum clearance sufficient to prevent damage to either structure. These clearances should be determined by the parties involved.

2. Separation between Supply and Communications Conduit Systems.

Conduit systems to be occupied by communications conductors shall be separated from conduit systems to be used for supply systems by:

- a. 3 in. of concrete
- b. 4 in. of masonry
- c. 12 in. of well tamped earth.

Lesser separations may be used where the parties concur.

3. Sewers, Sanitary and Storm.

a. If conditions require a conduit to be installed parallel to and directly over a sanitary or storm sewer, it may be done provided both parties are in agreement as to the method.

b. Where a conduit run crosses a sewer it shall be designed to have suitable support on each side of the sewer to prevent transferring any direct load onto the sewer.

4. Water Lines

Conduit should be installed as far as is practical from a water main in order to protect it from being undermined if the main breaks. Conduit which crosses over a water main shall be designed to have suitable support on each side as required to prevent transferring any direct loads onto the main.

VI. EXCAVATION AND BACKFILL

A. Trench.

The bottom of the trench should be undisturbed, tamped, or relatively smooth earth. Where the excavation is in rock, the conduit should be laid on a protective layer of clean tamped backfill.

B. Quality of backfill.

All backfill should be free of material that may damage the conduit system.

Backfill within 6 in. of the conduit should be free of solid material greater than 4 in. in maximum dimension or with sharp edges likely to damage it. The balance of backfill should be free of solid material greater than 8 inches in maximum dimension. Backfill material should be adequately compacted.

VII. DUCTS AND JOINTS

A. General.

1. Duct material shall be corrosion resistant and suitable for the intended environment.

2. Duct materials, the construction of the conduit or both shall be designed so that a cable fault in one duct would not damage the conduit to such an extent that it would cause damage to cables in adjacent ducts.

3. The conduit system shall be designed to withstand external forces to which it may be subjected by the surface loadings.

4. The internal finish of the duct shall be free of sharp edges or burrs which could damage supply cable.

B. Installation.

1. Restraint

Conduit, including terminations and bends, should be suitably restrained by backfill, concrete envelope, anchors, or other means to maintain its designed position under stresses of installation procedures, cable pulling operations, and other conditions such as settling and hydraulic uplift.

2. Joints.

Ducts shall be joint in a manner sufficient to prevent solid matter from entering the conduit line. Joints shall form a sufficiently smooth interior surface between joining duct sections so that supply cable will not be damaged when pulled past the joint.

3. Externally Coated Pipe

When conditions are such that externally coated pipe is required, the coating shall be corrosion resistant and should be inspected, tested, or both, to see that the coating is continuous and intact prior to backfill. Precautions shall be taken to prevent damage to the coating when backfilling.

4. Building walls.

Conduit installed through a building wall shall have internal and external seals intended to prevent the entrance of gas into the building insofar as practical. The use of seals may be supplemented by gas venting devices in order to minimize building up of positive gas pressures in the conduit.

VIII. MANHOLES, HANDHOLES AND VAULTS

A. Strength

Manholes, handholes and vaults shall be designed to sustain all expected loads which may be imposed upon the structure. The horizontal design loads, vertical design loads, or both shall consist of dead load, live load equipment load, impact load, load due to water table, and any other load expected to be imposed upon the structure, to occur adjacent to the structure, or both. The structure

enclosed areas used by the public, where such enclosures house transformers, switches, regulators, etc., the ventilating system shall be cleaned at necessary intervals. This does not apply to enclosed areas under water or in other locations where is impractical to comply.

J. MECHANICAL PROTECTION

Supply cables and equipment shall be installed or guarded in such a manner as to avoid damage by objects falling or being pushed through the grating.

K. IDENTIFICATION

Manhole and handhole covers should have an identifying mark which will indicate ownership and type of utility.

X. CABLE IN UNDERGROUND STRUCTURES

Installation.

A. General

1. Bending of the supply cable during handling, installation and operation shall be controlled to avoid damage. Manufacturer's recommendations may be used as a guide.

2. Pulling tensions and sidewall pressures on the supply cable should be limited to avoid damage.

3. Ducts should be cleaned of foreign material which could damage the supply cable during pulling operations.

Pad-Mounted Installations

A. Supply conductors or cables rising from a trench to transformers, switchgear, or other equipment mounted on pads shall be so placed and arranged that they will not bear on the edges of holes through the pad nor the edges of bends or other duct work below the pad.

B. Cable entering pad-mounted equipment shall be maintained substantially at adequate depth for the voltage class until it becomes protected by been directly under the pad, unless other suitable mechanical protection is provided.

XIV. SUPPLY CABLE TERMINATIONS

General

A. Cable terminations shall be designed and constructed to withstand the mechanical, thermal environmental, and electrical stresses expected during operation.

B. A cable termination shall be designed to prevent moisture penetration into the cable where such penetration is detrimental to the cable.

