Welcome to the second edition of the Seattle City Light Standards for Electrical Service. This collection is designed for use by Energy Delivery Engineering staff as well as customers, developers and contractors. It is designed to allow for easy access to all the standards referenced in each version of Service Construction Letter Attachment D.

The Seattle City Light Standards for Electrical Service apply whenever any public or private construction is performed within City Light Service Territory.

This collection includes the complete set of referenced standards effective as of January 2018.

Pawel Krupa, Interim Officer, Engineering and Technology Innovation
# Preface

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### NEW STANDARDS

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<tr>
<td>0231.03</td>
<td>Cast-in-Place Risers</td>
<td>This standard was created to provide direction on installation of cast-in-place risers, which are used either where standard height risers do not work, or where access is located on a sloped grade.</td>
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<tr>
<td>0473.50</td>
<td>Looped Radial and Network Service Entrance Cables in Conduit for Underground Primary Service</td>
<td>New standard for customer service entrance served by cables in conduit.</td>
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</table>
| 1561.05  | Customer Requirements for Underground Single or Dual Meters, Residential Service | This standard replaced U12-1.3/NMT10. In addition to carrying over existing requirements from U12-1.3/NMT10, this standard provides extra clarity around:  
  - Section 4.1, General Requirements, clarified conduit size and grounding; also included requirements for rigid galvanized steel  
  - Section 4.2, Mounting Height, added information to table 4.2  
  - Section 4.3, Clearances, updated meter clearances and made slight modifications to Figures 4.3a and 4.3b.  
  In the Scope section, “200A and 320A” were added for clarification.  
In Section 4, Requirements, the following changes were made:  
  - In Section 4.1, General Requirements, “legal service termination point” clarification was added.  
  - In Section 4.3, Clearances, Fig. 4.3a was modified to show a change in the minimum clearance dimension above the meter.  
  - Figures 4.4.1, 4.4.2, 4.6.1, and 4.6.2 now correctly depict the coupling of the riser bends in an above-ground position at the service entrance.  
Included more language from the customer service letter in the standard. |

### REVISED STANDARDS

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<tr>
<td>0222.02</td>
<td>Requirements for Duct Banks in the Public Right-of-Way</td>
<td>In Section 5, Duct Bank Construction, added general notes about duct bank construction. In Section 6, Conduits, added that conduit shall be RGS if there is 10 ft or less between bends.</td>
</tr>
<tr>
<td>0224.01</td>
<td>Customer Requirements for Underground Secondary Service, Looped Radial System</td>
<td>Reference to SCL U12-1.3/NMT-10 (canceled) has been updated to refer to SCL 1561.05 for residential underground service entrance to a single or dual-meter installation.</td>
</tr>
<tr>
<td>0224.05</td>
<td>Requirements for Underground Services on Private Property</td>
<td>In Section 6, Conduit, added Table 6b to communicate conduit minimum bend radius requirements, including Note which states that bending conduits with heat is not allowed. In Section 13, Inspection, added conduit inspection note.</td>
</tr>
<tr>
<td>0224.07</td>
<td>Requirements for Secondary Conduits in the Right-of-Way</td>
<td>Eliminated bracket compatible unit (CU) and integrated bracket materials into riser CU. In Section 11, Inspection, added conduit inspection note.</td>
</tr>
</tbody>
</table>
| 0224.34  | Steel Conduit Risers                                               | Eliminated bracket compatible unit (CU) and integrated bracket materials into riser CU. The following information was added to Section 3, Requirements:  
  - Section 3.1, General, clarified that a maximum of one set of risers shall be allowed per pole.  
  - Section 3.2, Orientation and Arrangement, clarified that if there is more than one conduit, the highest voltage conduit shall be placed closest to the pole.  
  - Section 3.3, Brackets, added statement that brackets shall be braced. In Section 3.4, Grounding, clarified final connection to pole ground by SCL crew. |
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<td>0231.01</td>
<td>Secondary Handhole Installation</td>
<td>Added a clarification that the location of the ground rod must be placed in the handhole corner so that it does not obstruct the conduit opening.</td>
</tr>
<tr>
<td>0257.06</td>
<td>Ceiling Channel for In-Building Vaults</td>
<td>Removed retrofit options.</td>
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<tr>
<td>0474.08</td>
<td>Looped Radial and Network Dry Vault Service Entrance Bus Duct for Underground Primary Service</td>
<td>Title revised to clarify that this standard is for underground primary service. In Section 3, Requirements, added that adjacent customer buses must be mounted at the same height above floor to minimize the amount of cable support necessary.</td>
</tr>
<tr>
<td>0652.01</td>
<td>Transformer Pad, Installation and Grounding, Single Phase, 25-167 kVA</td>
<td>Removed Fig.1 reference to conduit 36 inch bend radius. Standard points to SCL 0224.05.</td>
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<tr>
<td>0652.03</td>
<td>Transformer Pad, Installation and Grounding, Three-Phase, 150-300 kVA</td>
<td>Removed Fig.1 reference to conduit 36 inch bend radius. Standard points to SCL 0224.05.</td>
</tr>
<tr>
<td>0652.05</td>
<td>Transformer Pad, Installation and Grounding, Three-Phase, 500-1500 kVA</td>
<td>Removed Fig.1 reference to conduit 36 inch bend radius. Standard points to SCL 0224.05.</td>
</tr>
<tr>
<td>0652.07</td>
<td>Transformer Pad, Installation and Grounding, Three Phase, 2000-2500 kVA</td>
<td>Removed Fig.1 reference to conduit 36 inch bend radius. Standard points to SCL 0224.05.</td>
</tr>
<tr>
<td>1561.07</td>
<td>Customer Requirements for Underground Secondary Service Termination Facilities</td>
<td>All references to SCL U12-1.3/NMT-10 (canceled) have been updated to refer to SCL 1561.05 for residential underground service entrance to a single or dual-meter installation.</td>
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</table>
| 0751.00| Customer Requirements, In-Building Transformer Vaults, Network and Looped Radial Systems | Revisions made throughout the document, including Section 5, Accessibility:  
- In Section 5.1, added requirement that Looped Radial equipment hatch shall be outside the in-building vault. Oil hose is needed only for Network and Network-ready vaults.  
- In Section 5.12, revised equipment access path to require minimum dimensions and weight.  
- In Section 5.13, clarified a requirement for equipment transportation agreement.  
In Section 6.4, Location, added Looped Radial above-grade pulling vault information.  
In Section 7, Construction, the following changes were made:  
- In Section 7.7, the ceiling channels orientation was clarified.  
- In Section 7.12, added slab and slope details.  
- In Section 7.13.1, added that additional pulling irons may be required.  
- In Section 7.13.4, inserted a new subsection which added a pulling iron for 6 ft+ wide Looped Radial equipment access doors.  
In Section 8.1.1, Doorways and Openings, clarified personnel access door. If equipment access is provided by a drop-in hatch outside the vault, a separate personnel door that permits egress through the building is required.  
In Section 9.4.1, Ventilation, clarified that exhaust minimum mounting height is 10 feet above grade.  
| 0751.60| Concurrent Customer Requirements, In-Building Transformer Vaults     | In Section 9, General Requirements, revised Fig. 9a, Vault Layout diagram Section 13, Customer's Service Entrance, included the following changes:  
- In Section 13.3, added reference to allowed cables listed in new standard 0473.50.  
- In Section 13.3.1, added that customers are responsible for supplying cable limiters. |
| 0751.77| In-Building Vault Equipment Clearances                              | Added Figures 3.7c, and 3.7d to show clear space around SY transformers in in-building vaults.                                                                                                               |
## Significant Revisions and Additions Since Last Publication

### REVISED STANDARDS, continued

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| 1561.07 | Customer Requirements for Underground Secondary Service Termination Facilities | In Section 1, Scope, clarified that single and dual meter residential services over 320 A are outside scope of this standard.  
In Section 5, Service Termination Requirements, revised table columns in Tables 5.2, 5.3 and 5.4 around maximum service size.  
In Section 6, Conduits, added Table 6 which lists required conduits for service sizes, and clarified customer responsibility including two-conduit requirement for installations that cross a street. |
| 1714.50 | Underground Streetlight Systems                                     | In Section 4, Requirements, Figure 4b, added a ground conductor between the streetlight handhole and pole.  
In Section 7, Wiring, Figure 7, revised fuse from 3 A to 15 A.                                                                                                   |
| U2-15.1 | Installation of Ring Type Vaults                                   | Removed Section 8, Proximity to Sewers, per request from SPU. Correct information appears in SCL 0214.00.                                                                                                  |
| U10-7  | Requirements for Transformer Pads and External, Below-Grade Transformer Service Vaults, Looped Radial System | In Section 5, Secondary with Conduit and Cable, added reference to allowed cables listed in new SCL standard 0473.50.  
In Section 8.2, Protective Guard Posts, added that bollards shall be outside oil containment system.                                                              |

### CANCELED STANDARDS

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<td>Meter Location and Conduit Entrance Details for Secondary Underground Residential Service</td>
<td>Canceled and replaced by 1561.05, “Customer Requirements for Underground Residential Service Entrance, Single or Dual Meters.”</td>
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<td>7203.12</td>
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<td>7203.76</td>
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<td>7651.25</td>
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<td>7645.40</td>
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</table>
Clearances between SCL Underground Structures and Other Utility Structures in the Public Right-of-Way

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2. Scope

This standard covers clearance requirements between Seattle City Light (SCL) underground structures and other utilities underground structures located in the public right-of-way. This includes both Network and Looped Radial underground structures. Underground structures include vaults, handholes, basins, fire hydrants, duct banks, conduits, pipes, and root balls.

This standard addresses the minimum required horizontal and vertical clearances between structures and required operating space.

The requirements may be code based or safety related.

3. Application

This standard shall be used by SCL engineers, operations personnel, consultants, and contractors when designing and/or constructing vaults, handholes, manholes, conduits below grade that are in the vicinities of other utilities installations. These could be gas, water, sewer, steam, telephone, cable TV, and fiber optics. Other utilities and contractors should also follow these provisions when installing their facilities near any SCL facility.

Reasons for maintaining these minimum clearances are for allowing enough space for future equipment maintenance, assuring a safe environment to the public, avoiding thermal interferences between cables, repair and replacement of other utilities, and minimizing impact of other utilities failures on SCL equipment and vice versa.

The minimum clearances defined in this document are per SCL specifications taking into account the City of Seattle Land Use Code, Right-of-Way Improvement Manual, and Standard Plans and Specifications; and the Washington Administrative Code (WAC). SCL specifications are derived from engineering and operations experience.

For any deviation from the prescribed clearances, an agreement has to be reached between SCL Engineering and the interested parties.

4. Design and Construction Notes

4.1 Covers/Hatch

When reviewing designs, engineers should take into account cover or lid size for future needs.

4.2 Vault Knockouts

The knockout zone shall be eight feet long and the width shall equal the width of the knockouts plus 2 ft. The height of the knockout zone shall be equal to the height of the SCL facility. This zone should be reserved for future extensions of SCL duct runs unless parties receive explicit permission from SCL Engineering.

Non-SCL utility manhole construction in knockout zones shall be approved by SCL Engineering. These zones are planned for future conduit extensions. See Figure 4.2a.

No utility handholes or other underground structures shall be installed in the area outside and adjacent to knockouts. See Figure 4.2a.

No installations below SCL facilities shall occur without written SCL Engineering approval. See Figure 4.2b.

No installations above other existing utilities' structures shall occur without written SCL Engineering approval. See Figure 4.2b.
Figure 4.2a. Knockout Zone, Plan View

Non SCL utility construction in knockout zones should be approved by SCL Engineering. These zones are planned for future conduit extensions.
4.3 Shoring

During construction projects shoring piles and shoring lagging shall maintain a clearance from SCL conduits, duct banks, handholes, manholes and vaults of at least 1 ft.

