UNDERGROUND COMMERCIAL DISTRIBUTION (UCD)
INSTALLATION AND RESPONSIBILITY GUIDE

SUPPLEMENT TO SPECIFICATIONS FOR
ELECTRICAL INSTALLATIONS
ELECTRIC SYSTEM BULLETIN No. 759B
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UCD/URD Specifications and Installation Guide Acknowledgement (Job Spec/Signoff Forms)

The requirements and specifications outlined in this guide book must be strictly followed. Any requirements not adhered to can pose safety problems, can be detrimental to the installed system and must be corrected before final acceptance. The Customer will bear full cost to make corrections to sub-standard installations.

The Customer is responsible to provide enough lead time for the Company to design job, provide inspections and install Company equipment where applicable.

Typical lead times are shown below.

<table>
<thead>
<tr>
<th>Service</th>
<th>Lead-Time</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Design and Layout</td>
<td>Eight weeks</td>
<td>Company receives all required plans, load data and easement information</td>
</tr>
<tr>
<td>Trench, Conduit and Equipment Inspection</td>
<td>Three days</td>
<td>Company inspector</td>
</tr>
<tr>
<td>Company Installation</td>
<td>Four weeks</td>
<td>After all inspections are approved and permits/easements are procured</td>
</tr>
<tr>
<td>Material Pick up (If required)</td>
<td>10 Days</td>
<td>Company inspector</td>
</tr>
</tbody>
</table>

*NOTE: The above times are estimates only.*

Project Title ______________________________________________________

Location ____________________________________________________________

Owner/Developer ____________________________________________________

Customer’s Representative ___________________________ Date ____________

Company Representative ___________________________ Date ____________

Company’s Copy
UCD/URD Specifications and Installation Guide Acknowledgement (Job Spec/Signoff Forms)

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</tr>
</tbody>
</table>

**NOTE:** The above times are estimates only.

Project Title ____________________________________________

Location ________________________________________________

Owner/Developer _________________________________________

Customer’s Representative _______________________________ Date ______________________

Company Representative _________________________________ Date ______________________

Customer’s Copy
1.0 Scope
The purpose of this specification is to define, interpret and clarify the scope of work and materials dealing with Underground Commercial Developments (UCD) and Primary Radial Services to padmounted transformers. This document is a Supplement to Electric Service Bulletin (ESB) 750. This specification does not cover any primary metering.

It is important that the Specifications for Electrical Installations book (ESB 750) be obtained and referred to in conjunction with this supplement for these installations. Any reference in this specification to the Company shall mean the Liberty Utilities’ Company. Any reference to the Customer shall mean the Contractor, Developer or property owner.

2.0 General Requirements
All electrical wiring to be connected to the Company equipment shall be installed in accordance with one or all of the following:

- Local Municipal Inspection Authority
- State’s Electrical Code
- National Electrical Code
- National Electric Safety Code
- Applicable Distribution Construction Standards of the Company
- Liberty Utilities’ Specifications for Electrical Installations (ESB750)

There shall be no attempt to deviate from either the Distribution Construction Standards of the Company or the Company construction plan without the approval of the Company. Any specifications noted shall supersede the Specifications for Electrical Installations Booklet unless otherwise approved by the Company.

Often a pre-construction meeting is helpful to all parties to ensure timely completion of the project. The Company Business Service Representative will make the necessary arrangements for a pre-construction meeting, or a meeting to discuss changes. Company representatives will be available to discuss construction problems when requested or during a field visit.

References:
ESB750 – Specifications for Electrical Installations
ESB759A – URD Installation and Responsibility Guide
ESB759C – Residential Underground Services

The Customer shall be responsible to have all electrical and physical design documents prepared and updated by a design professional, in accordance with Section 1.7 of ESB 750 for trenching, conduit, transformer foundation pad, and handhole installations.

3.0 Type of Service
Electric service shall be three phase, four wire, 120/208 or 277/480 volt supplied from a padmount transformer to be located on the Customer’s premises. The primary electrical service to the padmounted transformer will be supplied from a Company Electric Power System (EPS) pole or Main Primary System cable and this primary service to the padmount transformer shall be Company owned.
4.0 Plans and Documentation
The Company may require the Customer to provide, in advance of engineering design and at no cost to the Company, the following:

i. a complete copy of construction plans including the subdivision plans approved by the planning board in the municipality, if such is required by the municipality;

ii. the estimated new or additional electrical loads, as far as is known by the Customer; or the names and estimated loads of proposed tenants or buyers for each building or the proposed type of occupant, as far as is known by the Customer; barring a known occupant, the Customer’s best estimates of the likely load of each proposed building;

iii. all applicable documents required for the Company to prepare an easement for its facilities to be installed on private property;

iv. a copy of the approval of the planning board for the subdivision, if such is required;

v. a copy of all permits and approvals that have been obtained for construction;

vi. the name and address of the financial institution providing financing for the Customer, including a contact person and phone number;

vii. a copy of a street light proposal for the development, approved by the municipality, or written notice from the municipality that street lighting will not be required. If installation is requested after construction is complete, additional cost may be borne by the municipality and/or Customer if the appropriate tariff does not collect all costs of construction;

viii. a schedule of the Customer’s best estimate for construction; and

ix. such other reasonable information that may be requested.

5.0 Permits
In general, all applicable permits necessary to trench and excavate, including street openings and wetland permits, shall be obtained by the Customer and made available upon request if necessary. The Customer shall be responsible for including these padmount and conduit/trench specifications with the wetlands application for developments located in or near wetlands. A copy of the wetlands permit may be requested by the Company prior to acceptance of the conduit/trench system by the Company.

The excavator doing the excavation shall obtain the required Dig Safe® (811) permits before any excavation may take place in a public or private way. The Customer doing the excavation is urged to obtain copies of the applicable statute and become familiar with its requirements, refer to RSA 374 NH Dig Safe Law and NHPUC 800 Rules Underground Utility Damage Prevention Program. Similarly, the Customer shall determine if the municipality in which the excavation is to be done requires that water, sewer or other utility, municipal or private, be contacted separately.

The Customer shall certify to the Company that areas in which the Company is to perform installation or maintenance work is free of preexisting contamination by hazardous wastes or materials and to indemnify the Company for any claims, costs, expensed, suits, demands, citations, fines or damages of any kind arising from the presence of any such contamination.
6.0 Easements
As a condition of service, the Applicant or Customer must provide the Company with an easement(s), properly executed by all owners of record drafted by the Company, for all Company owned facilities located on private property (to include User and Private Ways), whether or not such private property is owned by the Customer. The Applicant or Customer will provide such easement(s) prior to the start of the Company’s construction and at no cost to the Company. The Applicant or Customer shall provide a copy of its mortgage and deed, together with a copy of the survey and/or plan of record, for the Company’s use in preparation of the easement(s) as well as any other documents necessary for the Company to prepare such easement(s).

Rights-of-Way, Easements
In UCD, URD, or multiple occupancy building applications, the Customer shall provide the Company with two copies of the approved development map, certified as final by a design professional or licensed land surveyor, which the plan shall have been recorded or filed with the Registry of Deeds. The map shall indicate lot lines, building set back lines, grade lines, sidewalk, roadway, sewer, water, drainage, and other facilities. The map shall also include the identification and, where appropriate, delineation of sensitive environmental resources including, but not limited to, wetlands, streams, archaeologically sensitive areas, and hazardous waste disposal areas, etc. In addition to this base information, this map shall clearly indicate the easement strips dedicated to the Company and the location of the lots (units) for which electric service is requested. The governmental authority having control over land use shall approve this map. In addition, when electronic maps are used, the Customer must consult with the Company on method of submittal.

Rights-of-way and easements must be cleared of any obstructions at no charge to the company. The applicant shall grade the right-of-way or easement to within six inches (150 mm) of final grade before the Company commences construction. The applicant must maintain the Company’s clearance and grading requirements.

Easement application forms are located on pages 61 and 62.

7.0 Responsibility and Ownership
The division of ownership and responsibility shall be as outlined below, as specified by the State of New Hampshire PUC Tariff for Retail Delivery Service. Typical installation specifications to reflect installation practices are shown in the back of this guide.

7.0.1 New Underground Single Phase Primary Radial Service Located on Private Property to an Individual Residential or Commercial Customer

The Company will provide a Single Phase Primary Radial Service to a Residential or Commercial Customer from the Company’s distribution system under the conditions shown below.

The Company may, at its option, be exempt from undertaking construction during the period of December 1, to April 1 each year.

The Company shall be responsible for:
- Developing the plan to provide underground electric service (if feasible);
- Designating the location of all Company owned equipment, the service entrance, and meter location;
- Designating riser pole location or underground switching cubicle for primary service;
- Designating pad mount transformer location with protection (bollards), if required, and if oil containment is required for transformer foundation boxpad;
- Providing the Company owned transformer foundation boxpad and grounding for single phase pad mount transformer, along with pull box (if required).
- Inspecting transformer foundation boxpad installation (including ground grid), other designated Company owned equipment installations, conduit system, and trenching to provided Company specifications;
- Installing, owning and maintaining:
  - Single Phase Pad Mount Transformer, primary cable and cable terminations, secondary cable, and meter (up to and including 400 Amp service).

**The Customer, at no cost to Company, shall be responsible for:**
- Contacting Liberty Utilities to apply for a new electric service and obtain a work request number. This should be one of the first actions in the process to provide for applicable planning, material order, and construction schedule.
- Obtaining any required municipal electrical permits and arranging electrical inspection.
- Providing, prior to the start of the Company’s construction, all applicable documents required for the Company to prepare easements for its facilities to be installed on private property;
- Providing, prior to the start of the Company’s construction, a signed easement, drafted by the Company, for Company owned equipment on private property;
- Installing all required foundations, handholes, pullboxes, grounding systems, and conduit including spacers, glue and pulling rope, etc., according to the Company’s plan and Specifications.
- Installing a primary riser (conduit system), 8 feet above ground shall be galvanized steel, including 90 degree steel sweep flush mount to pole designated by the Company, and bonding clamp with copper wire tap for grounding. The Company will install ground rod and complete bonding requirements;
- Providing and installing Company approved Self-contained Meter Socket at location **Pre-Approved By the Liberty Utilities Meter Department**. Refer to Liberty Utilities ESB # 750 Specifications for Electrical Installations, latest version, Section 7.0 Metering, for Self-contained Meter Socket requirements.