Support at Terminations

A. Cable terminations shall be installed in a manner designed to maintain their installed position.

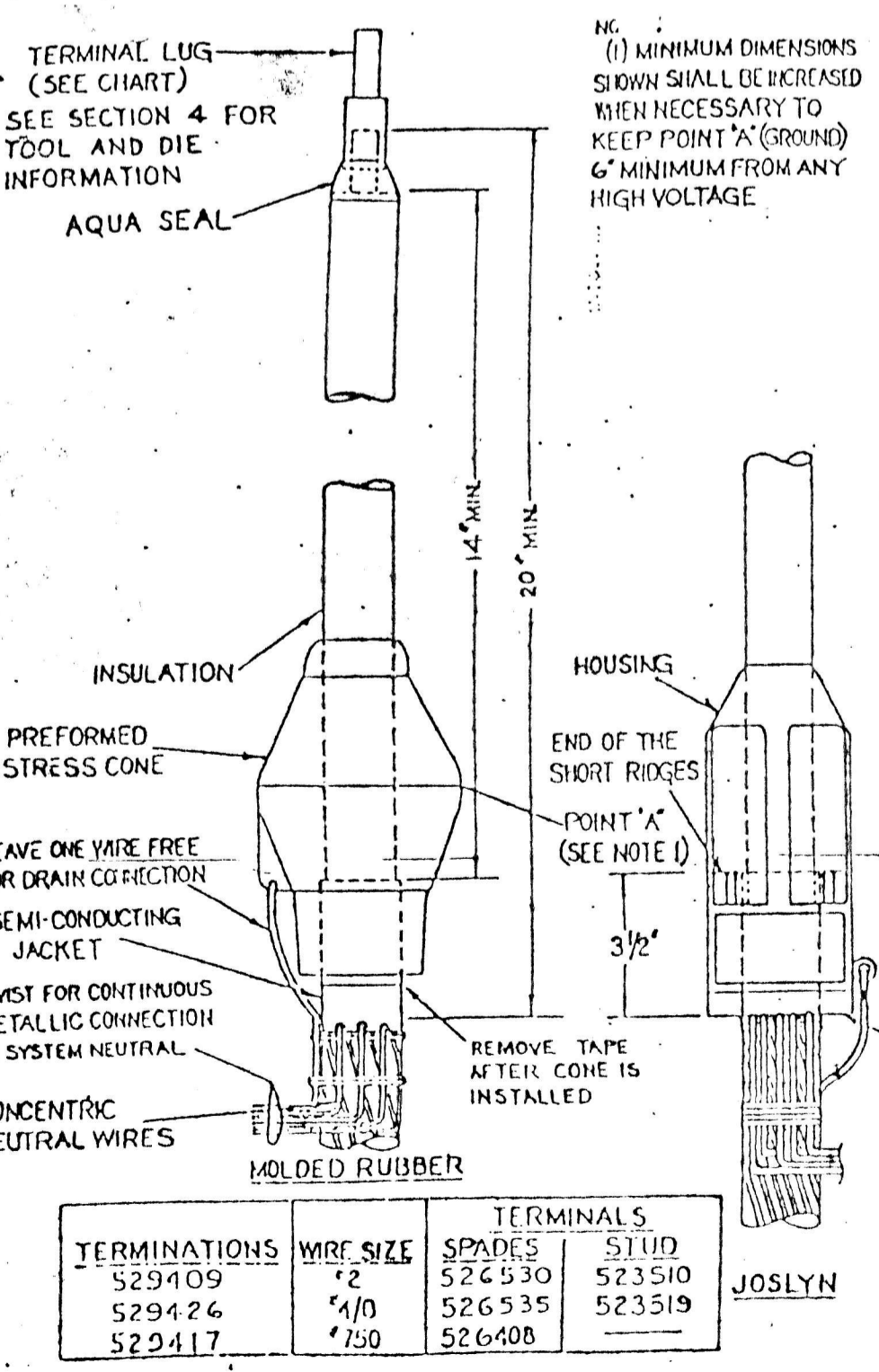
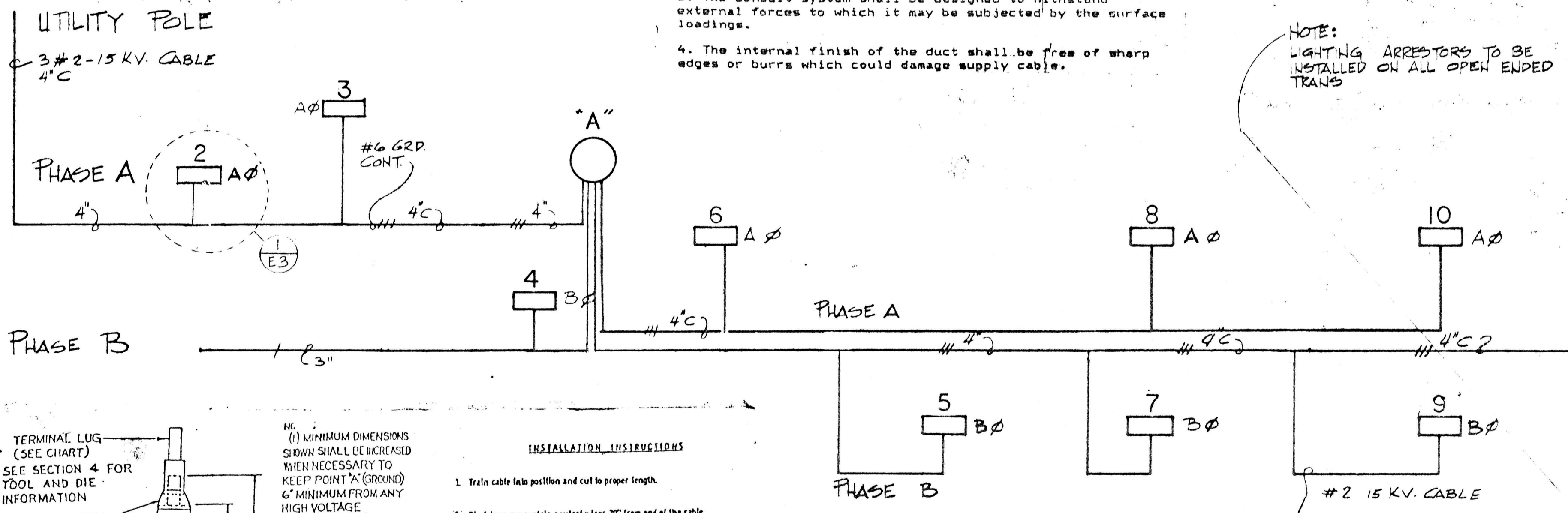
B. Where necessary, cable shall be supported or secured in a manner designed to prevent the transfer of damaging mechanical stresses to the termination, equipment, or structure.