4.4 Overhead Clearance for SCL Underground Structures

To allow crane access to SCL vaults and manholes for lowering and raising equipment, the minimum vertical height above the underground facilities, of overhead structures and any encumbrances, such as roadway columns, shall be 25 ft.

4.5 Access and Working Space for SCL Underground Structures

To allow crane access to SCL vaults and manholes, facilities must be located to allow permanent SCL vehicular (truck) access to the facility for installation and service of electrical equipment. SCL facilities must have a permanent, level, unobstructed, 8-ft wide working area around the facility for access to the facility and knockout zones.
5. Minimum Clearances between SCL Vaults or Handholes and Non-SCL Facilities, Conduits and Pipes

Non-SCL conduit can be 3 ft from SCL facility but must be below knockout zone.

If SCL knockout zones are planned for 115 kV or 230 kV facilities, horizontal clearance shall be 5 ft from SCL facilities to non-SCL facilities and conduits (except for high pressure steam or heat source).

Figure 5a. Minimum Horizontal Clearance, Plan View
Figure 5b. Minimum Horizontal Clearance, Elevation, Side View

Note: If SCL knockout zones are planned for 115 kV or 230 kV, horizontal clearance shall be at least 5 ft between SCL knockout zones and non-SCL conduit or pipes.
6. Minimum Clearance between SCL Conduits or Duct Banks and Non-SCL Facilities, Conduits and Pipes

If SCL conduit or duct bank contains 115 kV or 230 kV, the horizontal clearance between SCL facilities and non-SCL facilities shall be a minimum of 5 ft and the vertical clearance shall be a minimum of 1 ft.

Figure 6a. Minimum Horizontal Clearance, Non-Water Structures, Plan View
Figure 6b. Minimum Horizontal Clearance, Water Structures, Plan View
Figure 6c. Minimum Vertical Clearance, Elevation View

Notes
1. High pressure steam log or any heat source shall not cross SCL conduit or duct bank without SCL Engineering approval.
2. Vertical clearance applies to conduits crossing perpendicular underneath SCL conduits or duct banks. Non-SCL conduits are not allowed to be installed directly above or below parallel to SCL conduits or duct banks.
3. Crossing of sewer, storm, or water shall be perpendicular, except with written approval from SCL Engineering.
4. Backfill and bedding shall be installed as specified in Standard Plan 350 or 285.
5. Crossing under water requires support plan approved by SPU and observation by SPU Construction Management.
6. Conduit crossing over SPU pipe shall be reinforced for a minimum of 5 ft to either side. See SCL U2-11.2/NDK-20.
7. SPU shall be notified when any cast iron pipe is exposed.
7. Minimum Clearances between SCL Structures and Vegetation

There shall not be any planted trees within 2 ft of SCL vaults, manholes, handholes, conduits, and duct banks. The distance shall be measured from the tree’s root ball to the structure’s surface.

Figure 7a. Vegetation Clearance, Plan View
Figure 7b. Vegetation Clearance, Elevation View
8. Minimum Clearances between SCL Structures and Various Other Structures

No installation is allowed directly above or below SCL facilities without written SCL Engineering approval.

For setback or clearance requirements from bioretention cells and rain gardens, see Seattle Rights-of-Way Improvement Manual Chapter 4, 4.17.5.

Table 8. Minimum Horizontal Clearances

<table>
<thead>
<tr>
<th>Other Structures</th>
<th>Horizontal Clearance from SCL Structures (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conduits or Duct Banks Rated to 26 kV</td>
</tr>
<tr>
<td>Fire hydrants</td>
<td>3</td>
</tr>
<tr>
<td>Street curbing</td>
<td>1</td>
</tr>
<tr>
<td>Building footings</td>
<td>3</td>
</tr>
<tr>
<td>Metro buses and strain poles (overhead operations)</td>
<td>3</td>
</tr>
<tr>
<td>Concrete support columns</td>
<td>3</td>
</tr>
<tr>
<td>Concrete support column footings</td>
<td>3</td>
</tr>
<tr>
<td>Temporary construction shoring piles</td>
<td>1</td>
</tr>
<tr>
<td>SPU maintenance holes</td>
<td>5</td>
</tr>
<tr>
<td>CBs and inlets</td>
<td>3</td>
</tr>
</tbody>
</table>

\(^a\) To facility lid or hatch

9. Sources

City of Seattle, Seattle Right-of-Way Improvement Manual

City of Seattle Standard Plan No. 030; “Standard Locations for Utilities (Residential Street)”

City of Seattle Standard Plan No. 285; “Pipe Bedding Sewer/Storm Drain”

City of Seattle Standard Plan No. 331; “Watermain Thrust Drain Blocking Horizontal Fittings”

City of Seattle Standard Plan No. 350; “Watermain Trench and Bedding”

City of Seattle Standard Spec 1-07.17(2), Utility Clearances

Hall, Alan; SCL Engineer and subject matter expert for 0214.00 (alan.hall@seattle.gov)


Panomvana, Tanya; SCL Standards Engineer and originator of 0214.00 (tanya.panomvana@seattle.gov)

SCL Construction Guideline U2-10/NDK-50 (canceled); “Electrical Conduit and Facilities in Public Rights-of-Way”
Requirements for Duct Banks in the Public Right-of-Way

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2. Scope

This standard provides the general requirements for the construction and installation of duct banks in the public right-of-way within the Seattle City Light (SCL) service territory. This includes system duct banks of more than two conduits and primary service duct banks with only two conduits.

Job specific requirements are not covered in this standard. Refer to the SCL Requirements Letter for job specific requirements.

3. Application

This standard provides direction to SCL crews and contractors about where and how to properly install duct banks in the public right-of-way.

For cable and conduit installation on private property, refer to SCL 0224.05.

For secondary conduit installations in the right-of-way, refer to SCL 0224.07.

4. Location

Duct banks shall conform to Figures 4.1 and 4.2.

4.1 Depth

A minimum of 3 feet of cover above a duct bank is required between street intersections. A minimum of 4 feet of cover is required at street intersections. Cover shall not exceed 6 feet unless specified by SCL engineer.

4.2 Alignment

Center line of the duct bank shall be located 15 feet from center line of street on either side of the street unless otherwise specified by the SCL engineer.
Figure 4.1. General Duct Bank, End View

Figure 4.2. General Duct Bank, Side View
5. Duct Bank Construction

Duct banks and conduit systems are electrical facilities for power distribution. In order for the electrical system to perform at its full capacity, these systems shall be constructed in a neat and workmanlike manner to ensure that:

- All joints are tightly sealed against water intrusion.
- All joints are properly aligned, square and have adequate cure time.
- All edges are deburred and beveled to prevent damage to cables.
- Conduit runs are adequately supported so they do not become distorted during encasement or backfill.

Installations that do not meet these criteria will be rejected.

5.1 Arrangement

5.1.1 Transposition

Ducts shall NOT be transposed between vaults.

5.1.2 Numbering

The ducts shall be numbered separately by type; service ducts together and system ducts together. The numbering method shall be as follows:

For ducts running east-west, count from north to south and from top to bottom.

For ducts running north-south, count from west to east and from top to bottom.

Example shown in Figure 5.1.2.

Figure 5.1.2. Duct Numbering Example
5.2 Termination

5.2.1 Permanent

For permanent termination details, see SCL U2-11.3/NDK-30.

The first two feet of all conduits exiting the vault shall be vertically and horizontally perpendicular to the vault face.

If there are multiple duct banks or direct-buried conduits entering horizontally and at right angles to each other in the same corner of a vault, manhole or handhole, they shall enter at different elevations so they are vertically offset to the other.

All duct terminations into vaults, handholes, etc., shall be done by core drill.

Provide and install PVC-type DB-120 conduit end bells flush with the interior walls on all conduits entering the vault. The conduits shall be grouted both inside and outside of the vault. See SCL 7055.09 for approved manufacturers.

5.2.2 Temporary

Install reinforcement steel dowels whenever placing of encasement is to be delayed beyond initial set.

Spacers shall be placed as close to the temporary termination as possible in order to maintain proper conduit spacing.

Lower conduit shall be flush or protrude beyond the conduit above it to ease reattachment.

See Figure 5.2.2 for details.

**Figure 5.2.2. Temporary Termination**
5.3 Changes in Direction

Any changes in direction must consist of only one type of conduit material and all bends must have the radius of the largest conduit. See Table 5.3 for minimum bend radius requirements.

For a horizontal change in direction, the PVC conduit may be cold-formed, provided the deflection does not exceed 15 degrees per 10-ft section.

For standard wall fiberglass conduit, lateral deflection shall not exceed 1 ft per 20-ft section.

Each conduit bend shall be mandreled prior to placement and encasement. See SCL U2-11.40/NDK-40.

Table 5.3. Minimum Bend Radius

<table>
<thead>
<tr>
<th>Conduit System</th>
<th>Service</th>
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<tr>
<td>(in)</td>
<td>(in)</td>
</tr>
<tr>
<td>2.5</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>144</td>
</tr>
<tr>
<td>4</td>
<td>144</td>
</tr>
<tr>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>144</td>
</tr>
</tbody>
</table>

Notes:
1. PVC conduit is not allowed for system conduit bends.
2. Bending PVC conduits with heat is not allowed.
3. Typical unless otherwise specified by SCL engineer.

6. Conduits

Schedule 40 PVC, rigid steel or fiberglass conduits can be used in duct banks as specified in Table 6.

Table 6. Allowed Conduit Materials

<table>
<thead>
<tr>
<th></th>
<th>Schedule 40 PVC (SCL 7015.05)</th>
<th>Rigid Steel (RGS) (SCL 7050.05)</th>
<th>Fiberglass (SCL 7025.05)</th>
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</thead>
<tbody>
<tr>
<td>System – Straight</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>System – Bend</td>
<td>No</td>
<td>Yes</td>
<td>No¹</td>
</tr>
<tr>
<td>Service – Straight</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Primary Service – Bend</td>
<td>No¹</td>
<td>Yes</td>
<td>No¹</td>
</tr>
<tr>
<td>Secondary Service – Bend</td>
<td>No¹</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

¹ Typical unless otherwise specified by SCL engineer.

Conduits entering an in-building vault and/or within a building shall be steel.

Conduits exposed under aerial structures (bridges, etc.) shall be steel and effectively grounded.

Factory and field straight-cut ends shall be chamfered throughout the duct run.

The conduit shall be RGS if there is 10 ft or less between bends.

Allow two hours minimum to cure conduit adhesive prior to encasement.
7. Trench

The bottom of the trench shall be free of debris and fine-graded by hand to remove sharp, embedded rocks and loose stones over 1/2 inches in size. Or, the trench shall be over-excavated and replaced with bedding material to cover protruding rocks and stones by a minimum of 2 in. The bottom shall be graded even. Bedding material shall be sand.

8. Spacers

Spacers for conduit separation shall be plastic lock-type (see SCL 7015.80) of such configuration to give the required separation between conduit and earth, as shown in Figure 4.1.

Horizontally, spacers shall be placed 5 ft apart in both straight and bending sections of duct banks and a minimum of one foot away from any coupling, fitting or end bell, as shown in Figure 4.2.

Base spacers shall be used to obtain clearance to subgrade material under the conduit for the placement of the 3-in minimum of encasement.

Base spacers may also be used to obtain 3-in side cover of conduit in bends.

Two-inch concrete blocking, twice the area of the foot, shall be provided under the base spacers.

Secure conduit to spacers in order to prevent floatation and deflection during encasing.

9. Encasement

Conduit encasement is required if the conduits used are for cable rated 600 V or higher.

The encasement shall be red High Strength Fluidized Thermal Backfill (HSFTB). HSFTB is a concrete mix and is the only allowed material for encasement.