### 7.0.2 New Underground Three Phase Primary Radial Service Located on Private Property to an Individual Commercial Customer

The Company will provide a Three Phase Primary Radial Service to a Commercial Customer from the Company’s distribution system under the conditions shown below.

The Company may, at its option, be exempt from undertaking construction during the period of December 1, to April 1 each year.

**The Company shall be responsible for:**
- Developing the plan to provide three phase underground electric service (if feasible);
- Designating the location of all Company owned equipment, the service entrance, and meter location;
- Designating riser pole location or specify underground switchgear or switching cubicle for three phase primary service;
- Designating padmount transformer location with protection (bollards), if required, and if oil containment is required for transformer foundation pad;
- Inspecting transformer foundation pad installation (including ground grid), other designated Company owned equipment installations, conduit system (prior to backfilling), and trenching as indicated on the Company’s electric service plan and related construction documents and specifications;
- Providing, installing, owning, and maintaining:
  - 3 Phase Padmount Transformer, Primary Cable, CT and PT’s and Meter
  **Note:** Company will not install CT’s in customer supplied CT cabinet.
• Owning and maintaining:
  Primary conduit system (installed by Customer, to Company specifications)
• Checking the final torque connections to the transformer’s secondary bushings.

Note: The Customer will be held accountable for any transformer damage occurring during construction or due to improper secondary installation.

The Customer, at no cost to the Company, shall be responsible for:
• Contacting Liberty Utilities to apply for a new electric service and obtain a work request number. This should be one of the first actions in the process to provide for applicable planning, material order, and construction schedule.
• Obtaining any required municipal electrical permits and arranging electrical inspection.
• Providing, prior to the start of the Company’s construction, all applicable documents required for the Company to prepare easements for its facilities to be installed on private property;
• Providing, prior to the start of the Company’s construction, a signed easement, drafted by the Company, for Company owned equipment on private property;
• Providing and installing primary conduit system (including spare conduit and concrete encasement, if required) and trenching, including spacers, glue and pulling rope, etc., as indicated on the Company’s electric service plan and related construction documents and specifications.
• Providing and installing a primary riser and pull/splice box, if required (conduit system), 8 feet above ground shall be galvanized steel, including 90 degree steel sweep flush mount to pole designated by the Company, and bonding clamp with copper wire tap for grounding. The Company will install ground rod and complete bonding requirements;
• Turn over ownership of the conduit system, to the Company upon inspection and acceptance of the conduit system by the Company;
• Providing, installing, owning, and maintaining:
  • Transformer pad, reinforcement and grounding (per Company specifications);
  • Oil containment where required by the Company or local authority, (per Company specifications);
  • Transformer mechanical protection (bollards) as designated by Company (per Company Specifications);
  • All secondary equipment (including a secondary splice box or cabinet, if required) from the Company’s equipment to the designated meter locations(s);
  • Self-contained meter socket and CT Cabinet (Company specified) where required by Company, Refer to ESB #750 Specifications for Electrical Installations, latest version, for metering requirements;
  • For phase rotation and secondary phasing at energization, for 3 phase service;
  • Supply and install to Company’s max. requirement of cables to secondary spades: Secondary cable terminations to transformer secondary spades, Company to check final connection for proper torque of connections.

Note: The Customer will be held accountable for any transformer damage occurring during construction or due to improper secondary installation.
7.0.3 Underground Primary Service to Commercial Developments (UCD)

The division of ownership and responsibility shall be as outlined below, as specified by the State of New Hampshire PUC Tariff for Retail Delivery Service. Typical installation specifications to reflect installation practices are shown in the back of this guide.

**The Company shall be responsible for:**
- Developing the plan to provide underground electric infrastructure along the traveled way;
- Supplying a list of approved manufacturers and their part numbers for equipment to be supplied by the Customer;
- Designating the location of all Company owned equipment, the service entrance and meter location, excluding street lights;
- Determine if oil containment shall be required for pad mount transformer installation;
- Determine if padmount transformer and switchgear protection (bollards) is required and designating location;
- Making all connections to Company equipment;
- Inspecting and approving of the underground conduit system and equipment foundations installed by the Customer (Per Company Specifications), prior to backfilling;
- Providing, installing, owning and maintaining all transformers, primary cable, primary cable terminations, switchgear, and switching enclosures and related primary equipment;
- Providing Company owned street light foundations, street lights, and meters;
- Provide meters, current and potential transformers (CTs and PTs). Company will not install CTs in Customer’s CT cabinet.
- Checking all connections, including final torque, to Company-owned equipment.

**The Customer, at no cost to the Company, shall be responsible for:**
- Providing, prior to the start of the Company’s construction, all applicable documents required for the Company to prepare easements for its facilities to be installed on private property;
- Providing, prior to the start of the Company’s construction, a signed easement, drafted by the Company, for Company owned equipment on private property;
- Providing and installing all required foundations (except for Company owned street light foundations), handholes, manholes, splice/pull boxes, grounding systems, and conduit, and concrete encasement when required, including spacers, glue, and pulling strings, etc., as indicated on the Company’s plan and related construction documents (Per Company Specifications);
- Installing foundations, provided by Company, for Company owned street lights;
- Supplying copies of all invoices, when requested, indicating manufacturer and part number for all such equipment above; equipment that is not approved shall not be used without the prior written consent of the Company;
- Turn over ownership of the conduit and manhole system, to the Company upon inspection and acceptance of the conduit and manhole system by the Company;
- Furnishing and installing transformer and switchgear mechanical protection (bollards) and material for oil containment under pad mounted transformers where required (Per Company Specifications);
- All secondary equipment (including a secondary splice box or transclosure cabinet, if required) from the Company’s equipment to the designated meter locations(s);
- Self-contained meter socket and CT Cabinet (Company specified) where required by Company, Refer to ESB #750 Specifications for Electrical Installations, latest version, for metering requirements;
- For phase rotation and secondary phasing at energization, for 3 phase service;
- Supply and install to Company’s max. requirement of cables to secondary spades:
  Secondary cable terminations to transformer secondary spades, Company to check final connection for proper torque of connections.
Note: The Customer will be held accountable for any transformer damage occurring during construction or due to improper secondary installation.

8.0 Transformer Clearance from a Building

Oil insulated equipment shall be located in compliance with the minimum clearances indicated below. For existing buildings, the transformer shall not block access to existing building systems, such as wall mounted fire sprinkler systems. The building owner’s and/or tenants fire insurance carrier or local inspection authority may restrict the proximity of the equipment to doors, windows or combustible materials. It is the customer/developer’s responsibility to determine the acceptability of the proposed location of the equipment.

The clearances, line of sight, shall apply to doorways, windows, ventilation ducts and fire escapes.

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Notes:
1. Noncombustible material is defined as a material that will not ignite, burn, support combustion or release flammable vapors, when subjected to fire or heat, or as described by the latest edition of the NFPA-220.

2. No portion of a building or building structure shall overhang any part of the pad-mounted equipment.

3. In cases where required distances cannot be met, a noncombustible barrier, 6 foot minimum height, shall be constructed. This barrier shall be designed to provide adequate fire protection to the existing structure. A design for this structure shall be prepared and sealed by the customer’s Professional Engineer or Registered Architect and shall further be approved by the local authority having jurisdiction of building code enforcement.

4. For exits from a public assembly room, such as an auditorium, a 10 foot minimum clearance should be increased to 25 feet, unless there is a barrier.

5. This requirement may vary between individual states. Refer to the building code regulations for the state involved.
9.0 Transformer Clearance from Objects
Clearances from objects:

A. An area measuring 10 feet from any point of the transformer pad shall be kept free of all:
   - buried water lines, storm drainage lines, gas lines, other electric lines;
   - underground fuel storage tanks; and
   - above grade fire hydrants, cell towers, self contained diesel or diesel byproduct fueled generators, and outdoor enclosed generators.

   **NOTE:** The 10 ft. clearance may be reduced with a noncombustible barrier (see Note 3) and shall not be less than five (5) feet from the edge of the transformer pad. The Customer or their authorized representative shall obtain this clearance reduction approval from the Company and the local AHJ (Authority Having Jurisdiction), as necessary, prior to the noncombustible barrier installation.

B. An area measuring 25 feet from any point of the transformer pad shall be kept free of all:
   - exposed water lines, gas piping, sewer lines;
   - open conductor electric lines; and
   - above grade gas meters or regulator vents, fuel storage tanks or dispensing units,
     and non-enclosed gasoline/propane/LP or LNG gas fueled generators.
   - chemical storage silos/tanks.

   **NOTE:** The 25 ft. clearance may be reduced to 10 ft. with a noncombustible barrier (see Note 3) and shall not be less than five (5) feet from the edge of the transformer pad. The Customer or their authorized representative shall obtain this clearance reduction approval from the Company and the local AHJ (Authority Having Jurisdiction), as necessary, prior to the noncombustible barrier installation.

10.0 Transformer Accessibility
Equipment shall be located within 10 feet of a way open to vehicular traffic and a minimum distance from any structure such as poles, fences, etc. as a means to permit accessibility for installation and maintenance. A minimum of 10 feet of clear space shall be maintained in front of the equipment doors to permit installation and removal of separable connectors and fuses with shotgun stick.
11.0 Transformer Mechanical Protection/Bollards
Whenever possible, equipment should be located so it is not subject to vehicular damage. If this is not feasible, adequate guards such as concrete filled pipes (Bollards) shall be placed to protect the equipment. Bollards shall consist of 6 inch minimum diameter hot dip galvanized or painted steel pipes filled with concrete. When Bollards can not be painted at the time of installation, yellow bollard covers shall be installed. Page 58 shows manufacturer. Bollards are to be 5 feet above the ground and a minimum of 4 feet below the ground. Bollards are to be set in a concrete footing as shown in detail below. Concrete is to be crowned on top of all bollards. Bollards shall be installed with due care to avoid interfering with ground grid and conduits. Refer to Pages 41 thru 44 for Transformer Pad dimensions. For switchgear locations, see pages 38 and 39.

The number, type (galvanized or steel) and locations of bollards shall be determined by Liberty Utilities Distribution Design, taking into account proximity to traffic and to buildings as well as other barriers to traffic. Other factors such as salt spray and fertilizers may impact type of bollard required. Suggested bollard locations and dimensions are shown below. The location of bollards shall not impede a door opening of 100 degrees.