Identification

Suitable circuit identification shall be provided for all terminations. This requirement does not apply where the position of the termination, in conjunction with diagrams or maps supplied to workmen, gives sufficient identification.

PHYSICAL CHARACTERISTICS
CROSS-LINKED POLYETHYLENE INSULATED
UNDERGROUND CABLES

Conductor Size	Area Cir. Mils	Conductor O.D.	Nominal *Insulation O.D.	Nominal Jacket O.D.	Nominal O.D. Over Concentric	*Weight Lbs./1000 Ft. Al.	*Weight Lbs./1000 Ft. Cu.
#2 EPR	66,360	.292	.687	.752	.880	351	575



- INSTALLATION INSTRUCTIONS
1. Train cable into position and cut to proper length.
 2. Bend down concentric neutral wires 20° from end of the cable.
 3. Remove sufficient insulation from the end of the cable for terminat.
 4. Remove the semi-conducting jacket 1" from the end of the cable insulation.
 5. Carefully clean the insulation with solvent. *Do not use petroleum on the semi-conducting jacket.*
 6. Apply the supplied lubrication to the insulation.
 - a. For a molded rubber termination—Push the cone on the cable until the cone is in proper position as shown in the manufacturer's instructions.
 - b. For a epoxy termination—Push the cone on the cable until the end of the epoxy ridge on the housing is even with the end of the semi-conducting covering 1" from end of insulation as shown on the drawing. Hold the housing firmly in position and seat the screw plug.
 7. Clean the insulation of any excess lubrication with solvent.
 8. Crimp on the terminal lug. Remove any excess inhibitor.
 9. Apply cable adhesive to cable at the gap between connector and insulation. Then apply aqueous solvent. *Remove excess.*
 10. Connect the neutral strand to the termination as shown.
 11. Connect the cable to the high voltage busbar.
 12. Crimp the neutral wires to the system neutral, making a continuous connection.
 13. Clean the cable insulation with solvent.

TERMINATIONS	WIRE SIZE	TERMINALS	STUD
529409	#2	526530	523510
529426	#4/0	526535	523519
529417	#750	526408	

SCHEMATIC DIAGRAM
N.T.S.

TRANS. #2 TRU #11
25 KVA. PRIMARY 7120VOLT
SECONDARY 120/240 1Ø
TOTAL CONNECTED LOAD
120 KVA. PER UNIT

- LEGEND
- "A" MANHOLE
 - "# 1-11 TRANSFORMER

terminations shall be maintained, both between conductors and between conductors and ground, consistent with the type of terminator used.

B. Where exposed live parts are in an enclosure, clearances and separations or insulating barriers adequate for the voltages and the designed BIL shall be provided.

C. Where a termination is in a vault, uninsulated live parts are permissible provided they are guarded or isolated.

Grounding

A. All exposed conducting surfaces of the termination device, other than live parts and equipment to which it is attached, shall be effectively grounded, bonded, or both.

B. Conductive structures supporting cable terminations shall be effectively grounded. Grounding, bonding, or both is not required where the above parts are isolated or guarded.

CARIBBEAN CONSTRUCTION SERVICES AND ASSOCIATES

VILLA MADELEINE

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DATE: 6/14/88
BY: MALI
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