- Refer to Material Standard 7150.00 for HSFTB requirements.
- Refer to Construction Standard 0226.06 for HSFTB installation.
- Allow 48 hours to cure prior to pulling cable.

Forming is required for encasement:

- No forming or shoring structures shall be left in the trench after encasement.
- Metallic leave-in-place type forms may be allowed with permission of an SCL engineer. After curing, all forms and staking shall be cut flush with the top of the duct bank.

The encasement shall be a minimum of 3 in and a maximum of 6 in around all conduits in a duct bank.

The encasement shall end before the elbow of the conduit riser.
Figure 9. Encasement at the Conduit Riser

10. Backfill

10.1 Types of Backfill

Low Strength Fluidized Thermal Backfill (LSFTB) Refer to SCL 7150.00 for LSFTB specification.

Controlled Density Fill (CDF) – A self-compacting material used for backfill. Where CDF is used for backfill, comply with current City of Seattle standard specifications.

10.2 Requirements

System duct bank backfill shall be Low Strength Fluidized Thermal Backfill (LSFTB), and primary service duct bank backfill shall be CDF, unless otherwise specified by an SCL engineer.

Do not mix low strength and high strength FTB.

LSFTB shall be poured on top of set HSFTB.

11. Identification

Install two 3-in-wide red detectable underground marking tapes over the corners of the duct bank at 18 in below the finished grade.
12. Inspection

Inspections shall be done by Seattle City Light. Duct bank installations require that the inspection be done when laying conduit, prior to pouring encasement and prior to pouring backfill. Additional inspections may be done for more complex installations. Inspection approvals are required prior to moving on to the next stage of duct bank construction. An inspection may include verification of proper construction, adherence to engineer design and SCL standards and conduit mandreling and cleaning. See SCL U2-11.40/NDK-40 for mandreling and cleaning details.

13. Communications

On all new underground installations of duct banks, two 4-in PVC conduits shall be installed for communication uses. The two communication conduits shall be placed above the power conduits in looped radial duct banks and above the 2-in conduits in network duct banks. A 4 x 4 x 4 handhole is required for splicing when specified by the SCL engineer. If the communication conduits leave the duct bank, they shall be encased in red HSFTB and an orange, #12 stranded copper tracer wire shall be attached directly above one of the two communication conduits using electrical tape or cable ties.

14. Additional Network Conduits

On all new underground network installations of duct banks, two 2-in PVC conduits shall be installed. The two conduits shall be placed below the communication conduits in network duct banks. The 2-in conduits are typically used for system grounds, vault lighting and vault discharge. If the bend radius is greater than 10 ft, the 2-in PVC conduit may be cold-formed to match the rest of the duct run. If the bend radius is less than 10 ft, RGS elbows are required.

The 2-in conduit shall be terminated with a coupling.

15. References

SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”

SCL Construction Standard 0224.07; “Requirements for Secondary Conduits in the Right-of-Way”

SCL Construction Standard 0226.06; “Installation of Fluidized Thermal Backfill”

SCL Construction Standard U2-11.3/NDK-30; “Termination of Existing Duct Banks in New Vaults or Manholes”

SCL Construction Standard U2-11.40/NDK-40; “Mandreling and Cleaning Of Ducts and Conduits”

SCL Material Standard 7015.05; “Schedule 40 PVC Conduit and Fittings”

SCL Material Standard 7025.05; Fiberglass Conduit and Fittings, Standard-Wall, Five-Inch IPS

SCL Material Standard 7050.05; “Zinc-Coated Steel Conduit and Fittings”

SCL Material Standard 7150.00; “Fluidized Thermal Backfill”

SCL Material Standard 7015.80; “Conduit Spacers for PVC and FG Conduit”
16. Sources

City of Seattle Plans for Municipal Construction; City of Seattle, 2011 edition

Edwards, Tommy; SCL Inspector and subject matter expert for 0222.02, (tommy.edwards@seattle.gov)

Lu, Curtis; SCL Engineer and originator of 0222.02 (curtis.lu@seattle.gov)

SCL Construction Standard NDK-10 (canceled) "Installation of Nonmetallic Conduit with FTB Concrete Encasement"

SCL Construction Standard U2-11 (canceled) "Installation of Nonmetallic Conduit with Concrete or FTB Encasement"

Stewart, Bob; SCL Inspector and subject matter expert for 0222.02, (bob.stewart@seattle.gov)

Youngs, Rob; SCL Inspector and subject matter expert for 0222.02 (rob.youngs@seattle.gov)
Customer Requirements for Underground Secondary Service, Looped Radial System

1. Scope

This standard covers customer requirements for underground secondary services within the Seattle City Light (SCL) Looped Radial system.

An underground secondary service can be served from an overhead, pole-mounted transformer or an underground transformer located in the right-of-way. The service point is determined by SCL.

Underground secondary service in the Network system is outside the scope of this standard.

Primary service is outside the scope of this standard.

SCL shall determine whether the service design will be primary or secondary.

A service where the customer must provide a facility on private property for SCL transformers is outside the scope of this standard.

2. Application

This standard is intended for use by customers and SCL engineering, electric service representatives, and operations personnel.

This standard provides a reference to SCL standards that specify customer requirements for underground secondary service in the looped radial system.
3. Inspection

The following items must be inspected by SCL before cover is installed:

- Conduit trench
- Trench bedding
- Conduit cleaning and mandreling
- Trench backfill
- Handholes

Inspection points shall be adhered to for all installation projects. Inspection points are put in place to ensure conformity to SCL requirements. Failure of the customer to request an inspection may result in additional requirements.

4. Conflict

Where conflict exists between SCL requirements, the following order of precedence shall apply:

1. Project-specific Customer Requirements Package, including the Service Construction Drawing
2. SCL 0224.01
3. SCL RESC
4. Other SCL standards

5. Requirements

Customer is responsible for obtaining municipal permit before trenching in the right-of-way.

It is the customer’s responsibility to locate all underground utilities before excavating. Customer should call 811 at least two business days before the planned excavation date.

Customer-owned cable shall comply with the National Electrical Code (NEC) and shall be visibly marked at the point of termination (service point) to indicate phase and service being fed.
Figure 5. Guide to Underground Secondary Service Standards

6. References

Requirements for Electrical Service Connection (RESC); Seattle City Light

SCL Construction Guideline DU13-4/NMT-30; “Meter Base Arrangements”

SCL Construction Standard 0214.00; “Clearance between SCL Underground Structures and Other Utility Structures in the Public Right-of-Way”

SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”

SCL Construction Standard 0224.07; Requirements for Secondary Conduits in the Right-of-Way”

SCL Construction Standard 0224.34; “Steel Conduit Risers”

SCL Construction Standard 0231.01; “Secondary Handhole Installation”

SCL Construction Standard 0232.05; “Underground Residential Equipment Location of 577 Vaults and Secondary Handholes”
SCL Construction Standard 0233.05; “Secondary Handhole Grounding”

SCL Construction Standard 0461.10; “Grounding Electrodes for Handholes and Vaults”

SCL Construction Standard 1561.05; “Customer Requirements for Underground Single or Dual Meters, Residential Service”

SCL Construction Standard 1561.07; “Customer Requirements for Underground Secondary Service Termination Facilities”

SCL Construction Standard U2-11.40/NDK-40; “Mandreling and Cleaning of Ducts and Conduits”

SCL Construction Standard U2-14.2; “Vault Installation”

7. Sources

Chao, Yaochien: SCL Standards Engineer, originator, and subject matter expert for 0224.01 (yaochien.chao@seattle.gov)

Hanowell, Manny: SCL North Distribution Engineer and subject matter expert for 0224.01 (manny.hanowell@seattle.gov)

Panomvana, Tanya: SCL North Distribution Engineer and subject matter expert for 0224.01 (tanya.panomvana@seattle.gov)

Perander, Eivind: SCL North Distribution Supervisor and subject matter expert for 0224.01 (eivind.perander@seattle.gov)
Requirements for Underground Services on Private Property

1. Scope

This standard covers the requirements for the construction and installation of underground services on private property in the Seattle City Light (SCL) service territory. This standard only applies to the underground service installation that is on private property prior to the point of termination. Easements on private property shall meet the requirements for underground installation in the right of way.

For underground installations in the right-of-way, refer to SCL 0222.02.

2. Application

This standard provides direction to engineers, consultants, contractors and customers about how to properly install an underground service on private property.

This standard also provides the details to be used for inspection by SCL electric service representatives/engineers, civil inspectors and electrical reviewers.
3. General Requirements

General requirements are shown in Table 3 and Figure 3 below.

Table 3. General Requirements

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Looped Radial</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 – 600 V</td>
<td>601 – 50000 V</td>
</tr>
<tr>
<td>Cover (minimum)</td>
<td>24 in</td>
<td>36 in</td>
</tr>
<tr>
<td>No. of Conduits (minimum)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Encasement</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Marking Tape</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 3. General Requirements

4. Location/Clearances

4.1 Low Voltage (0-600 V)

Low voltage installations require a minimum of 24 inches of cover from the top of the conduit to grade. See SCL 0224.07 for easement areas.

Clearances to property line and other facilities shall meet the requirements of Figure 4.1.
4.2 High Voltage (601-50,000 V)

High voltage installations require a minimum of 36 inches of cover from the top of the conduit to grade.

5. Termination

All conduit terminations into vaults, handholes, etc. shall be done by core drill.

6. Conduit

The conduit used shall be SCL approved material specified for direct burial. Schedule 40 PVC, rigid steel or fiberglass conduits can be used as specified in Table 6a.

Table 6a. Allowed Conduit Materials

<table>
<thead>
<tr>
<th>Service</th>
<th>Schedule 40 PVC (SCL 7015.05)</th>
<th>Rigid Steel (RGS) (SCL 7050.05)</th>
<th>Fiberglass (SCL 7025.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service – Straight</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Primary Service – Bend</td>
<td>No</td>
<td>Yes</td>
<td>No^a</td>
</tr>
<tr>
<td>Secondary Service – Bend</td>
<td>No^a</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

^a Typical unless otherwise specified by SCL engineer.

For high voltage (601 – 50000 V) installations, a spare conduit shall be provided. Factory and field straight-cut ends shall be chamfered throughout the duct run. If four or more conduits are required, see SCL 0222.02 for duct bank installation details.
Table 6b. Minimum Bend Radius

<table>
<thead>
<tr>
<th>Conduit (in)</th>
<th>Minimum Bend Radius (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
</tr>
</tbody>
</table>

Note: Bending PVC conduits with heat is not allowed.

7. Trench

The trench shall be excavated with a minimum spacing of 6 in from the conduit to the closest trench wall.

The bottom of the trench shall be free of debris and fine-graded by hand to remove sharp, embedded rocks and loose stones over 1/2 inches in size. Or, the trench shall be over-excavated and replaced with bedding material to cover protruding rocks and stones by a minimum of 2 in. The bottom shall be graded even. Bedding material shall be sand.

8. Spacers

Spacers for conduit separation shall be plastic lock-type (see SCL 7015.80) of such configuration to give the required separation between conduit and earth, as shown in Figure 3.

Horizontally, spacers shall be placed 5 ft apart in both straight and bending sections of duct banks and a minimum of one foot away from any coupling, fitting or end bell.

Base spacers shall be used to obtain clearance to subgrade material under the conduit for the placement of the 3-in minimum of encasement.

Base spacers may also be used to obtain 3-in side cover of conduit in bends.

Two-inch concrete blocking, twice the area of the foot, shall be provided under the base spacers.

Secure conduit to spacers in order to prevent floatation and deflection during encasing.

9. Backfill

For direct-buried conduit, backfill with clean native soil.

If encasement is used, use Controlled Density Fill (CDF) to backfill.

10. Encasement

For high voltage (601 – 50000 V) installations, the conduits shall be encased in 3 in of red high strength fluidized thermal backfill (HSFTB) and placed as required in SCL 0226.06.