<table>
<thead>
<tr>
<th>Bollards Required</th>
<th>Bollards Not Required</th>
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Notes:
1. Six foot minimum clearance from front of pad.
2. Design Engineering shall designate the number and location of Bollards by marking the Bollards of this drawing as follows:
3. Bollards shall be supported with a 12” minimum diameter concrete footing 6” below grade to base of the bollard.
4. For installations around oil containment curbs, install bollards six feet minimum on all applicable sides.
12.0 Transformer Pad
The Customer shall provide and install a concrete transformer foundation in accordance with the Company standards. Precast concrete transformer foundations (preferred installation) built to Company standards are available from a variety of vendors listed on page 56. Spec sheets of the different size pads are shown on pages 41 thru 44.

Cast in place pads shall meet the following specifications. Concrete shall be a Mix M-4 detailed specifications are on pages 48 thru 52. Reinforcing in pad shall be # 5 grade 60 bars and shall conform to ASTM STANDARD A-615 of latest date. Reinforcing rods are to be located in center of the slab, with a minimum of 2 inches of clearance from face of concrete. All transformer pads must have and adequate base of 2 inches of sand and 12 inches of gravel as shown on Pages 41 thru 44. The gravel shall be thoroughly compacted and the sand thoroughly wetted immediately before placing the concrete.

The location of the concrete transformer pad, on the Customer premises, shall be approved by the Company in advance of the construction. The Company must, with sufficient notification (24 hours minimum) from the Customer, inspect the forming and reinforcing of the pad, the sub grade preparation, and the ground grid prior to the pouring of concrete. This requirement is critical. Failure to have inspection done may result in the need to remove and rebuild the concrete foundation.

13.0 Transformer Secondary
Size and number of secondary cables shall be in accordance with the NEC and shall be approved by the electrical inspector or AHJ of the town or city involved. Maximum number of secondary cables to be physically connected to the Company's pad-mounted transformer is outlined below:

<table>
<thead>
<tr>
<th>Secondary Cables</th>
<th>Number of Sets</th>
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<tbody>
<tr>
<td>4 Hole Spades</td>
<td>6 sets</td>
</tr>
<tr>
<td>6 Hole Spades</td>
<td>8 sets</td>
</tr>
<tr>
<td>10 Hole Spades</td>
<td>10 sets 600 kcmil or 8 sets of 750 kcmil</td>
</tr>
</tbody>
</table>

Secondary cable requirements greater than this, will require a separate compartment, handhole, or bus duct.
Secondary cable shall not be installed until pad mount transformer has been set to ensure adequate length of secondary cable and connections.

All acceptable spade terminals are shown in Figures 1, 2 and 3. Minimum terminal thickness is to be ¼ inch, with 9/16 inch holes.
### Notes:

1. **Figure 4** – Compression connections will accommodate up to four cables with a maximum individual lug width of 1 ¼ inch.

2. **Figure 5** – Compression connections will accommodate two cables with lug greater than 1 ¼ inch width.

3. **Figure 6** – Typical example of bolted connections for two, four or six cables to maximum capacity of lug.

4. Metering (CT’s) mounted inside the padmounted transformer may reduce the number of sets of secondary that can be installed by blocking off some holes on the secondary spade. In some cases the customer may be required to purchase a secondary splice transclosure junction box.

5. A list of a few manufacturers that supply the connectors is located on page 60.
13.1 Transformer Secondary Connections
All connectors and connector fasteners shall be furnished, installed, owned and maintained by the customer/developer. The customer/developer/electrician shall install secondary connections to the secondary spades of the padmount transformer finger tight. Connectors shall be approved by the Company prior to purchase. Final electrical connection to the transformer secondary terminals shall be made by the Company, to assure a final torque of 40 foot pounds and to prevent damage to secondary bushings. Size and number of secondary cables shall be in accordance with the NEC and shall be approved by the electrical inspector or AHJ for the town or city involved. The Customer shall be responsible for proper phase rotation and secondary phasing at time of energization.

13.2 Secondary Bolt Assembly
The customer/developer shall supply and install aluminum connectors for use with aluminum cable. or copper connectors for use with copper cable. Tin plated connectors can also be used as an alternate connector for aluminum and copper connectors. Connector shall be a cable to flat clamp or compression type connector, with a minimum of two holes in the flat pad and two clamping elements or two compressions per cable, and must be approved by company representative. Bolts and flat washers shall be grade 304 stainless steel. Belleville washers shall be grade 301 stainless steel. Nuts shall be waxed grade 316 stainless steel.

A. A flat washer is placed between the concave side of the belleville washer and the surface of the member being joined. The belleville is thus captured between the head of the bolt and the large flat washer. The flat washer should have an outside diameter greater than the flattened belleville’s such that no overhand results. Select a flat washer that is twice as thick as the belleville for strength. (If not available, stack two or three thinner washers to achieve the same effect).

B. With the belleville washer captured between the flat washer and the bolt head, fit the assembly into its hole. When the washers are fitted in position, there should be no interference with washers of adjacent bolts and no overhang over surface edges.

C. Tighten the nut on the bolt (with a washer of its own) until a sudden, noticeable increase in torque is required to continue. The belleville washer is now flat. It is not necessary to “back off” the nut after tightening to this point.
13.3 Secondary Splice Box
A secondary splice box may be required where the Customer’s number of secondary cables exceeds the maximum allowed amount on the transformer. Supplying and installing this box is the Customer’s responsibility. The cables from the transformer to this box are to be specified by Company’s representative. The Customer is responsible to supply and install the cables.

Once the service is energized the Company will take over ownership of only the secondary cables from the transformer to the secondary splice box.

A list of a few manufacturers that supply the secondary splice box is located on page 60.

14.0 Transformer Sweep Entry
Conduit shall be installed as shown on Pages 41 thru 44 before slab is poured. Use 36 inch radius sweeps, with couplings, nipples and bushings as required. Sweeps for primary cables shall be galvanized steel or PVC. Conduits shall be raised a minimum of 1 inch approximately over the concrete slab. Expanding foam Hilti Inc. CF810 or equivalent shall be used to fill inside the conduits after the primary/secondary is installed. Ownership of cable will determined who installs the foam on each cable. After pulling tape is in, install the expanding foam in any spare/empty conduits. Place a rag into empty conduits prior to the foam as a support for the foam while curing takes place.

After the concrete pad is cured, the remainder of the conduit primary and secondary openings through pad will be sealed with grout. Before sealing steel sweeps, the sweeps must have a bond clamp attached with a #4 Cu tap to connect to the ground grid. Fill the conduit primary and secondary openings with sand (no aggregate) to a grade of approximately 2 inches below the top of the concrete pad. Place a layer of concrete grout (no aggregate) 1 to 2 inches thick on top of the sand layer to seal the conduit entrance. Do not cover the conduit ground clamps with grout. The expanding foam may be used as an alternate for filling in the opening with sand and concrete grout. Ownership of conduits and pad will determine who seals openings. See page 62 for further details in Company bulletin 09-09 Three Phase Padmounted Transformer Sealing.

Expanding Foam CF810 available at
Hilti Inc. 1-800-879-8000
Stuart C Irby Co 1-315-453-2970 and 1-315-329-0038
Graybar, Manchester NH 603-624-8614

Spare conduits can also be sealed with conduit plugs, see page 56 for a list of manufacturers.

15.0 Transformer Grounding and Bonding
The ground grid shall be 2/0, bare, soft drawn, 19 strand copper wire. The wire shall be installed 12 inches below finished grade and located around the transformer pad as shown on pages 20 - 21. Bond to all exposed metallic conduit and leave 3 feet of wire above pad for grounding transformer, one lead in the primary conduit window opening and the other lead in the secondary conduit window opening.

Two ⅜ inch diameter, 8 feet long copper weld ground rods and approved connectors shall be installed to 12” below finished grade. Leave the ground rods and grid exposed until inspected the Company. The ground grid is to be complete and backfilled prior to energizing the transformer. Connections to ground grid to be made as shown on Details A and B below, except that exothermic welding ("cad weld") shall be an acceptable alternative to a compression connection. Bolted connectors are only acceptable for the ground grid connections to the ground rods. The Company will install the ground taps onto the transformer.
8' Ground Rod

To Telco, Ground. (if available)

Detail A

Ground Grid
2 /0 Cu Bare Soft Drawn-19 Strand

Detail B

2 /0 Cu Bare Soft Drawn-19 Strand

‘C’ Type Compression Connector ST4G

Ground Clamps G4

Detail B

8' Ground Rod

For the latest authorized version, please refer to the company’s website at http://www.libertyutilities.com/electricalspecifications
16.0 Oil Containment
This is to be used where oil containment is required by local authorities or where otherwise justified. This liner system will significantly slow the migration of oil into the under laying sub grade, allowing additional time to initiate a cleanup response. The polypropylene geotextile allows the passage of water but absorbs small quantities of oil. This design is intended to confine 100% of total transformer oil present, with a 20% reserve margin, for up to 36 hours. If additional confinement is desired consult the Company Environmental Engineer. Follow the following installation steps. See Pages 22 - 23 for construction detail. A precast containment barrier is available as an alternate to casting one in place, check with the precast suppliers on page 57 for availability. Precast curb can be one piece or made up of separate pieces assembled in the field.

Note: on field assembled pieces. All pieced must be sealed together with rope tar, rubber sealant or equivalent.

1) Build oil curb, this should be installed with concrete in accordance with Mix #4 per concrete specifications on pages 49 thru 52. Reinforcement to be #4, grade 60 rods minimum, 6 inches on center, bend rods around corners. Curb to be 24” deep with a minimum thickness of 6”.
2) Install geotextile liner from top of walls and around bottom of containment area.
3) Areas where conduit crosses overlap liner around conduit and seal with expanding foam.
4) Install 6” of silty sand on top of liner.
5) Install second layer of geotextile liner as noted in step 2.
6) Build up area for transformer pad with 6” of compacted gravel and level.
7) Install ground grid.
8) Set/build transformer pad.
9) Fill in conduit openings with silty sand or expanding foam up to the last two inches of the pad
10) Fill rest of conduit opening with concrete grout or expanding foam.