11. Identification

Install two, 3-in wide, red detectable underground marking tapes over the corners at 18 in below the finished grade.
12. Transition

The conduit(s) installed on private property must include a proper transition on the private property when meeting up with conduit in the right-of-way that requires a minimum 36-in cover. For a proper transition, see Changes of Direction section in SCL 0222.02.

13. Inspection

Inspections shall be done by Seattle City Light. Duct bank installations require that the inspection be done when laying conduit, prior to pouring encasement and prior to pouring backfill. Additional inspections may be done for more complex installations. Inspection approvals are required prior to moving on to the next stage of duct bank construction. An inspection may include verification of proper construction, adherence to engineer design and SCL standards and conduit mandreling and cleaning. See SCL 0222.02 Section 5 for conduit details. See SCL U2-11.40/NDK-40 for mandreling and cleaning details.

14. References

SCL Construction Standard 0222.02; “Requirements for Duct Banks in the Public Right-of-Way”
SCL Construction Standard 0224.07; “Requirements for Secondary Conduits in the Right-of-Way”
SCL Construction Standard 0226.06; “Installation of Fluidized Thermal Backfill”
SCL Construction Standard U2-11.40/NDK-40; “Mandreling and Cleaning of Ducts and Conduits”
SCL Material Standard 7015.05; “Schedule 40 PVC Conduit and Fittings”
SCL Material Standard 7015.80; “Spacers, Plastic – Nonmetallic Conduit”
SCL Material Standard 7025.05; “Fiberglass Conduit and Fittings, Standard-Wall, Five-Inch IPS”
SCL Material Standard 7050.05; “Zinc-Coated Steel Conduit and Fittings”
SCL Material Standard 7150.00; “Fluidized Thermal Backfill”

15. Sources

Lu, Curtis; SCL Standards Engineer and originator of SCL 0224.05; (curtis.lu@seattle.gov)
SCL Construction Standard U12-1.4/NDK-60 (canceled); “Installation Details for Underground Services Nonmetallic and Rigid Steel Conduit on Private Property”
Stewart, Bob; SCL Civil Inspector and subject matter expert for SCL 0224.05; (bob.stewart@seattle.gov)
Requirements for Secondary Conduits in the Right-of-Way

1. Scope

This standard provides the general requirements for the construction and installation of secondary conduits in the right-of-way within the Seattle City Light (SCL) service territory. This standard also applies to conduits within SCL easement areas.

Job-specific requirements are not covered in this standard. Refer to the SCL Requirements Letter for job-specific requirements.

2. Application

This standard provides direction to SCL crews, contractors, and customers about where and how to properly install secondary conduits in the right-of-way.

For cable and conduit installation on private property, refer to SCL 0224.05.

For secondary conduits within a primary duct bank installation, see SCL 0222.02 for details.

3. Conflict

Where conflict exists between SCL requirements, the following order of precedence shall apply:

1. Project-specific Customer Requirements Package, including the Service Construction Drawing
2. SCL 0224.07
3. SCL Requirements for Electric Service Connection (RESC)
4. Other SCL standards

4. Requirements
4.1 General

General requirements are shown in Figure 4.
Conduit runs shall not exceed 270 degrees in bends between pulling access points, including riser bends under the termination point and at the pole.

A pulling handhole may be necessary to reduce the total length of service conduit between pulling access points to 150 ft, or to reduce the conduit bends to 270 degrees between pulling access points.

5. Location/Clearances

Secondary conduits shall be installed in locations specified by the SCL engineer.

A minimum of 36 inches of cover from the top of the conduit or encasement to grade is required.

For clearances to non-SCL facilities, conduits, and pipes, see SCL 0214.00.

6. Conduit

Conduit shall be SCL-approved material specified for direct burial.

Conduit size and number of conduits are specified by the SCL engineer.

A minimum of two conduits are required for street crossings.

Conduits shall be mandreled and cleaned per SCL U2-11.40/NDK-40.

Factory and field straight-cut ends shall be chamfered throughout the duct run.

Schedule 40 PVC or rigid steel conduits can be used as specified in Table 6a.

All Network conduits shall be encased. See SCL 0222.02 for encasement details.
Table 6a. Allowed Conduit Materials

<table>
<thead>
<tr>
<th></th>
<th>Schedule 40 PVC (SCL 7015.05)</th>
<th>Rigid Steel (RGS) (SCL 7050.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bend</td>
<td>No*</td>
<td>Yes</td>
</tr>
</tbody>
</table>

\* Typical unless otherwise specified by the SCL engineer.

Table 6b. Minimum Bend Radius

<table>
<thead>
<tr>
<th>Conduit (in)</th>
<th>Minimum Bend Radius (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
</tr>
</tbody>
</table>

Note: Bending PVC conduits with heat is not allowed.

6.1 New Conduit Termination

For termination of new conduit into a handhole, see SCL 0231.01.
For termination of new conduit into a conduit riser, see SCL 0224.34.

6.2 Existing Conduit Termination

For termination of existing conduit into a new handhole or vault, see U2-11.3/NDK-30.

7. Trench

The trench shall be excavated with a minimum spacing of 6 inches from the conduit to the closest trench wall.

The bottom of the trench shall be free of debris and fine-graded by hand to remove sharp, embedded rocks and loose stones over 1/2 inches in size. Or, the trench shall be over-excavated and replaced with bedding material to cover protruding rocks and stones by a minimum of 2 inches. The bottom shall be graded even. Bedding material shall be sand.

8. Backfill

Backfill shall be clean native soil.

9. Identification

Install two, 3-in-wide, red detectable underground marking tapes over the conduits at 18 inches below the finished grade.

10. Transition

A proper transition is required when transitioning conduits onto private property. See SCL 0222.02 for requirements on changes in direction.
11. Inspection

The following items must be inspected by SCL before backfill is installed:

- Conduit trench
- Trench bedding
- Proper conduit installation and adherence to engineering design and SCL standards
- Conduit mandreling and cleaning
- Trench backfill material

Inspection points shall be adhered to for all installation projects. Inspection points are put in place to ensure conformity to SCL requirements. Failure of the customer to request an inspection may result in additional requirements. See SCL 0222.02 Section 5 for conduit details.

12. References

SCL Construction Standard 0214.00; “Clearances between SCL Underground Structures and Other Utility Structures in the Public Right-Of-Way”

SCL Construction Standard 0222.02; “Requirements for Duct Banks in the Public Right-of-Way”

SCL Construction Standard 0224.34; “Steel Conduit Risers”

SCL Construction Standard 0231.01; “Secondary Handhole Installation”

SCL Construction Standard 7015.05; “Schedule 40 PVC Conduit and Fittings”

SCL Construction Standard 7050.05; “Zinc-Coated Steel Conduit and Fittings”

SCL Construction Standard U2-11.40/NDK-40; “Mandreling and Cleaning of Ducts and Conduits”

13. Sources

Chao, Yaochiem; SCL Standards Engineer, originator, and subject matter expert for 0224.07 (yaochiem.chao@seattle.gov)

Perander, Eivind; SCL North Distribution Supervisor and subject matter expert for 0224.07 (eivind.perander@seattle.gov)
Steel Conduit Risers

1. Scope

This standard covers the installation of primary and secondary steel conduit riser assemblies on Seattle City Light (SCL) distribution system wood poles. Instructions for installing the riser to the pole are included, along with requirements for spacing and hardware.

Riser extensions are covered in SCL 0126.04.
Primary pole terminations are covered in SCL 0126.01.
Streetlight pole terminations are covered in SCL 1714.50.
Composite, steel, laminated, and other non-wood poles are outside the scope of this standard.

2. Application

This standard provides direction to SCL engineers, crews and contractors who specify or install steel conduit risers on SCL distribution system wood poles.

3. Requirements

3.1 General

A maximum of one set of risers are allowed per pole.
All risers and bends shall be rigid steel.
All conduit risers originating from the direction of the face of the pole shall be constructed as shown in Figure 3.1a and 3.1b.
All conduit risers originating from the back and around the pole shall be constructed as shown in Figure 3.1b, 3.1c and 3.1d.
Two, three, and five inch, 22.5-degree steel bends are bent in the field. Additional straight sections have been provided for field bending.
For primary risers, below-grade conduits shall be encased and constructed as shown in SCL 0222.02. The encasement shall end before the elbow.
For secondary risers, below-grade conduits shall be constructed as shown in SCL 0224.05 for conduits in private property, and 0224.07 for conduits in the right-of-way or SCL easement areas.
Figure 3.1a. Steel Conduit Riser, Top View

Figure 3.1b. Steel Conduit Riser, Side View
3.2 Orientation and Arrangement

The first ten feet of conduit up the pole shall be attached to a bracket that is installed on the face of the pole. If there is more than one conduit, arrange the highest voltage conduit closest to the pole while attaching to alternating sides of the bracket as shown in Figure 3.2a. The closest riser conduit shall be a minimum of 4.5 inches away from the pole face. Each additional riser conduit installed shall be 1 inch from the conduit next to it. Each conduit shall be attached to the bracket with a strap. If there are wraparound conduit risers and standard risers, the wraparound riser shall be located closer to the pole.
Figure 3.2a. Orientation and Arrangement of Riser Conduits

3.3 Bracket

One riser bracket shall be used per above grade conduit section. The maximum riser bracket length shall be 26 inches. If a 5-inch conduit is being installed, a 26-inch bracket shall be used. The lowest point of the lowest bracket on the pole shall be located a minimum of 8 feet above grade. The lowest bracket on a pole shall be a braced bracket. If a bracket exists and has enough space, add conduits to it. If there is not enough space, replace with a larger bracket. Contact a SCL engineer if there are more than 4 conduits on a bracket.

3.4 Grounding

A ground clamp shall be installed below the top of the steel conduit and above the riser bracket as shown in Figure 3.1b. The clamp shall be connected to the pole ground using copper wire. When more than one steel conduit is installed, use one continuous piece of copper wire between ground clamp bushings and connect once to the pole ground. Final connection to pole ground shall be performed by the SCL overhead crew. Materials are listed in Table 5b.

3.5 Identification

A label identifying the facility and the originating facility shall be affixed to the riser directly below the conduit strap on the side facing away from the bracket. A call before you dig sticker shall also be affixed directly below the facility label at no lower than 5 feet above grade. Identification is installed by the SCL underground crew. Materials are listed in Table 5d.

3.6 Installation

PVC pipe wrap shall be wrapped around the conduit starting 8 inches below the ground level to 8 inches above the ground level.

An end cap shall be installed on all spare conduits.

All conduit located above grade shall be vertical.

After installation, backfill around conduits and pole as required in the City of Seattle Standard Specifications.

4. Construction Notes

The pole shall be temporarily guyed or braced before excavation is made at the base of the pole.

Remove all temporary brackets and braces located below 8 feet prior to backfilling.
5. Material Lists

### Table 5a. Materials for Steel Conduit Riser Assemblies

<table>
<thead>
<tr>
<th>Fig</th>
<th>Compatible Unit</th>
<th>ID</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1b</td>
<td>Riser, 2&quot; assembly</td>
<td>DRGS-RISER2</td>
<td></td>
</tr>
<tr>
<td>3.1b</td>
<td>Riser, 3&quot; assembly</td>
<td>DRGS-RISER3</td>
<td></td>
</tr>
<tr>
<td>3.1b</td>
<td>Riser, 4&quot; assembly</td>
<td>DRGS-RISER4</td>
<td></td>
</tr>
<tr>
<td>3.1b</td>
<td>Riser, 5&quot; assembly</td>
<td>DRGS-RISER5</td>
<td></td>
</tr>
</tbody>
</table>

# Material Description | ID | Quantity |
1 Conduit, rigid steel, 2" | 734741 | – | – | 20 |
1 Conduit, rigid steel, 3" | 734743 | – | – | 20 |
1 Conduit, rigid steel, 4" | 734745 | – | 20 | – |
1 Conduit, rigid steel, 5" | 734747 | 20 | – | – |
2 Coupling, rigid steel conduit, 2" | 731096 | – | – | 1 |
2 Coupling, rigid steel conduit, 3" | 731098 | – | – | 1 |
2 Coupling, rigid steel conduit, 4" | 731100 | – | 1 | – |
2 Coupling, rigid steel conduit, 5" | 731102 | 1 | – | – |
3 Conduit adapter, PVC to steel 2" | 734544 | – | – | 1 |
3 Conduit adapter, PVC to steel 3" | 734537 | – | – | 1 |
3 Conduit adapter, PVC to steel 4" | 734539 | – | 1 | – |
3 Conduit adapter, FG to steel 5" | TBD | 1 | – | – |
4 Elbow, rigid steel, 2" | 734820 | – | – | 1 |
4 Elbow, rigid steel, 3" | 734822 | – | – | 1 |
4 Elbow, rigid steel, 4" | 012176 | – | 1 | – |
4 Elbow, rigid steel, 5" | 734826 | 1 | – | – |
5 Strap, strut pipe/conduit, 2" | 689764 | – | – | 1 |
5 Strap, strut pipe/conduit, 3" | 689768 | – | – | 1 |
5 Strap, strut pipe/conduit, 4" | 689772 | – | 1 | – |
5 Strap, strut pipe/conduit, 5" | 689774 | 1 | – | – |
6 Tape, pipe wrap, PVC, 2" x 10 mil (roll) | 736730 | 1 | 1 | 1 |
7 Plug, PVC, 2" | 734938 | – | – | 1 |
7 Plug, PVC, 3" | 734940 | – | – | 1 |
7 Plug, PVC, 4" | 734942 | – | 1 | – |
7 Plug, PVC, 5" | 734943 | 1 | – | – |
8 Conduit, rigid steel, 22.5° | 013749 | – | 1 | – |
13 Bolt, lag, 1/2" x 4" | 785261 | 3 | 3 | 3 |
14 Bracket, pole riser, w/ brace, 18" | 686796 | 1 | 1 | 1 |
Table 5b. Steel Riser Grounding

<table>
<thead>
<tr>
<th>Fig</th>
<th>Compatible Unit</th>
<th>ID</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1b</td>
<td>2” Steel riser ground</td>
<td>GRND-RISER2</td>
<td></td>
</tr>
<tr>
<td>3.1b</td>
<td>3” Steel riser ground</td>
<td>GRND-RISER3</td>
<td></td>
</tr>
<tr>
<td>3.1b</td>
<td>4” Steel riser ground</td>
<td>GRND-RISER4</td>
<td></td>
</tr>
<tr>
<td>3.1b</td>
<td>5” Steel riser ground</td>
<td>GRND-RISER5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>Material Description</th>
<th>ID</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Clamp, conduit grounding 2”</td>
<td>676283</td>
<td>–</td>
</tr>
<tr>
<td>9</td>
<td>Clamp, conduit grounding 3”</td>
<td>676285</td>
<td>–</td>
</tr>
<tr>
<td>9</td>
<td>Clamp, conduit grounding 4”</td>
<td>676286</td>
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<tr>
<td>9</td>
<td>Clamp, conduit grounding 5”</td>
<td>676287</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Connector, vise jaw #4 AWG</td>
<td>012173</td>
<td>1</td>
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<tr>
<td>11</td>
<td>Wire, #4 AWG, Cu soft drawn</td>
<td>610208</td>
<td>3</td>
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</tbody>
</table>

Table 5c. Steel Riser Labeling

<table>
<thead>
<tr>
<th>#</th>
<th>Material Description</th>
<th>ID</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>12</td>
<td>“Call Before You Dig” label</td>
<td>765255</td>
<td>1</td>
</tr>
</tbody>
</table>

6. References

City of Seattle Standard Plans and Specifications

SCL Construction Standard 0126.01; “Primary Pole Terminations”

SCL Construction Standard 0126.04; “Riser Extensions”

SCL Construction Standard 0222.02; “Requirements for Duct Banks in the Public Right-of-Way”

SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”

SCL Construction Standard 0224.07; “Requirements for Secondary Conduit in the Right-of-Way”

SCL Construction Standard 1714.50; “Underground Streetlight Systems”

7. Sources

Chao, Yaochiem; SCL Standards Engineer and subject matter expert for 0224.34 (yaochiem.chao@seattle.gov)

Hall, Alan; SCL Electrical Engineer and subject matter expert for 0224.34 (alan.hall@seattle.gov)

Lu, Curtis; SCL Standards Engineer and originator of 0224.34 (curtis.lu@seattle.gov)

SCL Construction Standard U7-10/NDK-70 (canceled); “Conduit Risers on Poles”
SCL Construction Standard U7-10.1/NDK-80 (canceled); “Secondary Conduit Riser Pole Base Detail”

SCL Construction Standard U7-10.2/NDK-90 (canceled); “Primary Conduit Riser Pole Base Detail”

SCL Construction Standard U7-10.9/NDK-120 (canceled); “Grounding Conduit Risers on Poles”
Installation of Fluidized Thermal Backfill

1. **Scope**

   This standard covers the mix, field, and testing requirements for the installation of Fluidized Thermal Backfill (FTB).

2. **Application**

   This standard is intended to be used by Seattle City Light (SCL) crews, inspectors, reviewers, contractors, and customers when installation of FTB is specified.

3. **Industry Standards**

   Construction shall meet the applicable requirements of the following industry standards:

   - **ASTM C31;** “Standard Practice for Making and Curing Concrete Test Specimens in the Field,” 2012
   - **ASTM C143;** “Standard Test Method for Slump of Hydraulic-Cement Concrete”
   - **ASTM 172;** “Standard Practice for Sampling Freshly Mixed Concrete”

   City of Seattle; “Standard Specifications for Road, Bridge and Municipal Construction,” 2014 (henceforth referred to as the “2014 Standard Specifications”)

4. Mix Requirements

4.1 Mix Design

Prior to placement, the contractor shall submit to SCL the proposed FTB mix design for approval. The mix design shall conform to SCL 7150.00, “Fluidized Thermal Backfill.”

4.2 Conformance to Mix Design

Quantities of batched component materials shall match those specified in the FTB mix design within the tolerances specified in Section 6-02.3(5)C (“Conformance To Mix Design”) of the 2014 Standard Specifications.

5. Field Requirements

5.1 Delivery Certificate

The FTB supplier shall provide a Manufacturer’s Certificate of Compliance for each truckload of FTB per Section 6-02.3(5)B (“Certification Of Compliance”) of the 2014 Standard Specifications. The Certificate shall include the following information:

- Identification code
- Delivery location
- Quantity of water added to mix after batching

5.2 Delivery Time Limit and Temperature

The time for placement and temperature shall conform to Section 6-02.3(4)D (“Temperature and Time for Placement”) of the 2014 Standard Specifications.

5.3 Retempering

Retempering is prohibited.

5.4 FTB Placement

FTB shall be placed per the applicable provisions of Section 6-02.3(6) (“Placing Concrete”) of the 2014 Standard Specifications.

If the concrete is to drop more than 5 ft, it shall be deposited through a sheet metal (or other approved material) conduit. No aluminum conduits or tremies shall be used to pump or place concrete.

FTB shall flow readily and fill all voids during installation. Formation of air pockets during installation shall be cause for rejection.

Conduits to be encased in FTB shall be adequately anchored so that they do not float during FTB placement. The water content of FTB may not be reduced to mitigate conduit buoyancy.

5.5 Vibration

Should vibration be required to ensure that the conduits are fully encased in FTB, it shall be in conformance with Section 6-02.3(9) (“Vibration of Concrete”) of the 2014 Standard Specifications.
6. Testing Requirements

For SCL power system construction projects that require more than 100 cubic yards of any combination of FTB materials, the project manager shall provide an FTB thermal test and FTB compressive strength test for each FTB mix design employed by the project.

The testing shall be done at the beginning of FTB placement for that project. Both thermal and compressive strength samples shall be drawn from the same batch of FTB. Test results shall be submitted to SCL for review.

Where thermal and compressive strength testing is done on the same batch of FTB, the samples shall have identical sample locations or other matching sample identification codes, assigned to both sets. The purpose is correlation of test data.

Field test parameters shall apply to field approvals of FTB encasement and backfill where required.

The thermal resistivity requirement will be evaluated by comparing the FTB thermal test report specified in section 6.2 to the resistivity benchmarks from SCL 7150.00.

6.1 Sampling

Sampling shall be in conformance with ASTM C172.

Sample containers shall be cylindrical, 3 inches in diameter and 6 inches tall. A set of three sample containers are required for each thermal test. The sample containers shall be prepared per ASTM C94, and sealed to prevent moisture loss.

Each sample container shall receive a label with the following information:

- Date of sample
- Location where sampled FTB was installed. The description of the location should be detailed enough to determine which duct bank, or portion thereof, was sampled.
- Project name and the SCL Work Order number, if known
- Type of FTB (high-strength or low-strength)
- FTB Producer
- FTB Producer’s Mix Design number
- Name of the SCL Inspector, SCL Crew Chief, or person responsible for sampling

The concrete delivery ticket and batching compliance report shall be included with each set of samples. Only legible copies are acceptable.

The samples shall cure 24 hours prior to shipping. The samples shall be shipped in a cardboard box with adequate packing materials to prevent damage during shipping. The samples shall be shipped to an SCL-approved consultant for thermal testing.

6.2 Thermal Testing

Seattle City Light uses thermal testing results to assess FTB performance and to investigate FTB-related issues. FTB documentation shall be adequate to trace the source of each aggregate and the source of fluidizer material for each batch of FTB installed. Failure to systematically identify sources of materials shall be cause for rejection and disqualification.

Thermal testing shall be conducted in compliance with IEEE Standard 442.
The testing consultant shall provide a complete copy of the test report to SCL that includes:

- Name and contact information of the thermal testing consultant
- Report date
- Concrete delivery ticket number
- FTB Producer
- FTB Producer’s Mix Design No.
- Dry density of each sample set, in pounds/cubic foot
- Thermal resistivity of each sample set (°C-centimeter/watt)

### 6.3 Strength Testing

Strength testing for high-strength FTB shall be performed in compliance with ASTM C39. A complete copy of the test report shall be provided to Seattle City Light.

Sampling shall be performed in compliance with ASTM C31, and the samples shall be labeled as described in the Thermal Testing Procedure.

### 6.4 Field Testing

When field testing is required, thermal testing shall be done by an SCL-approved consultant in compliance with IEEE Standard 442.

A field slump test shall be performed on each batch. The slump test shall conform to ASTM C143 and meet the performance values listed in Table 4 of SCL 7150.00.

One test is required per project or location. Additional testing is required when requested by SCL personnel. The test report shall contain the information specified in sections 6.2 and 6.3.

### 7. Remedies for Installation of Unapproved FTB Mixes

Installation of an FTB mix, where specified, that has not been approved by Seattle City Light requires one of the following remedies:

- Removal and replacement of all noncompliant FTB with a Seattle City Light-approved mix.
- In-field thermal testing of all non-compliant FTB. Any unapproved FTB that does not meet the FTB Mix Design Requirements shall be removed and replaced with a Seattle City Light-approved mix.

### 8. References

- **SCL Material Standard 7150.00**, “Fluidized Thermal Backfill”
- **SCL Design Standard 9266.06**, “Understanding Fluidized Thermal Backfill”

### 9. Sources

- **Lu, Curtis**; SCL Standards Engineer, and originator and subject matter expert for 0226.06 (curtis.lu@seattle.gov)
- **Stewart, Bob**; SCL Civil Inspector and subject matter expert for 0226.06 (bob.stewart@seattle.gov)
Secondary Handhole Installation

1. Scope

This standard covers the requirements for secondary handhole installations. This standard addresses open bottom and closed bottom handholes. Streetlight handholes are outside the scope of this standard. See Seattle City Light (SCL) 1716.07.