Geo-textile Liner
Generic name is: 16oz polypropylene geotextile also called filter fabric weighing 16oz/square yard.

Brand names / Suppliers are:
AME1680 available from American Engineering Fabrics (AEF), Inc.(Emphasize polypropylene not polyester)
New Bedford, MA@1-617-965-0007 / 1-800-770-2666 or from Vellano Bros. Lancaster NY 1-716-684-7222, several other locations in NY, MA, RI and NH, go to www.vellano.com

Synthetic Industries ST 160 available from Spartan Mills Inc’s, Spartanburg, NC @ 1-803-576-2353

Carthage Mills FX-160HS / US Construction Fabrics LLC 90 Range Rd, Windham NH 03087 1-603-898-0532

Shea Precast Concrete Products Nottingham, NH – 603-942-5668
Will provide geo-textile liner with precast curbing
Containment Area Plan View

Typical Cross Section of Containment Pad A-A
17.0 Riser Pole

The Company shall designate all conduit riser pole locations. All primary risers installed, 8 feet above ground shall be galvanized steel, including 90 degree steel sweep flush mount to pole as shown in plan below, and bonding clamp with copper wire tap for grounding provided by Customer. The Company will install ground rod and complete bonding requirements. Per NESC all steel risers must be bonded 6" down from top of riser and the bond must be at least 8' high from finished grade. For Underground Primary Radial Service to Individual Customers, the Customer shall install the galvanized steel riser pipe and 90 degree steel sweep (flush mount to pole at quarter portion of pole away from traffic flow) and conduit and shall not be covered until inspection by the Company.

NOTE *1 U-Guard

NOTE *2 Galvanized steel conduit and bend are to be used, they shall be grounded by bonding to an approved U-bolt type ground clamp 6" (150 mm) from top of the conduit. A 24" (600 mm) conductor shall be provided to extend to the Company's grounding conductor. The conductor shall be sized as required by the National Electrical Code. Article 250; but in no case shall it be smaller than #4 AWG copper. Recommend use of corrosion resistant bend in locations subject to highway salting.

NOTE *3 Galvanized steel conduit, galvanized steel sweep, attachment clamps, grounding clamp and 24" grounding conductor shall be furnished and installed by Customer. Normally, the conduit shall rise on the side of the pole away from traffic up to 8 ft (2.5 m) to 11 ft (3.4 m). Consult company for proper location on pole.

NOTE *4 Pipe straps, install at not more than 30" (750 mm) intervals.

NOTE *5 The conduit burial depth shall be 30" (750 mm) minimum.
18.0 Heavy Duty Handhole
This primary conduit handhole may be specified in the design for installation in roadways or sidewalks areas where duct length requires extra pulling locations. Heavy duty handholes are supplied and installed by the Customer, per Company specifications.

Notes:
1. Chimney height is kept to a minimum to facilitate placing completed splices in handhole from above grade.
2. Concrete minimum strength 4,00 PSI after 28 Days
3. Roof opening 3’ 2” inches x 3’ 2”.
4. Handhole frame, ring and cover are typically provided by the customer with the heavy duty handhole. See Section 25.1 page 33 for details.
19.0 Primary Cable Pull/Splice Box
This primary conduit Pull/Splice Box may be specified in the design for installation in sidewalks or grass plot areas where duct length or design requires extra pulling locations or splices. The splice box is H20 rated and shall be installed in locations not frequently traveled over by vehicles. Pull/splice boxes are supplied and installed by the Customer.
20.0 Trench Requirements

Final grades shall be established; the surface rough graded with in 6” from finished grade, roadway and property boundaries shall be staked or marked by the Customer before any trenching is started. Trench spoils shall be kept a distance of 2’ minimum from excavated trench.

The Customer shall adhere to the construction plan and specifications specifying trench locations, trench depth and concrete encasement. Any deviation shall be subject to approval by the Company.

The Company shall be notified in advance of the backfilling of any electric facility (e.g. concrete, conduit, manholes, riser bends). The Company reserves the right to require re-excavation of the conduits and foundations if the Customer fails to have inspection done or backfills before inspection.

Trenches shall not be backfilled until concrete has set (for at least two hours) and until after approval by authorized Company personnel. Note: if trench is subjected to traffic then the trench shall set for at least twelve hours. All backfill shall be sand or gravel containing stones less than 1” in any dimension. Backfilling shall not take place over any open-ended (unplugged) conduits. Company approved red “Warning” tape shall be installed directly above the Company’s cable eight to twelve inches below finished grade. Laying the warning tape directly on the cable, concrete or conduit is not acceptable. Certain installations in the public way may require flowable fill instead in place of normal backfill.

20.1 Trench Depth New Hampshire Concrete Encased Conduit (When Required)

Burial depths for electrical conduit shall be maintained not less than 30” from the top of the concrete encasement to grade during all phases of construction. The trench bottom shall be solid, undisturbed earth. Earth that shows signs of peat, cinders, rubble, or any conditions not suitable for a stable foundation shall be reported to the Company for additional recommendations. Small pockets of unsuitable soil shall be replaced with compacted gravel (max. 2” stone) and at riser pole end concrete encasement just before riser sweep.
### Figure 20.0-1 Typical Trenches

<table>
<thead>
<tr>
<th>Conduit Trench</th>
<th>Conduit in Concrete Trench</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Conduit Trench Diagram" /></td>
<td><img src="image2" alt="Conduit in Concrete Trench Diagram" /></td>
</tr>
</tbody>
</table>

**Legend**

- Base Spacer
- Intermediate Spacer
- Primary Electric Duct
- Communication Duct or Cable
- Spare Duct
- Direct Burial
- Concrete
- Sand

**Warning tape, provided by company.**
21.0 Conduit Requirements

The Customer shall be responsible for all trenching, excavating, backfilling, and installation of the main primary duct system. Exceptions to this shall be in areas where there is an existing manhole and duct system and the limits of trenching by the Customer shall be determined by the Company. The Customer is also responsible to supply and install any necessary manholes, primary cable pull/splice boxes, heavy duty handholes, frames, and covers used in the primary distribution system, as specified by the Company. Concrete encasement shall be provided and installed by the Customer as specified by the Company.

The Customer shall ascertain the requirements of the specific municipality in which the development is located. For example, some municipalities may require that the Customer employ a licensed electrician to direct the installation of all conduit intended for electric facilities.

Temporary mechanical protection over buried conduit and encasements is recommended to prevent crushing or damage during construction. This is the Customer’s responsibility.

All road crossings shall, when practical, be perpendicular to the sidelines of the road.

The minimum size conduit shall be 4" schedule 60 DB. All sweeps at foundations and risers shall have a minimum radius of thirty-six inches (36”). The riser sweep shall be galvanized steel. The padmount transformer sweeps shall be galvanized rigid steel or Scheduled 40 PVC, with the transformer sweeps rising typically 1” above the concrete pad. The Customer shall install bell ends on the conduits. The Customer shall install conduit plugs in all unused conduits and pulling tape. At the riser pole, the galvanized rigid steel sweeps and the PVC/steel adaptors shall not be concrete encased. The Customer shall be responsible to install rigid galvanized steel straight conduit flush up the pole as shown on page 24, including conduit ground straps, up the riser pole (unless directed otherwise by the Company). The Company will specify on which quarter of the pole the riser shall be installed, usually away from oncoming traffic.

Except as noted on construction prints, curves and bends in conduit shall be gradual, and the radius of curvature shall not be less than forty feet. All curves shall be formed with 5-degree couplings. The minimum length between single, 5-degree couplings is 42”. Heat bending is not allowed.

Conduit grade shall be such as to cause all ducts to drain toward one or both equipment foundations or pullboxes. Minimum pitch shall be three inches (3") per one hundred feet (100').

The Customer shall insure that clearances are met and maintained, and that they are inspected by the Company. Unless local jurisdictions require greater clearances, the minimum clearances shall be as follows:

**Communication Systems** – Company conduit shall not be directly above or below communication conduit, except when crossing below communication conduit at approximately right angles. Company conduit and communication conduit shall be separated by a minimum of 3” of concrete encasement.

**Water, Gas, Sewer** – Company conduit shall not be directly above or below these utilities, except when crossing above these utilities at approximately right angles. Where the paths of these utilities cross under Company conduits at approximately right angles, the minimum separation is 12”. A minimum separation of 24” shall be maintained between parallel placement of any of these utilities and electrical conduit.

A 6-inch clearance shall be between conduit envelopes and major subsurface pipes (e.g. drainage pipes).
The Customer shall mandrel all primary conduits to insure their integrity before the Company shall attempt to pull any primary cable. The Customer shall furnish and install an approved synthetic, 2,500 pound test tape in each primary conduit run including risers. Pulling tape installation and mandreling the duct shall be witnessed by the Company inspector.

Company owned duct shall not share a concrete encasement with foreign utilities (e.g. do not place communication or private electrical duct in the same concrete encasement as Company duct).

21.1 Pulling Tape
All conduits shall have a pulling tape, also known as “Mule Tape”. This tape is to be be rated for 2,500#. Manufacturers of this tape are listed on page 56.

21.2 Trench and Conduit System Inspection
A designated Company inspector shall be responsible for the inspection of the trench and or conduit system being prepared and installed by the Customer, at various stages of installation. The Customer shall provide the Company inspector with a minimum of 24 to 72 hours notice. Required inspections are:

1) After conduit, ground system, reinforcing bars and forming are completed; but before concrete is poured.
2) After concrete is poured but before backfilling.
3) After backfilling.

The inspection shall not be limited to the above.

22.0 Primary Cable, Conduit System, and Electrical Equipment
Refer to Section 7.0 for the division of ownership and responsibility for specific scenario of underground primary service. The Company will designate a switchgear or switching enclosure location as a service point between the underground electric distribution infrastructure along the traveled way and private property. The Customer will supply and install the conduit system to Company specifications and the Company will provide, install, and maintain cable supplying a Company owned Pad Mount Transformer.

For a new Underground Primary Radial Service located on Private Property, the Customer will provide and install the duct system to Company specifications and the Company will provide, install, and maintain the cable and pad mount transformer and other miscellaneous primary electrical system components.

The designation and location of the riser pole(s) and pad mounted transformer shall be determined by the Company.

At those locations where manholes or above ground switchgear are required, additional specifications will be provided by the Company.