2. Application

This standard provides direction to SCL crews and contractors regarding proper installation of secondary handholes owned and maintained by SCL.

3. Grounding Requirements

Grounding of secondary handholes shall conform to requirements of SCL 0233.05 and 0461.10. Ground rod shall be located in the corner of the handhole and shall not interfere with conduits and wires. See Figure 3.
4. Handhole Requirements

Handholes rated H-20 or Tier 22 shall only be installed in planting strips and pedestrian sidewalks where an occasional car or light truck may inadvertently traverse, or in side streets that see only light truck traffic.

In backfill, aggregate, and planted areas, handholes shall be installed 1 in above grade. In paved areas, handholes shall be installed flush with grade.

All handhole covers shall have a slip resistant surface that meets the requirements of SCL 7203.01.

Rigid steel conduit ends shall be protected with plastic bushings and furnished with a ground bushing or grounding clamp.

PVC conduit ends shall be protected with end bells.

Unused conduits shall be plugged and protected.

Used conduits shall be sealed with duct seal or foam.

Handholes shall be easily accessible and not hidden among planned landscaping that will obscure it over time.

Handholes shall not be located in an area subject to heavy vehicle traffic.

Handholes shall be placed to avoid collecting surface water.

Handholes shall be bedded on a minimum of 6 inches of 3/8-in washed gravel, mineral aggregate Type 9.02.

Conduits shall enter the handhole perpendicular to the walls.

Conduit entrances into the handhole shall be offset to allow cables to wrap in the same direction. See Figure 4.

Conduits entering the handhole shall have a minimum depth of 30 inches.
Figure 4. Offset Conduit, Plan View
4.1 Open Bottom Handhole

Typical open bottom secondary handhole installation shall conform to Figure 4.1.

**Figure 4.1. Open Bottom Handhole, Elevation View**
4.2 Closed Bottom Handhole

All penetrations shall be by core drill.

End bells shall be PVC type DB-120 conduit and installed flush with the inside wall of the handhole. See SCL 7055.09 for approved manufacturers.

Typical closed bottom secondary handhole installation shall conform to Figure 4.2.

Conduit shall be grouted both inside and outside of the handhole.

**Figure 4.2. Closed Bottom Handhole, Elevation View**
5. Material List

<table>
<thead>
<tr>
<th>Description</th>
<th>Stock No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handhole, without cover</td>
<td></td>
</tr>
<tr>
<td>Type 2</td>
<td>012978</td>
</tr>
<tr>
<td>233</td>
<td>013183</td>
</tr>
<tr>
<td>3030</td>
<td>013187</td>
</tr>
<tr>
<td>444</td>
<td>013093</td>
</tr>
<tr>
<td>Conduit, entering handhole</td>
<td></td>
</tr>
<tr>
<td>Schedule 40 PVC</td>
<td></td>
</tr>
<tr>
<td>2 in</td>
<td>734530</td>
</tr>
<tr>
<td>3 in</td>
<td>734532</td>
</tr>
<tr>
<td>4 in</td>
<td>734523</td>
</tr>
<tr>
<td>Steel</td>
<td></td>
</tr>
<tr>
<td>2 in</td>
<td>734820</td>
</tr>
<tr>
<td>3 in</td>
<td>734822</td>
</tr>
<tr>
<td>4 in</td>
<td>734824</td>
</tr>
<tr>
<td>Steel conduit grounding</td>
<td></td>
</tr>
<tr>
<td>Grounding insulated bushing</td>
<td></td>
</tr>
<tr>
<td>2 in</td>
<td>731531</td>
</tr>
<tr>
<td>3 in</td>
<td>013270</td>
</tr>
<tr>
<td>4 in</td>
<td>012857</td>
</tr>
<tr>
<td>Grounding clamp</td>
<td></td>
</tr>
<tr>
<td>2 in</td>
<td>676283</td>
</tr>
<tr>
<td>3 in</td>
<td>676285</td>
</tr>
<tr>
<td>4 in</td>
<td>676286</td>
</tr>
</tbody>
</table>

6. References

SCL Construction Standard 0232.05; “Underground Residential Equipment Location of 577 Vaults and Secondary Handholes”

SCL Construction Standard 0233.05; “Secondary Handhole Grounding”

SCL Construction Standard 0461.10; “Grounding Electrodes for Handholes and Vaults”

SCL Construction Standard 1716.07; “Streetlight Handhole and Conduit Requirements”

SCL Material Standard 7050.09; “Conduit Fitting, Cable Protector”

SCL Material Standard 7055.09; “DB120, PVC Conduit Fittings”

SCL Material Standard 7203.01; “Precast Reinforced Concrete Handholes—General”

7. Sources

Chao, Yaochiem; SCL Standards Engineer, originator, and subject matter expert for 0231.01 (yaochiem.chao@seattle.gov)

Lu, Curtis; SCL Standards Engineer and subject matter expert for 0231.01 (curtis.lu@seattle.gov)

Perander, Eivind; SCL Engineer and subject matter expert for 0231.01 (eivind.perander@seattle.gov)

SCL Construction Standard U2-13.1/NVH-50; “Typical Handhole with Conduit” (canceled)
1. Scope

This standard covers the requirements for cast-in place risers to bring the vault access to grade.

This standard addresses 42-inch round risers and 5496 equipment hatch risers. The “5496” refers to the riser’s inside dimension of 54 in x 96 in.

2. Application

This standard provides direction to SCL crews and contractors regarding proper installation of cast-in place risers for slope adjustment on Seattle City Light (SCL)-owned and maintained vaults. Cast-in place risers will be used where standard height risers do not work, or access is located on a sloped grade.

This standard reflects content presented in SCL Power Production & Substations Drawing B-7470. See Appendix.

3. Requirements

3.1 General

The minimum compressive strength of the concrete shall not be less than 4,000 pounds per square inch in 28 days as determined by the ASTM Method C39.

Concrete finish shall be free of rock pockets and honeycombed areas.

The interior walls and exterior exposed surfaces shall be smooth.
Rock pockets over 3/8-inch-deep and other imperfections on all surfaces shall be patched and troweled to match the surrounding surface.

Steel reinforcing bars shall conform to ASTM A615, Grade 60 or ASTM A706, Grade 60. Reinforcing bar size shall be a minimum of #4.

The ends of the reinforcing bars shall have an overlap minimum of 18 in.

Welding of the reinforcing bars shall conform to the Structural Welding Code, Reinforcing Steel (AWS D1.4) of the American Welding Society.

The number of reinforcing bar hoops shall be as described in Table 3.1.

### Table 3.1. Reinforcing Bar Hoop Requirements

<table>
<thead>
<tr>
<th>Riser Height of the Low End (t) (in)</th>
<th># of Rebar Hoops Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–4</td>
<td>1</td>
</tr>
<tr>
<td>4–6</td>
<td>2</td>
</tr>
<tr>
<td>6–8</td>
<td>3</td>
</tr>
<tr>
<td>8–10</td>
<td>4</td>
</tr>
</tbody>
</table>

The concrete cover (measured from the surface of the concrete to the outside surface of the reinforcement) for reinforcement shall be a minimum of 2 inches for main reinforcing bars, with a 2-in typical cover on the bottom of the riser.

Dimensions shall be as shown in Figure 3.1a.

The keyway shall either 1) be of the dimensions and configuration as shown in Figure 3.1b, or 2) match the surface profile of adjoining piece (roof opening, other riser or casting frame).

A 2-day minimum cure time shall be required prior to installation of steel cover and frame.

A 4-day minimum cure time shall be required prior to traffic loading.

Figure 3.1a. Riser Height and Rebar Detail
3.2 Round Riser

Round risers shall meet the requirements as shown in Table 3.2 and Figure 3.2.

Table 3.2. Round Riser Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall thickness, minimum</td>
<td>4 in</td>
</tr>
<tr>
<td>Inside diameter, maximum</td>
<td>42 in</td>
</tr>
<tr>
<td>Outside diameter, maximum</td>
<td>50 in</td>
</tr>
</tbody>
</table>

Figure 3.2. Round Riser

3.3 5496 Equipment Hatch Riser

Equipment hatch risers shall meet the requirements as shown in Table 3.3 and Figure 3.3.
Table 3.3. Equipment Hatch Riser Requirements

<table>
<thead>
<tr>
<th>Wall thickness, minimum</th>
<th>Match existing riser outline, 6 in minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside dimensions, maximum</td>
<td>5 ft-6 in x 9 ft</td>
</tr>
<tr>
<td>Inside opening dimensions</td>
<td>Match vault roof opening, 4 ft-6 in x 8 ft (typical)</td>
</tr>
</tbody>
</table>

Figure 3.3. Equipment Hatch Riser

4. References

ASTM A615/A615M-09b, “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”


ASTM A706, “Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement”

AWS D1.4, “Structural Welding Code—Reinforcing Steel”

SCL Power Production & Substations Drawing No. B-7470, “Cast-in-Place Grade Adjustment Vault Riser”

5. Sources

Ng, Sharon; Senior Civil Engineer and subject matter expert for 0231.03 (sharon.ng@seattle.gov)

SCL Construction Standard U2-6/NVH-20; “Inspection and Repair Procedures for Precast Vaults and Manholes”

SCL Construction Standard U2-14.2; “Vault Installation”

SCL Construction Standard U2-15.1; “Installation of Ring Type Vaults”

SCL Material Standard 7204.15; “Cover Slabs and Risers for Electric Vaults”
SCL Material Standard 7203.21; “Precast Reinforced Concrete Structures – General”
SCL Material Standard 7204.70; Frames and Covers, 42-Inch Round, Iron”

Wang, Quan; SCL Standards Engineer and coordinator for 0231.03
(quan.wang@seattle.gov)
Appendix: SCL Drawing B-7470, Cast-in-Place Vault Riser

NOTES:
1. CAST-IN-PLACE RISER REINFORCEMENT: WHEN A Riser size or right size does not work for
   MINIMUM COMPRESSIVE STRENGTH
   MATERIAL MINIMUM COMPRESSIVE STRENGTH (MPA)
   F_2000 psi AT 28 DAYS
2. CUBE SHOULD BEasured (3” x 3” x 3”)
3. FRAME
4. Riser shall bege 2-½ AS A VOLUME OF 
   OPENING (4” IN 5’-0” WALL), OTHER RISERS
   SURFACE profile of:
   $\begin{array}{|c|c|}
   \hline
   \text{Riser} & \text{Minimum} \\
   \hline
   4 & 4’’ \\
   6 & 6’’ \\
   \hline
   \end{array}$

<table>
<thead>
<tr>
<th>Riser</th>
<th>Rebar</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

SECTION B-B

PLAN - RECTANGULAR RISER

PLAN - ROUND RISER
1. Scope

This standard covers preferred and alternate locations and orientations for 5 ft x 7 ft (577) vaults and secondary handholes.

See Construction Guideline U9-6 for additional clearance requirements for 577 vaults with junction boxes.

2. Application

This standard shall be used by Seattle City Light (SCL) engineers, operations personnel, and contractors when reviewing designs or constructing 577 vaults and handholes in residential areas.

3. General Requirements

The location of any installed SCL facility must be approved by SCL prior to installation. The specific size of a vault and handhole are project specific.

4. 577 Vaults

577 vaults are typically used as a pulling vault or a loadbreak vault. The purpose of specifying the location and orientation of the vault is to ensure proper working space for SCL operations personnel.