23.0 Secondary Cable and Conduit System
Secondary cables shall be installed underground in customer/developer furnished, installed, owned and maintained conduit system or raceway. Conditions requiring more secondary cables than the Company’s transformer secondary terminals can accommodate may require the customer/developer to supply an intermediate splice box to make a transition from National Electrical Code required cable capabilities (required to match main switch), to actual load cable capabilities. Page 60 lists manufacturers of the splice box.
24.0 Metering
Refer to the Company’s latest edition ESB No. 750 Specifications for Electrical Installations for the type of installation. Division of work and material will be performed with the approval and authorization of the Company Metering Services Manager or their designee.

25.0 Manhole
Manhole installation may be required as part of the infrastructure to serve certain customers. The Customer shall provide and install the manhole to Company specification. On page 60 lists precast concrete providers. Please contact the Company if details are needed for specifications of manholes.

LU-MS3462
Note: Construction joint to be sealed with asphalt or equivalent.
25.1 Manhole Frame, Ring, and Cover
The Customer shall be responsible for providing and installing the manhole frame, ring, and cover to finished grade. Approved frame, ring and covers are shown below. Frame shall be installed on a chimney at least 6" in height minimum. The maximum allowable chimney shall be 36" from the top of the roof of the manhole to finished grade.

LU Cover – EJ Ironworks # 00227641
LU Ring – EJ Ironworks # 00227661
LU Frame – EJ Ironworks # 00228611
25.2 Switchgear Manhole
Switchgear installation may be required as part of the infrastructure to serve certain customers. The **Customer** shall provide and install the switchgear manhole to **Company** specification. On page 60 lists precast concrete providers. The **Company** shall identify which collar shall be used from the choices on pages 35.

LU-MS3467
PME Switchgear collar (LU-MS3467)

**CROSS-SECTION A-A**

**SECTION B-B**
25.3 Switchgear Manhole Ground Grid
The *Customer* shall install the ground grid for a switchgear manhole installation as shown in the picture.

**FIG. 1 - PLAN**

- **Ground Rod Detail B**
- **Detail A**
- **24”**
- **4/0 Cu Bond To Re Bar**
- **Ground Grid 4/0 Cu 19 Strand Soft Drawn**
- **‘C’ Type Compression Connector**
- **Ground Rod Detail B**
- **24”**
- **4/0 Cu Bond To Re Bar**
- **‘C’ Type Compression Connector**
- **Grade 12”**
- **4/0 Cu Bare Soft Drawn-19 Strand**
- **Ground Clamp**
- **8’ copperweld grnd rod**
- **Detail A**
- **Detail B**

For the latest authorized version, please refer to the company’s website at [http://www.libertyutilities.com/electricalspecifications](http://www.libertyutilities.com/electricalspecifications)
25.4 Switchgear Manhole Bollard Layout

The drawing below depicts the locations for bollard installations around a switchgear manhole. Distribution Design/Planning and or Company inspector shall designate the number and location of required bollards for each job. Refer to Transformer Mechanical Protection/Bollards on page 16 for more details on bollards.
26.0 Fiberglass Switchgear Base with Conduit Entry’s

The fiberglass switchgear base can be used as an alternate to the switchgear manhole in locations where allowed by the Company. It is not recommended for installations where the primary coming into the base is 500MCM or larger.

**NOTE:** This base will only accommodate standard PMH-9, PMH 10, PMH 11 and PMH 12 switchgears.
26.1 FIBERGLASS SWITCHGEAR GROUND GRID

The Customer shall install the ground grid for a fiberglass switchgear installation as shown in the picture.

Front Elevation

5/8” x 8’ solid copperweld ground rod and connector

4/0 Cu Bare Soft Drawn 19 Strand

Fiberglass Pad

5/8” x 8’ solid copperweld ground rod and connector

5/8” x 8’ solid copperweld ground rod and connector

4/0 Cu Bare Soft Drawn 19 Strand

Molded-In Stainless Steel Hex Nut ½”-13 UNC

Fiberglass Pad

5/8” x 8’ solid copperweld ground rod and connector

5/8” x 8’ solid copperweld ground rod and connector

To Switchgear Ground Connectors

5/8” x 8’ solid copperweld ground rod and connector

4/0 Cu Bare Soft Drawn 19 Strand

compression conn.
26.2 Switchgear Fiberglass Boxpad Bollard Layout
The drawing below depicts the locations for bollard installations around a switchgear fiberglass boxpad. Bold outline referenced on drawing is the exposed outside sides of the boxpad. Distribution Design/Planning and or Company inspector shall designate the number and location of required bollards for each job. Refer to Transformer Mechanical Protection/Bollards on page 16 for more details on bollards. Bold outline referenced on drawing below is the exposed outside sides of the boxpad.
26.3 Sectionalizing Cabinets – Three Phase and Single Phase Applications

This primary sectionalizing cabinet may be specified in the design for installation in the UCD or URD primary distribution system. The Company will supply and install this equipment. The foundations used for mounting this equipment will be part of the duct system infrastructure which is the responsibility of the Customer/Developer. The three phase sectionalizing cabinet is designed to fit on top of a primary cable pull/splice box (See section 19.0) and a single phase sectionalizing cabinet is designed to fit on top of a transformer box pad foundation. Both sectionalizing cabinets require the installation of a ground grid (installed by Customer/Developer), see detail below.

**Sectionalizing Cabinet Ground Grid Installation:**

1. The ground grid shall be #2, bare soft drawn, 7 strand copper wire. Installed 12 inches below finished grade and located around the foundation used for cabinets.
2. Two 5/8 inch diameter, eight foot long copperweld ground rods and approved connectors shall be installed 12 inches below finished grade.
3. Leave the ground rods and ground grid exposed until inspected and approved by the Company representative.
4. The ground grid is to be complete and backfilled prior to energizing the equipment.
Figure 27.0-1 15kV Transformer Pad   75-500kVA  44-113 (LU-MS2582)
Figure 27.0-2 15kV Transformer Pad  750-2500kVA 44-114 (LU-MS2583)
Figure 27.0-3  25-35kV Transformer Pad   75-300kVA   44-115

PLAN

3/4" Chamfer

REBAR DIAGRAM

SECTION A–A

Concrete Slab

#5@12" Maximum Spacing On Center Each Way Mid-Depth

Primary

Secondary

Ground Clamp

Finished Grade

Sand

Gravel
Figure 27.0-4  25-35kV Transformer Pad   500-2500kVA 44-116

PLAN

3/4" Chamfer

#5@12" Maximum Spacing On Center Each Way Mid-Depth

REBAR DIAGRAM

3/4" Chamfer

Ground Clamp

Concrete Slab

Finished Grade

Sand

Gravel

SECTION A–A
28.0 Sample Installations

PICTURE OF CONDUIT INSTALLATION BEFORE CONCRETE POUR

PICTURE OF BOLLARD INSTALLATION for PADMOUNT TRANSFORMER WITH OIL CONTAINMENT FOUNDATION
PICTURES OF A RISER POLE INSTALLATION

Riser Pole Bonding
Rigid Galvanized Steel. Bond higher than 8’ and at least 6” from top.

Completed Riser Pole
The Company will specify on which quarter of the pole the riser shall be installed, away from traffic.
HEAVY DUTY HANDHOLE INSTALLATION
PICTURES OF MANHOLE & DUCT SYSTEM INSTALLATIONS
29.0 Bollard Detail

**TYPICAL BOLLARD DETAIL**

YELLOW PLASTIC COVER, USE FOR BOLLARDS THAT CAN NOT BE PAINTED DURING TIME OF INSTALLATION
30.0 Concrete Specifications

30.01 SCOPE - For general use of reinforced and plain concrete when job specifications are not being issued. Not for use when placing concrete underwater (Tremie concrete).

30.02 MATERIALS - Cement shall be a standard brand of Portland Cement Type II conforming to ASTM C150. If concrete is to be in contact with sea water or soils other than clean gravel, or if job conditions require earlier strength development than Type II provides, notify Civil Engineering for use of a higher strength or high-early strength concrete.

Sand shall be sharp and clean and shall conform to ASTM C33, latest revision.

Coarse aggregate shall be of gravel, crushed gravel or crushed stone and conform to ASTM C33, latest revision.

Water shall be from a potable water supply or tested and approved by Civil Engineering, assuring it is clean and free from injurious amounts of oil, acids, alkali, organic materials, or other harmful substances.

30.03 READY-MIX CONCRETE - Ready-mix concrete shall be proportioned at the plant. Mixing and delivery shall be in accordance with ASTM C94, latest revision. Mixes shall conform to Table 1 for minimum 28 day strength, nominal maximum size aggregate, and slump.

An air-entraining agent shall be added to concrete mixes in which the surface will be exposed to the elements. No other admixtures shall be used without approval of Civil Engineering. Air-entrainment content shall be as follows:

<table>
<thead>
<tr>
<th>Mix Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2 and M3</td>
<td>7.0% plus or minus 2.0%</td>
</tr>
<tr>
<td>M4</td>
<td>5.0% plus or minus 1.5%</td>
</tr>
<tr>
<td>M5</td>
<td>4.5% plus or minus 1.5%</td>
</tr>
<tr>
<td>M6 and M7</td>
<td>6.0% plus or minus 1.0%</td>
</tr>
</tbody>
</table>

The Purchaser reserves the right to make tests at any time on materials used and concrete furnished by the ready-mix concrete supplier. The batch plant, equipment, and operating procedures are subject to inspection and approval by Civil Engineering or their qualified representative.

<table>
<thead>
<tr>
<th>Table I - Concrete Mixes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Number</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>M1</td>
</tr>
<tr>
<td>M2</td>
</tr>
<tr>
<td>M3</td>
</tr>
<tr>
<td>M4</td>
</tr>
<tr>
<td>M5</td>
</tr>
<tr>
<td>M6</td>
</tr>
<tr>
<td>M7</td>
</tr>
</tbody>
</table>

**NOTE:** If a greater slump is required, contact Civil Engineering for an additive to meet the specific job requirements.
Ready-mix concrete shall be ordered in accordance with this Specification with a copy of same supplied to the ready-mix concrete manufacturer. The cubic yards, delivery point, time schedule, and applicable mix number for the particular application shall be specified on the order. Delivery of a concrete batch in excess of the rated mixer drum capacity is cause for rejection. The latest drum inspection certificate should be available for verification.