4.1 Preferred Location and Orientation

The preferred orientation for a 577 vault is the length of the vault perpendicular to the curb as shown in Figure 4.1.
The vented section of the vault shall be located in the sidewalk.

When installed within a planting strip, the top of vault shall be set 1/2 inch above surrounding grade. Slope grade away from vault for drainage.

4.2 Alternate Location and Orientation

The alternate orientation for a 577 vault is the length of the vault parallel to the curb as shown in Figure 4.2. The location of the vault shall be entirely within the planting strip.

Figure 4.2. Alternate Location and Orientation for 577 Vault

When vault or handhole extends into the sidewalk area because of a narrow planting strip, the vault or handhole shall be located entirely in the sidewalk with the edge flush with the street edge of the sidewalk and to the sidewalk grade. This applies only to the alternate location.
5. Secondary Handhole

The secondary handhole shall always be oriented with the length side of the handhole parallel to the curb.

5.1 Preferred Location

The preferred location is within the planting strip as shown in Figure 5.1.

Figure 5.1. Preferred Location for Secondary Handhole

5.2 Alternate Location

When there is lack of space in the planting strip, the alternate location for a secondary handhole is along the street side of the sidewalk, as shown in Figure 5.2.

Figure 5.2. Alternate Location for Secondary Handhole

6. References

SCL Construction Guideline U2-14.1 (canceled); “Residential Equipment Location Details”

SCL Construction Guideline U9-6; “577 Vault with Three Loadbreak Junction Boxes Installation, Grounding and Connections”

SCL Construction Standard 0214.00; “Clearances Between SCL Underground Structures and Other Utility Structures in the Public Right-of-Way”

7. Sources

Diop, Aida; Former SCL Standards Engineer and subject matter expert for 0232.05
Panomvana, Tanya; SCL Standards Engineer, subject matter expert and originator of 0232.05 (tanya.panomvana@seattle.gov)

Secondary Handhole Grounding

1. Scope

This standard covers the grounding requirements for a single secondary handhole located between the service transformer and a customer. This standard does not cover streetlight handholes.

2. Application

This document provides direction to SCL crews and contractors about how to install proper grounding for a SCL secondary service handhole. The goal is to assure handhole grounding is uniformly and properly installed by SCL crews and contractors. The required grounding includes grounding handhole lids constructed of conductive material. The handholes in this Standard are all rated for H-20 loading.

3. Definitions

- **Heavy Traffic**: constant vehicular loading (i.e. roadway)
- **Medium Traffic**: occasional vehicular loading (i.e. driveway)
- **Light Traffic**: rare vehicular loading (i.e. sidewalk)

4. Grounding Handhole Lid and Frame Installations

Figures 4a and 4b provide detail on how the secondary handhole grounding should be connected. Bond any metal conduits using grounding bushing (stock number 013270).

**Figure 4a**, Schematic, handhole wiring

**Figure 4b**, Elevation, handhole wiring
5.1 Choose appropriate method based on traffic load:

<table>
<thead>
<tr>
<th>Traffic Load</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>heavy</td>
<td>A</td>
</tr>
<tr>
<td>medium</td>
<td>A</td>
</tr>
<tr>
<td>light</td>
<td>B</td>
</tr>
</tbody>
</table>

5.2 Method A, example, 17” x 28” handhole, heavy or medium traffic

Use precast handhole (stock number 720391) with lid that has factory installed ground strap.

Connect factory ground strap from lid to frame:

1. Install and test grounding electrodes per SCL 0461.10.
2. Install green #8 THWN ground wire (stock number 612277) from frame using factory bolt and set screw lug (stock number 012564) to ground rod using a ground rod clamp (stock number 564012).
   - Fog-Tite – manufacturer frame ground bolt is on the center of the long side wall below lip – see Figure 5.
   - Christy/Old Castle – frame ground bracket is on the short side wall – see Figure 5.
3. Bond neutral conductor to a #8 green THWN ground wire (Stock Number 612277) with an irreversible connection. Connect ground wire to ground rod electrode with an irreversible connection listed for direct burial use.

6. Existing Handhole Installations

6.1 Remove and replace

Whenever possible: remove the existing handhole and replace with a new up-to-date handhole. See section 5.

6.2 Grounding retrofit of existing handholes with factory frame ground

Where the removal of the old handhole and the installation of a new one is not possible it is necessary to retrofit the existing handhole to add grounding.

Determine if the existing handhole has access to the factory frame ground. For handholes with factory frame ground, follow directions in section 5.2 on new handhole installation for grounding. If any components of the grounding system are missing (factory installed ground strap, etc.) or inadequate refer to section 6.3, below.

6.3 Grounding retrofit of existing handholes without factory frame ground

For handholes without access to frame ground:

1. Install frame ground (performed by appropriate personnel).
2. Install ground rod or series of ground rods (stock number 564238).
3. Test the ground rod or series of ground rods to insure the rods have a resistance to ground of 25 ohms or less.
4. Replace lid with new lid that has factory ground strap installed (stock number 012660).
5. Connect ground strap from lid to ground rod using a ground rod clamp (stock number 564012).
6. Bond neutral to ground using split bolt connector (stock number 668861), green #8 THWN ground wire (stock number 612277) and ground rod clamp (stock number 564012).

Figure 5, Frame ground location

5.3 Method B, example, 17” x 28” handhole, Light Traffic

Use composite fiberglass, reinforced plastic, polymer mortar/concrete handholes (stock number 720393) and lid (stock number 720397). This handhole and lid do not require grounding.
7. Material List

<table>
<thead>
<tr>
<th>Description</th>
<th>Stock No.</th>
<th>Matl. Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setscrew lug, #14 str to #6 str</td>
<td>012564</td>
<td>None (see Stock Cat. page 65-23)</td>
</tr>
<tr>
<td>Type 2 handhole cover, labeled “ELECTRIC”</td>
<td>012660</td>
<td>7203.10</td>
</tr>
<tr>
<td>Grounding insulated bushing, 3-in</td>
<td>013270</td>
<td>None (see Stock Cat. page 73-74)</td>
</tr>
<tr>
<td>Clamp for 5/8-in ground rods</td>
<td>564012</td>
<td>6762.15</td>
</tr>
<tr>
<td>Ground rods, copper-covered, sectional</td>
<td>564238</td>
<td>6762.25</td>
</tr>
<tr>
<td>Copper wire, type THWN thermoplastic polyvinyl chloride</td>
<td>612277</td>
<td>6122.3</td>
</tr>
<tr>
<td>Conductor fittings, copper, parallel tap, split bolt cable connectors</td>
<td>668861</td>
<td>6688.7</td>
</tr>
<tr>
<td>Type 2 handhole, with frame and cover, “ELECTRIC”</td>
<td>720391</td>
<td>7203.10</td>
</tr>
<tr>
<td>Handhole, secondary, composite fiberglass, reinforced plastic type</td>
<td>720393</td>
<td>7203.12</td>
</tr>
<tr>
<td>Handhole cover, secondary, composite fiberglass, reinforced plastic type</td>
<td>720397</td>
<td>7203.12</td>
</tr>
</tbody>
</table>

8. References

SCL Construction Standard 0461.10; “Grounding Electrodes for Handholes and Vaults”

SCL Material Standard 7203.10; “Handhole, 17 X 28 Precast, Secondary”

9. Sources

Barnett, John; SCL Engineer and subject matter expert for 0233.05 (john.barnett@seattle.gov)

Hanson, Brett; SCL Standards Engineer and subject matter expert for 0233.05

Lu, Curtis; SCL Standards Engineer, originator and subject matter expert for 0233.05 (curtis.lu@seattle.gov)


Smalley, Edward; SCL Engineer and subject matter expert for 0233.05 (edward.smalley@seattle.gov)
Ceiling Channel for In-Building Vaults

1. Scope

This standard provides the requirements for the installation of ceiling channels in new or retrofit in-building vaults.

2. Application

This standard provides direction to Seattle City Light (SCL) crews and contractors about how to properly install ceiling channels in Network and Looped Radial vaults to support ceiling-mounted equipment including Integrated Web Channel Bus (IWCB) or trapeze-type cable supports.

3. Installation

3.1 Spacing

Channels shall be spaced on 22-in centers across the ceiling of all in-building vaults including IWCB vaults. Channel shall be installed level so that the threaded rods hang vertically when attached with standard channel nuts. Channels shall be installed with the channel ends 6 to 12 inches away from the vault walls. Confirm direction of channels with SCL engineer prior to construction.

3.2 Construction

Concrete insert channels shall be embedded in the ceiling concrete during construction with the bottom of the channel flush with the ceiling surface per manufacturer’s instructions. See Figure 3.2.

Concrete inserts shall be 12-gauge, galvanized Unistrut P3200 series (1-5/8 in x 1-3/8 in) or equal.
4. References

Hanson, Brett; SCL Standards Engineer and originator of 0257.06  
(brett.hanson@seattle.gov)

Kohashi, Owen; SCL Civil Engineer and subject matter expert for 0257.06  
(owen.kohashi@seattle.gov)

SCL Construction Standard NCI-190 (canceled); "Ceiling Channel for Network Vaults"
Grounding Electrodes for Handholes and Vaults

1. Scope

This standard details the requirements for installing grounding electrodes in Network and Looped Radial vaults and handholes.

This standard does not cover streetlight system grounding electrodes which are detailed in Seattle City Light (SCL) Construction Standard 1710.50.

2. Application

This standard provides direction to SCL engineers, crews, inspectors and others about installing a grounding electrode system for use in vaults and handholes.

3. Definitions

Ground electrode: a conductor or group of conductors in intimate contact with the earth for the purpose of providing a connection with the ground.

Concrete-encased electrode: a metallic wire encased in concrete, that is not insulated from direct contact with earth, run as straight as practical for the purpose of providing a connection with the ground.

Wire electrode: a bare wire buried in earth, laid approximately straight for the purpose of providing a connection with the ground.
4. Introduction

A safe electrical system is dependent on its grounding and bonding system. Because conductors, exposed metallic components and other conductive surfaces can become energized, it is critical that grounding and bonding systems be installed correctly. Grounding electrodes are a key component of the grounding and bonding system.

Guiding codes, including the National Electrical Safety Code (NESC), recognize that the ground resistance of an electrode should not exceed 25 ohms.

While an individual 5/8-inch diameter by 8 foot long ground rod is an electrode recognized by the NESC and used extensively by SCL to ground poles and other equipment, soil conditions vary widely throughout seasons of the year and throughout the service territory. Additionally, damage to and theft of grounding conductors continues to be an industry-wide problem so augmenting the grounding electrode system is beneficial to both the safety and the efficacy of the distribution system.

Due to these factors, SCL has chosen to supplement the grounding capability of a single ground rod when installed in a handhole or vault by connecting a concrete-encased electrode whenever possible or at the minimum, a wire buried in dirt directly below the conduit route.

SCL has found installing multiple ground rods at the same location to provide only marginal improvement in reducing ground resistance.

Concrete-encased electrodes are recognized in the industry as a superior grounding electrode in terms of longevity and success in extreme environments and are SCL’s preferred grounding electrode for vaults.

Wire buried directly in earth is also a recognized grounding electrode and is an acceptable substitute when a nearby concrete duct bank is not available to form a concrete-encased electrode.

Exothermic weld connections are recognized as a superior method for connecting grounding components as there are no mechanical parts to fail. This is SCL’s required grounding connection method. See Figure 4.

Figure 4. Exothermic weld for cable to ground rod connection, Example
5. Components

The components necessary for constructing vault and handhole grounding electrodes are shown in Table 5.