30.04 CONCRETE - DELIVERY AND MIXING - In the event that delivery of concrete is called for when the air temperature is below 40º F the following shall apply:
   a. When the air temperature is between 30º F and 40º F, the concrete shall be delivered in excess of 55º F.
   b. When the air temperature is between 0º F and 30º F the concrete shall be delivered at a temperature in excess of 60º F.

In hot weather concrete shall be delivered at a temperature which will not cause difficulty from loss of slump, flash set, or cold joints. Discharge of concrete at the job site shall be completed within one (1) hour of adding the mixing water.

30.05 CONCRETE - FORMS - Formwork shall be designed and constructed in accordance with the American Concrete Institute's "Recommended Practice For Concrete Formwork", ACI 347, of latest date.

Forms shall be built substantially; true to form, lines, dimensions, and grades shown. They shall be braced and tied to maintain position and shape, without yielding to pressure of fluid concrete or other forces, including those produced by vibratory compaction.

Forms shall be constructed of 3/4" BB grade plywood supported with 2 x 4 studs on 16" centers. Forms shall not exceed a 10' pour height and form tie spacing shall not exceed 2'. Form ties and accessories, manufactured by Richmond Screw Anchor Company or equal, shall be used. Prefabricated forms are allowed after approval by Civil Engineering. The forms shall be vertical and symmetrical and in the largest sizes practicable. Sheets showing torn grain, worn edges, hole patches, or other defects, which impairs the texture of the concrete surface, shall not be used.

Forms shall be treated with approved form oil, before erection or reinforcing steel placement, to prevent adhesion of the concrete.

Forms shall be mortar-tight. For surfaces which will be exposed, the form faces shall be smooth and mortar-tight.

Forms shall be removed carefully to avoid damage to the concrete surfaces. The removal time is governed by the concrete's condition, curing temperature, curing time, and the forces the new concrete may be subjected. Under favorable curing conditions, forms may be removed no sooner after placement than the following:
   • seven (7) days for supported floor and roof slabs
   • 48 hours for wall and columns
   • 24 hours for footing walls and piers
   • 12 hours for underground duct lines

If high-early strength concrete is used, the above time periods may be reduced by one-half.

These periods presented are the cumulative number of days or fractions thereof, not necessarily consecutive, during which the concrete temperature is above 50º F. Whenever formwork is removed during the curing period, the exposed concrete shall be repaired immediately, finished, and cured as specified under "Concrete - Curing".

For the latest authorized version, please refer to the company’s website at http://www.libertyutilities.com/electricalspecifications
30.06 CONCRETE - PLACEMENT - Concrete shall not be placed until the forms, previously poured concrete surfaces, reinforced steel, and embedded parts have been cleaned of laitance, loose or defective concrete, soil on rock surface, and any other foreign materials.

All concrete placed when the air temperature is above 45º F shall be placed at the coolest temperature as practicable. Concrete placement is not permitted when hot weather conditions prevent proper placement and consolidation. Concrete will not be accepted if its temperature is in excess of 80º F.

When the mean daily temperature falls below 40º F, the minimum concrete temperature shall be 55º F and as close to this minimum as possible.

When the air temperature is below 40º F, provide suitable protection so the concrete can be maintained at a minimum of 50º F throughout the curing period. The protection and heat source, shall maintain the required temperature and moisture conditions without injury due to concentration of heat. All materials which the concrete contacts such as reinforcing, forms, ground, etc., shall be free of frost prior to placement.

Concrete temperature changes during and immediately following the curing period shall be as uniform as possible and shall not exceed 5º F in any one hour, nor 40º F in any 24 hour period. When heaters are used, prevent local surface heating and drying and provide adequate ventilation to prevent carbonation damage to exposed concrete surfaces. Thermostatic temperature controls shall be provided to control the heated enclosures to 50º F. Temperatures exceeding 80º F are to be avoided.

Concrete shall not be allowed to fall from the end of a chute, tube, or bucket more than 5 feet to point of deposit and shall have a fall free from obstructions. Chutes shall be metal or metal-lined.

Pumping equipment, pipelines, procedures, etc., shall be in accordance with ACI 304R, latest revision, and Civil Engineering shall be consulted for mix design of any pumped application. Conveying equipment for pumped concrete shall be of suitable kind, without “Y” sections and with adequate pumping capacity. No aluminum pipe shall be used. Placement shall be controlled so there is no separation in the discharged concrete. The maximum loss of slump in pumping equipment shall be 1½”.

Concrete shall be deposited as near to its final position as possible to avoid long flows in the forms. Concrete shall not be moved more than 10’ from point of deposit. Concrete shall be placed in successive horizontal layers, ranging in thickness from 6” to 15” maximum. Concrete shall be placed within 1½ hours after addition of cement to the aggregate.

Where conditions make it difficult to place concrete uniformly and perform compaction at the bottom of forms, batches of mortar containing the same proportion of cement to sand as in the concrete mix shall be deposited first and spread over the cleaned surface to a depth of approximately 1”.

Segregated, unworkable, and excessive slump concrete shall not be placed or, if placed, shall be removed and wasted as directed. High slump concrete resulting from addition of approved additives is acceptable for placement. Free water accumulating on new concrete during placement shall be removed as directed by the Engineer.

Placement and compaction methods shall ensure homogeneous concrete with maximum consolidation without segregation. Consolidate concrete by internal vibration, spading, or rodding by working it thoroughly around reinforcement, embedded items, and into corners of forms to eliminate all air or stone pockets which cause honeycombing, pitting, or planes of
weakness. Concrete contacting all formed surfaces shall be spaded manually to eliminate air bubbles.

Place horizontal construction joints at uniform vertical spacing unless otherwise shown on the drawings. Concrete shall not be placed to a depth of more than 10 feet in any 24 hour period, unless approved by Civil Engineering. All concrete placements shall be such as to keep cold joints from forming.

Whenever work is suspended on any section for more than one hour, the horizontal edges of the concrete next to the forms shall be brought to a plane perpendicular to the form face, and treated so no irregular, rough, or feathered edge joints show in the finished work. Before placing the next lift, clean the joint surface and remove all laitance. Immediately before placing new concrete wet the joint surface and remove all standing water.

Unless adequate weather protection is provided, do not place concrete during rain, sleet, or snow.

30.07 CONCRETE - CURING - Protect freshly deposited concrete from premature drying and hot or cold temperatures. Maintain a constant temperature throughout the curing period without drying.

All exposed concrete surfaces shall be kept continuously moist overnight by ponding, sprinkling, or by use of an approved membrane type curing compound, which conforms to ASTM C309, latest revision, and applied in conformance with the manufacturer’s recommendations.

Curing shall continue, using one of the above methods or waterproof paper, for a 7 day period (3 days for high-early strength concrete) maintaining the concrete at a minimum temperature of 50º F as is practicable. Protective covering with tarpaulins, hay, straw, etc. shall be provided to retard moisture evaporation during hot weather and to prevent rain damage before hardening. Protective covering shall be available for immediate use at all times.

During the curing period, the concrete shall be protected from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.

30.08 SURFACE FINISH - All surface fins shall be removed.

Exposed concrete surfaces shall not be given any special treatment to enhance appearance, such as rubbing with a stone, without permission of Civil Engineering.

30.09 LOADING OF CONCRETE - Normal concrete structures shall not be subjected to external loads in less than:

- four days for foundations, manhole floors, and walls
- seven days for floors, roofs, and columns

Each concrete placement shall be allowed to set 48 hours before addition of a subsequent pour upon it. If high-early cement is used this time period may be reduced by one-half.

Trenches containing concrete encased duct lines constructed on undisturbed original ground may be backfilled not less than two (2) hours after placement. Compaction by light tamping equipment may proceed immediately. Loading of the backfill by heavy equipment or traffic is not permitted before 12 hours after placement.

30.10 WATERPROOFING - Waterproofing is provided by the density of the concrete mix and the thickness of concrete. Care must be used in placing and compacting the concrete to eliminate all voids and potential leakage paths. When structures less than 8" thick must be waterproof, consult Civil Engineering to revise the mix design to achieve the desired waterproof result.
# 31.0 Easement Application Form

**LIBERTY UTILITIES EASEMENT APPLICATION FORM**

<table>
<thead>
<tr>
<th>FOR LIBERTY UTILITIES’ USE ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application for Easements (check one):</td>
</tr>
<tr>
<td>□ Padmount transformer only</td>
</tr>
<tr>
<td>Work Request Number</td>
</tr>
<tr>
<td>Utility Engineer’s Name:</td>
</tr>
</tbody>
</table>

Please complete **ALL** of the sections below so that we may prepare an easement for your signature. Do not leave any sections unanswered. If a section does not apply to you simply put “n/a” on that line. Incorrect or incomplete information will delay service installation.

Property Owner(s): 

<table>
<thead>
<tr>
<th>Property Owner Mailing Address</th>
<th>Property Address of Easement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
<td>Address:</td>
</tr>
<tr>
<td>City:</td>
<td>City:</td>
</tr>
<tr>
<td>State &amp; County</td>
<td>State &amp; County</td>
</tr>
<tr>
<td>Zip</td>
<td>Zip</td>
</tr>
</tbody>
</table>

Customer Contact Person: 

Daytime Phone(s):

Re: Subdivision Title:

1. Provide us with a **RECORDED** copy of the present owner’s deed, Book_______ Page_______
   
a) If multiple deeds make up the whole parcel, please include all deeds.

b) If the Property Owner is a b1) CORPORATION, b2) TRUST, b3) PARTNERSHIP, or b4) LIMITED LIABILITY COMPANY, provide the following which is applicable:

   b1) President Name: ________________ Treasurer Name: ________________
   
   *See Footnote Below*

   Or

   Vice President: ________________ Asst. Treasurer: ________________

   *If neither “Name Combinations” is available, the person(s) signing the easement must have a Corporate vote authorizing them to sign on behalf of the Corporation.*

For the latest authorized version, please refer to the company’s website at [http://www.libertyutilities.com/electricalspecifications](http://www.libertyutilities.com/electricalspecifications)
b2) Trust: No. Of Trustees: ______________________ Name(s): ______________________
   Name of Trust: __________________________________________________________________

b3) Partnership: Number of Partners: __________ Name(s): __________________________

b4) LLC: Authorization to Sign, Name(s): __________________________________________

2. a) Provide us with an approved: “Definitive Subdivision Plan”
   Plan Book: __________________ Plan: __________________ Dated:____________________

b) If there is no recorded subdivision plan please include the following information:
   Assessor’s Map: __________ Block: __________ and Lot: __________

3. Is your property mortgaged (circle one)? YES NO

   If “YES”, please complete this section:
   a) Name of Bank/Company/Person holding mortgage(s): ____________________________
   b) Address of mortgage holder(s): ________________________________________________
   c) Date and recording information of mortgage(s): _________________________________
      Date: __________ County Recorded: __________ Book: __________ Page: __________

   Additional Comments:
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
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   ____________________________________________________________________________
   ____________________________________________________________________________

Please contact your Liberty Utilities Representative if you have any questions regarding this form.
### 32.0 Approved Precast Concrete Manufacturers

<table>
<thead>
<tr>
<th>Shea Precast Concrete Products</th>
<th>Shea Precast Concrete Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 Old Turnpike</td>
<td>87 Haverhill Street</td>
</tr>
<tr>
<td>Nottingham, NH 03290</td>
<td>Amesbury, MA 01913</td>
</tr>
<tr>
<td>Phone: 1-800-696-7432, 603-231-1685</td>
<td>Phone (800) 696-SHEA</td>
</tr>
<tr>
<td>Contact: Jerry Mailloux</td>
<td>Greg Stratus 1-800-696-7432</td>
</tr>
</tbody>
</table>

For the latest authorized version, please refer to the company’s website at [http://www.libertyutilities.com/electricalspecifications](http://www.libertyutilities.com/electricalspecifications)
### 33.0 Approved Material – Underground Commercial Installations

<table>
<thead>
<tr>
<th>Liberty Utilities Item ID</th>
<th>Item Description</th>
<th>Manufacturer 1 Part No.</th>
<th>Manufacturer 2 Part No.</th>
<th>Manufacturer #3 Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conduit – Straight</strong></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>8830-2010404</td>
<td>Conduit, 4&quot;, PVC</td>
<td>Carlon: 48815</td>
<td>IPEX:8741</td>
<td>Cantex A79EA42</td>
</tr>
<tr>
<td>8830-2011024</td>
<td>Conduit, Galvanized, 4&quot;</td>
<td>By Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8830-2010405</td>
<td>Conduit, 5&quot;, PVC</td>
<td>Carlon 48815</td>
<td>IPEX 8751</td>
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</tr>
<tr>
<td>8830-2011025</td>
<td>Conduit, Galvanized, 5&quot;</td>
<td>By Description</td>
<td></td>
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<tr>
<td><strong>Conduit – Bends</strong></td>
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</tr>
<tr>
<td>8830-5690446</td>
<td>Bend, Galvanized, 4&quot; 36&quot; radius</td>
<td>BayneJones 400R9036</td>
<td>Conduit mfg TUB490D36RGALEL</td>
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</tr>
<tr>
<td>8830-5690493</td>
<td>Bend, PVC Sch 40, 4&quot;, 90 Degree, 36&quot; Rad.</td>
<td>Cantex: 5233842</td>
<td>Carlon: UA9FN B</td>
<td>Certifsaft 59734</td>
</tr>
<tr>
<td><strong>Spacers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8830-5646963</td>
<td>Spacer, 4&quot;, Base</td>
<td>GS Industries: 186-1</td>
<td>IPEX: 29573</td>
<td></td>
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<tr>
<td>8830-5646960</td>
<td>Spacer, 4&quot;, Inter.</td>
<td>GS Industries: 185-1</td>
<td>IPEX: 29557</td>
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</tr>
<tr>
<td><strong>Conduit Accessories</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8830-5641210</td>
<td>Riser Strap, 4&quot;</td>
<td>Electrical Materials: 50-4 USHD</td>
<td>BayneJones MINRLAC HD-296</td>
<td></td>
</tr>
<tr>
<td>8830-7011830</td>
<td>Lag Screw, 1/4&quot; x 2&quot;</td>
<td>Elect. Materials 106 or 106M</td>
<td>Joslyn J26486.1</td>
<td>PLH LSNW-142</td>
</tr>
<tr>
<td>8830-3503074</td>
<td>Pipe Grd. Connector, 4&quot; and 5&quot;</td>
<td>Burndy GAR3905-BU</td>
<td>Thomasbett (0)3905-BU</td>
<td></td>
</tr>
<tr>
<td>8830-2010424</td>
<td>Temporary Duct 4&quot; Plug, DB</td>
<td>Carlon: P258NT</td>
<td>Scepter 57</td>
<td></td>
</tr>
<tr>
<td>8830-2011254</td>
<td>Duct Plug Galvanized 4&quot;</td>
<td>Crousehind PLG105</td>
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<tr>
<td>8830-2010434</td>
<td>Adapter, Female, PVC-Steel, 4&quot;</td>
<td>Carlon: E942N</td>
<td>Cantex: 5140052</td>
<td>Scepter FA55</td>
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<tr>
<td>8830-5693359</td>
<td>Coupling, 5 Degree, Bell-Spigot, 4&quot;</td>
<td>Carlon: E244N</td>
<td>Cantex: 6151452</td>
<td>Certifsaft 59544</td>
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<tr>
<td>8830-2010444</td>
<td>Coupling, 5 Degree, Bell-Bell, 4&quot;</td>
<td>Ameripipe FT518</td>
<td>Carlon E2440NF</td>
<td>Scepter 7604360040</td>
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<tr>
<td>8830-2010454</td>
<td>Straight Coupling, 4&quot;</td>
<td>Carlon: E240N</td>
<td>Scepter 760443540</td>
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</tr>
<tr>
<td>8830-2010464</td>
<td>Bell End Female 4&quot;</td>
<td>Carlon: E997N</td>
<td>Cantex: 5144012</td>
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<tr>
<td>8830-9202062</td>
<td>Mule Tape</td>
<td>NEPTCO WP2500P</td>
<td>Arnco DLWP25</td>
<td>Condux 08096303</td>
</tr>
<tr>
<td>8830-2011254</td>
<td>Plug Galvanized. 4&quot; Threaded for Spare Riser</td>
<td>CROUSEHIND PLG105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8830-9202201</td>
<td>Plug Conduit 4&quot; with metal loop for mule tape.</td>
<td>Carlon MAEPG7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberty Utilities Item ID</td>
<td>Item Description</td>
<td>Manufacturer 1 Part No.</td>
<td>Manufacturer 2 Part No.</td>
<td>Manufacturer #3 Part No.</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>8830-9200896</td>
<td>Three Phase 15 kV 75-500 kVA</td>
<td>Reference 044-113 LU-MS2582</td>
<td>Shea Precast Concrete</td>
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</tr>
<tr>
<td>8830-9202324</td>
<td>Three Phase 15 kV 750-2500 kVA</td>
<td>Reference 044-114 LU-MS2583</td>
<td>Shea Precast Concrete</td>
<td></td>
</tr>
<tr>
<td>8830-9200898</td>
<td>Three Phase 25-35kV 75-300kVA</td>
<td>Reference 044-115 UF8C</td>
<td>Shea Precast Concrete</td>
<td></td>
</tr>
<tr>
<td>8830-9200896</td>
<td>Three Phase 25-35kV 500-2500kVA</td>
<td>Reference 044-116 UF8D</td>
<td>Shea Precast Concrete</td>
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</tbody>
</table>

**Transformer Foundations – Precast**

**Grounding Accessories**

<table>
<thead>
<tr>
<th>Liberty Utilities Item ID</th>
<th>Item Description</th>
<th>Manufacturer 1 Part No.</th>
<th>Manufacturer 2 Part No.</th>
<th>Manufacturer #3 Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8830-2011100</td>
<td>Grounding Bushing, 4&quot;</td>
<td>CROUSEHIND GLL-10C</td>
<td>OZGEDNEY BLG 4122</td>
<td></td>
</tr>
<tr>
<td>8830-3503013</td>
<td>Grounding Rod 5/8&quot; x 8' Solid Copperweld</td>
<td>ERITECH 615880</td>
<td>Galvin6258 Joslyn:J8338</td>
<td></td>
</tr>
<tr>
<td>8830-9201272</td>
<td>2/0 Cu, Bare, Soft Drawn, 19 Strand</td>
<td>By Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8830-3503328</td>
<td>Ground Rod Clamp</td>
<td>Burndy: GRC58 Blackburn: JAB58H Electromotion EM58DBW</td>
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<tr>
<td>8830-5960412</td>
<td>“C” Connector, 2/0 – 2/0</td>
<td>Burndy: YC26C26TN</td>
<td></td>
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</tr>
<tr>
<td>8830-3503074</td>
<td>Clamp, ground, conduit 4” heavy duty, Bronze</td>
<td>Burndy GAR3905-BU</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Splice box, Handhole, Switchgear Manhole**

<table>
<thead>
<tr>
<th>Liberty Utilities Item ID</th>
<th>Item Description</th>
<th>Manufacturer 1 Part No.</th>
<th>Manufacturer 2 Part No.</th>
<th>Manufacturer #3 Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8830-5640808</td>
<td>Primary Pull/Splice Box</td>
<td>Quazite (Hubbell): PA12-3060-37-0271</td>
<td>Highline: CVA306038HEIK</td>
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<tr>
<td>8830-5643075</td>
<td>Heavy Duty Handhole on page 26</td>
<td>Shea Precast Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8830-9200893</td>
<td>Switchgear Manhole 15kV</td>
<td>Shea Precast Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8830-9200894</td>
<td>Switchgear Manhole 25-35kV</td>
<td>Shea Precast Concrete</td>
<td></td>
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</tr>
<tr>
<td>8830-2012198</td>
<td>Fiberglass Switchgear (Contact LU for specs.)</td>
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</tbody>
</table>

**Precast Oil Containment Wall**

<table>
<thead>
<tr>
<th>Liberty Utilities Item ID</th>
<th>Item Description</th>
<th>Manufacturer 1 Part No.</th>
<th>Manufacturer 2 Part No.</th>
<th>Manufacturer #3 Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8830-9202153</td>
<td>Three Phase 15 kV 75-500 kVA</td>
<td>Shea Precast Concrete</td>
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<td></td>
</tr>
<tr>
<td>8830-9202154</td>
<td>Three Phase 15 kV 750-2500 kVA</td>
<td>Shea Precast Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three Phase 25-35kV 75-300kVA</td>
<td>Shea Precast Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three Phase 25-35kV 500-2500kVA</td>
<td>Shea Precast Concrete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Manhole Frame, Ring and Cover**

<table>
<thead>
<tr>
<th>Liberty Utilities Item ID</th>
<th>Item Description</th>
<th>Manufacturer 1 Part No.</th>
<th>Manufacturer 2 Part No.</th>
<th>Manufacturer #3 Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8830-5644514</td>
<td>Frame 36&quot; square</td>
<td>EJ Part # 00227029</td>
<td>EJ Ironworks Shea Precast Products</td>
<td></td>
</tr>
<tr>
<td>8830-5644550</td>
<td>Ring 26&quot; to 36&quot;</td>
<td>EJ Part # 00227029</td>
<td>EJ Ironworks Shea Precast Products</td>
<td></td>
</tr>
<tr>
<td>8830-5644360</td>
<td>Cover 26&quot;</td>
<td>EJ Part # 00227029</td>
<td>EJ Ironworks Shea Precast Products</td>
<td></td>
</tr>
</tbody>
</table>
### 34.0 Other Materials/ Suppliers

#### Secondary connectors

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burndy Co</td>
<td>Compression Connection Crimp Tool (Used for ground grids) Burndy MD7-8 with the extra die set (W-BG).</td>
</tr>
<tr>
<td>Richards Co</td>
<td>Stuart C. Irby Co</td>
</tr>
<tr>
<td>Utilco</td>
<td>Wesco</td>
</tr>
<tr>
<td>Graybar</td>
<td>80 Pepsi Road Manchester, NH 03109-5303 Wally Litchfield 603-624-8614 <a href="mailto:wally.litchfield@graybar.com">wally.litchfield@graybar.com</a></td>
</tr>
</tbody>
</table>

#### Secondary Splice box

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elliot Industries</td>
<td>EJ Ironworks Brockton, Ma Walter O’Leary – 508.586.3130 800.626.4653 ejco.com</td>
</tr>
</tbody>
</table>

#### Bollard Covers

<table>
<thead>
<tr>
<th>Description</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manhole frame, ring and cover</td>
<td>Innoplast 1-800-516-9287</td>
</tr>
</tbody>
</table>

The materials in this book can be found at most Electrical supply stores, listed below are a few.

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone Number</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graybar</td>
<td>80 Pepsi Road Manchester, NH 03109-5303 Wally Litchfield 603-624-8614 <a href="mailto:wally.litchfield@graybar.com">wally.litchfield@graybar.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wesco</td>
<td>117 Londonderry Tpke. Hookset, NH 03106-2015 Duane Cahill 603-391-3118</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** If 5” conduit is specified in the design to be used the Company will need to verify and approve materials purchased for installation by the Customer.
35.0 Job Check Off Sheets

3 PHASE, CONDUIT ENCASED IN CONCRETE INSPECTION CHECK LIST

Do not pour concrete or backfill BEFORE conduit system inspection and approval by company inspector. Every item listed below must be inspected and checked by a Company inspector.

<table>
<thead>
<tr>
<th>N*</th>
<th>Y*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

**PRE-TRENCH (no inspection)**
- / / Final grade established, surface rough graded, and roadways staked.
- / / Developer has Service Specifications on site.
- / / Easement has been executed.

**TRENCH (prior to concrete encasement)**
- / / Min. 30" depth from existing grade to top of encasement during all phases of construction.
- / / Electric conduits on "road side", with 1 spare conduit, in all multi-utility trench installations.
- / / Min. separation between electrical conduit and foreign conduits or pipes.
- / / All road crossing perpendicular.
- / / Conduit plugs installed.
- / / Plastic spacers properly installed every 5 to 8’ intervals and at every coupling.
- / / All curves properly formed with 5° couplings.
- / / Company conduits to be in separate encasement from all other utilities.

**PRE-BACKFILL (after concrete encasement)**
- / / Company conduit in separate encasement.
- / / Minimum separation to foreign utilities and subsurface pipes maintained.
- / / Encased concrete thickness > 3" around all conduits.
- / / Sand or screened backfill (with less than 1” stones) on-site for backfilling entire trench, (inspector may witness backfilling).
- / / Warning tape 8” to 12” below finish grade and directly above electrical conduit system.
- / / No parallel non company utilities directly above or below electrical system.

**AFTER BACKFILL (pre-conductor installation inspection)**
- / / Install 2500 lb. Pulling Tape in all conduit after rodding with a mandrel.

**HEAVY DUTY HANDHOLE**
- / / 6” of crushed stone under handhole.
- / / Seal around conduit entrances with concrete or mortar.
- / / Manhole cover at finish grade with 2 courses of brick and grout for chimney.

**PULLBOX/SPLICE BOX**
- / / 4” of crushed stone under pullbox foundation.
- / / Cover left secured to box when unattended.
- / / Flush with sidewalk or slightly above any grassy area.
- / / Installed behind curb or other protection to prevent damage (e.g. snowplow)

**RISER POLE**
- / / 90° BEND AND straight pipe galvanized steel conduit.
- / / Steel-PVC adapter and steel sweep shall not be encased.
- / / Ground clamp installed with tap.

*NOTE Y – Acceptable N – Deficient*
**TRANSFORMER FOUNDATION INSPECTION CHECK LIST**

Do not pour concrete prior to inspection and approval by Company of the pad forming and reinforcement, the subgrade preparation, and the ground grid. Do not back fill after removing the forms prior to pad inspection. Every item listed below must be inspected and checked off by Company inspector.

<table>
<thead>
<tr>
<th>N*</th>
<th>Y*</th>
</tr>
</thead>
</table>

**PRE-INSTALLATION**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Proposed location within 10' of paved way open to vehicular access.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Proposed location has minimum of 10' clear space in front of transformer doors.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Proposed location has minimum clearance to buildings, doorways, windows, ventilation ducts, fire escapes, and other combustibles as per pages 14 and 15 of this guide.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Bollard locations are identified by Company.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Ground grid installation and two ground rods</td>
<td></td>
</tr>
</tbody>
</table>

**PRE-POURING**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>/</td>
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<tr>
<td>12&quot; gravel and 2&quot; sand below pad location.</td>
<td></td>
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<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Reinforcing bars.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Concrete forms correct height, size, orientation, opening, etc.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Concrete forms in correct location.</td>
<td></td>
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<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Ground grid installation and two ground rods.</td>
<td></td>
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<tr>
<td>/</td>
<td>/</td>
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<tr>
<td>36° radius at all 90° sweeps into pad stopping 1&quot; above pad.</td>
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<tr>
<td>/</td>
<td>/</td>
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<tr>
<td>Secondary sweeps in place and proper number.</td>
<td></td>
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</tbody>
</table>

**AFTER POURING** (after removing forms and prior to backfilling)

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Pad correctly formed and 10&quot; high.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>¾&quot; chamfer along the edges.</td>
<td></td>
</tr>
<tr>
<td>Sweep 1&quot; above pad.</td>
<td></td>
</tr>
</tbody>
</table>

**AFTER BACKFILLING**

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td>/</td>
<td>/</td>
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<tr>
<td>6&quot; protective bollards are correctly installed.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Pad 5&quot; above final grade.</td>
<td></td>
</tr>
<tr>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Pad has 10' of clear space in front of transformer doors, is 10' from an accessible paved way and has the minimum clearance to other structures.</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**  
Y – Acceptable  
N- Deficient
### 36.0 Cable Installation Maximum Pull Chart

<table>
<thead>
<tr>
<th>Wire Size</th>
<th>15kV Class</th>
<th>35kV Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Riser to Pad</td>
<td>Riser to Pull Box</td>
</tr>
<tr>
<td>#2 AL</td>
<td>530</td>
<td>605 750</td>
</tr>
<tr>
<td>1/0 AL</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>2/0 CU</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>4/0 CU</td>
<td>695 720</td>
<td>750</td>
</tr>
</tbody>
</table>

**Note:**
1. All Calculations are based on a straight pulls
2. All conduits are 4”
3. Assume 50Lb reel drag
4. Assume .5 for coefficient of friction
5. Pulls are in feet
6. Pulls distances are shown from worst case pulling end.
37.0 Padmount Transformer Compartment Sealing Requirements

**Issued by Standards #09-09**

**THREE PHASE PADMOUNTED TRANSFORMER SEALING**

Padmounted transformer compartment areas shall be sealed to minimize the direct release of transformer fluid into the ground through the primary and secondary compartment areas of the transformer. Sealing the compartment areas will better contain the release, allowing the fluid to be noticed more promptly.

The following describes how to seal the compartments areas. Compartment areas shall be filled with sand to a grade of 4” below the top of the concrete pad. On top of the sand a concrete grout (no aggregate) or expanding foam (STD Item UF10) shall be installed to the top to the concrete pad. The installer of the transformer pad and conduit is required to seal the compartment areas. All conduits shall also be filled in with expanding foam. The customer is required to seal all conduits where they are installing customer owned cables, this includes the spare conduits in that duct bank. The company is required to seal all conduits where they are installing company owned cables, this includes the spare conduits in that duct bank. This detail is further explained in the Underground Construction Standards book in section 44.20. Note: Keep the expanding foam stored in a heated environment to make applying easier.

Cross section view of a padmounted transformer having primary and secondary compartments filled with sand and Expanding Foam.
### 38.0 Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Rev #</th>
<th>Description</th>
<th>Author/Lead Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/03/12</td>
<td>0</td>
<td>Initial Version of Document</td>
<td>Robert J Johnson</td>
</tr>
<tr>
<td>04/01/14</td>
<td>1.0</td>
<td>Update to reflect new Liberty Utilities Policy 2 Line Extension Policy for Residential Developments (URD)</td>
<td>Robert J Johnson</td>
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<tr>
<td>04/01/18</td>
<td>2.0</td>
<td>Update to reflect new Liberty Utilities Policies for new Electric Tariff requirements for underground service</td>
<td>Robert J Johnson</td>
</tr>
</tbody>
</table>
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Liberty Utilities
15 Buttrick Rd
Londonderry, NH 03053
1-800-375-7413
www.libertyutilities.com