**Table 5. Grounding Electrode Components**

<table>
<thead>
<tr>
<th>Description</th>
<th>Stock No.</th>
<th>Material Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8-in x 8-ft ground rod</td>
<td>564238</td>
<td>5642.10</td>
</tr>
<tr>
<td>#2 AWG copper wire, bare, stranded</td>
<td>610434</td>
<td>6103.90</td>
</tr>
<tr>
<td>250 kcmil copper wire, bare, stranded</td>
<td>610412</td>
<td>6103.90</td>
</tr>
</tbody>
</table>

6. Connections

The following subsections summarize preferred grounding electrode methods. For each trench of conduits that enters a handhole, provide a grounding electrode and connect via exothermic weld per SCL 0468.90. See Table 6.

If the grounding electrode recommended below comes in contact with a metallic pole riser conduit, connect with a conduit grounding clamp. See U7-10.9/NDK-120.

**Table 6. Grounding Electrode Methods**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Single Vault or Handhole</th>
<th>Series of Vaults or Handholes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduits in Soil Trench</td>
<td>Install a ground rod in vault or handhole.</td>
<td>Install a ground rod in each vault or handhole.</td>
</tr>
<tr>
<td></td>
<td>For each trench that penetrates vault or handhole, install a 50-ft, #2 AWG wire electrode routed in the bottom of that trench and connect to ground rod with exothermic weld. See Section 6.1.</td>
<td>Install a continuous #2 AWG wire electrode routed in the bottom of trench throughout the conduit system. Connect cable electrode to ground rod in each vault or handhole with an exothermic weld. See Section 6.2.</td>
</tr>
<tr>
<td>Conduits in Encased Ductbank</td>
<td>Install a ground rod outside the vault or handhole.</td>
<td>For each duct bank that penetrates vault or handhole, install a 50-ft, 250 kcmil, concrete-encased electrode in the bottom of the duct bank. See Section 6.3.</td>
</tr>
<tr>
<td></td>
<td>For each duct bank that penetrates vault or handhole, install a 50-ft, 250 kcmil, concrete-encased electrode in the bottom of the duct bank. See Section 6.3.</td>
<td>For each duct bank that penetrates vault or handhole, install a 50-ft, 250 kcmil, concrete-encased electrode in the bottom of the duct bank. See Section 6.4.</td>
</tr>
</tbody>
</table>
6.1 Direct Buried Conduits Entering a Single Vault or Handhole

Figure 6.1. Direct buried conduits entering a single vault or handhole

Install a ground rod and connect 50 ft of #2 AWG wire. Route wire electrode in the bottom of the trench. Drill a hole into each vault wall for each grounding electrode entry. Drill each hole through the vault on the same wall that the conduits enter, above the water table if present. At entry into vault, exothermically weld each wire to eliminate air gaps between strands. Seal the wire’s entry into vault to prevent water intrusion.

6.2 Direct Buried Conduits Entering a Series of Vaults or Handholes

Figure 6.2. Direct buried conduits entering a series of vaults or handholes

Install a continuous #2 AWG wire throughout the system and exothermically connect to the ground rod in each handhole. Route wire electrode in the bottom of the trench. Drill a hole into each vault wall for each grounding electrode entry. Drill each hole through the vault on the same wall that the conduits enter, above the water table if present. At entry into vault, exothermically weld each wire to eliminate air gaps between strands. Seal the wire’s entry into vault to prevent water intrusion.
6.3 Concrete Duct Bank Conduits Entering a Vault or Handhole

Figure 6.3. Concrete duct bank conduits entering a vault or handhole

For each duct bank that penetrates the vault or handhole, install 50 ft of bare 250 kcmil wire in the bottom of that duct bank to form a concrete-encased electrode. Wire must be positioned to ensure it is surrounded by 2 in of concrete on all sides when concrete is poured. Install a ground rod outside the vault. For each electrode, install 20 ft of additional wire in order to route it from the electrode, up through drilled hole in vault, and down to common grounding point within vault. Drill a hole into each vault wall for each grounding electrode entry. Drill each hole through the vault on the same wall that the electrode enters, above the water table if present. At entry into vault, exothermically weld each wire to eliminate air gaps between strands. Seal the wire’s entry into vault to prevent water intrusion.

6.4 Concrete Duct Bank Conduits Enter a Series of Vaults or Handholes

Figure 6.4. Concrete duct bank conduits enter a series of vaults or handholes

For each duct bank that penetrates the vault or handhole, install 50 ft of bare 250 kcmil wire in the bottom of that duct bank to form a concrete-encased electrode. Wire must be positioned to ensure it is surrounded by 2 in of concrete on all sides when concrete is poured. Install 20 ft of additional wire in order to route it from the duct bank, up through drilled hole in vault, and down to common grounding point within vault. Drill a hole into each vault wall for each grounding electrode entry. Drill each hole through the vault on the same wall that the duct bank enters, above the water table if present. At entry into vault, exothermically weld each wire to eliminate air gaps between strands. Seal the wire’s entry into vault to prevent water intrusion.
7. Testing

The grounding electrode system shall be constructed to ensure it has a resistance to ground of 25 ohms or less prior to connecting the neutral or service. SCL shall test to confirm compliance. If the electrode system does not result in a resistance to ground of 25 ohms or less, inform SCL engineer. SCL shall advise additional grounding measures required.

8. References

SCL Construction Standard U7-10.9/NDK-120; “Grounding Conduit Risers on Poles”

SCL Construction Standard 0468.90; “Exothermic Connection System”

SCL Material Standard 6762.90; “Exothermic Connection System”

SCL Design Standard 9702.30; “Grounding and Bonding, Fundamentals and Detailed Requirements”

9. Sources

Hanson, Brett; SCL Standards Engineer, originator and subject matter expert for 0461.10 (brett.hanson@seattle.gov)


The Authoritative Dictionary of IEEE Standards Terms (IEEE 100-2000); Seventh Edition; Institute of Electrical and Electronics Engineers (IEEE), 2000
Exothermic Connection System

1. Scope

This standard identifies the appropriate handle clamp and weld metal capsule to use with a given exothermic mold. It also includes application notes specific to Seattle City Light (SCL). Operator instructions and other literature are cited in Section 5.

2. Application

This standard is directed at personnel who plan to install exothermic connections in the field. Design engineers may find this standard helpful when planning or specifying material usage.

To make a connection, the operator inserts the conductors into the appropriate mold, places a weld shot (a small conical cup of weld metal) into the mold receptacle, and attaches the control unit. The assembly is held together by the handle clamp. The operator presses a button on the control unit to initiate the welding operation. (The term “exothermic” means the process gives off heat.)

For copper conductor only.

3. Handle Clamp, Weld Metal, and Mold Cross Reference

All jobs will require at least one electronic control unit (ignition tool), Stock No. 013335. This battery-powered ignition tool is designed to make 600 connections on one set of eight standard AA batteries.

Each exothermic connection (mold) will require the use of one of two (reusable) handle clamps and one of a variety of color-coded, (one-shot) weld metal capsules. The appropriate handle clamp and weld metal capsule are identified in Table 3.
### Table 3. Exothermic Connection System Components

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>013557</td>
<td>4/0 stranded wire butt splice</td>
<td>013336</td>
<td>013560</td>
<td>Gray</td>
</tr>
<tr>
<td>013339</td>
<td>250 kcmil wire butt splice</td>
<td>013336</td>
<td>013338</td>
<td>Orange</td>
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<td>013401</td>
<td>500 kcmil wire butt splice</td>
<td>013336</td>
<td>013339</td>
<td>Yellow</td>
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<tr>
<td>013402</td>
<td>250 kcmil wire to 5/8-in ground rod</td>
<td>013336</td>
<td>013398</td>
<td>Dk Blue</td>
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<tr>
<td>013403</td>
<td>500 kcmil wire to 5/8-in ground rod</td>
<td>013397</td>
<td>013400</td>
<td>Brown</td>
</tr>
<tr>
<td>013441</td>
<td>250 kcmil wire to 3/4-in ground rod</td>
<td>013336</td>
<td>013399</td>
<td>Yellow</td>
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<tr>
<td>013442</td>
<td>500 kcmil wire to 3/4-in ground rod</td>
<td>013397</td>
<td>013440</td>
<td>Lt Brown</td>
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<td>013558</td>
<td>4/0 stranded wire all way, horizontal Tee connection</td>
<td>013336</td>
<td>013398</td>
<td>Dk Blue</td>
</tr>
<tr>
<td>013559</td>
<td>4/0 stranded wire all way, lapped, horizontal X connection</td>
<td>013336</td>
<td>013561</td>
<td>Purple</td>
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<tr>
<td>013580</td>
<td>#2 AWG stranded wire to 5/8-in ground rod</td>
<td>013336</td>
<td>013560</td>
<td>Gray</td>
</tr>
<tr>
<td>013581</td>
<td>#4 AWG solid wire to 5/8-in ground rod</td>
<td>013336</td>
<td>013560</td>
<td>Gray</td>
</tr>
<tr>
<td>013585</td>
<td>2/0 stranded wire to 5/8-in ground rod</td>
<td>013336</td>
<td>013560</td>
<td>Gray</td>
</tr>
</tbody>
</table>
4. Application Notes

4.1 General Installation Notes

Exothermic connection systems are used to form permanent, low-resistance, high-reliability, welded electrical connections that may be direct buried or embedded in concrete.

Exothermic connection systems are commonly used to construct power station ground mats where it is not practical to inspect connections or repair failing connections.

Exothermic connection systems have long been referred to as Cadweld®, however Cadweld® is just one of many manufacturers of such systems.

Molds are available in many configurations for a wide variety of applications.

One mold should make about 50 connections, after which it should be replaced.

Reusable items may be obtained from the warehouse General Section or the Tool Room.

Operators must always wear approved gloves and safety glasses when working with exothermic materials.

4.2 Installation Notes Specific to Seattle City Light

Butt-splice molds are used to create water blocks where stranded ground cables enter vaults.

Most cable-to-cable or cable-to-ground rod connections in the Looped Radial and Network distribution systems use 250 kcmil, stranded copper conductors. Counterpoise ground conductors near substations are typically constructed with 500 kcmil, stranded copper. Contact the design engineer for questions regarding choice of conductor size.

Unless noted otherwise, butt splice, T-connection, and X-connection molds are for horizontal-lying cable.

5. References

SCL Material Standard 6762.90; “Exothermic Connection System”
6. Sources

**CADWELD®** Exothermic Welding Manual, E834I E1123LT08WWEN 0071M9 (Erico literature file name LT30323)

**CADWELD®** PLUS Control Unit (Erico literature file name LT31163)

**CADWELD®** PLUS Leading Technologies In Exothermic Welding (Erico literature file name LT0414)

**CADWELD®** PLUS Pictorial Instructions, ERICO P/N IPX B295WMPLUS E918IS05WW (Erico literature file name LT0580)

**CADWELD®** PLUS Welding Material; MATERIAL SAFETY DATA SHEET (Erico literature file name LT1298)

**CADWELD®** Welded Electrical Connections Facility Electrical Protection Catalog, A1C E1068CT08NAEN 00610M8 (Erico literature file name LT0039)

**CADWELD®** Welded Electrical Connections Quick Reference Product Guide, E782C-NAEN E1820CT07NAEN 0045M8 (Erico literature file name LT1449)

Electric Railway Improvement Company (ERICO); www.erico.com

Shipek, John; SCL Standards engineer and originator of 0468.90 (john.shipek@seattle.gov)
Looped Radial and Network Service Entrance Cables in Conduit for Underground Primary Service

1. Scope

This standard covers the requirements for a customer service provided by NEC-sized cables routed in conduit to the point of termination located in the Seattle City Light (SCL) Looped Radial or Network System.

An underground secondary service from an overhead transformer or underground transformer located in the right-of-way is outside the scope of this standard. See SCL 0224.01.

2. Application

This standard provides direction to customers about how to select cable in conduit systems to meet SCL requirements. The goal is to inform the customer of the requirements and available options as well as giving the crews defined requirements to reference.

Vault requirements are outside the scope of this standard. See U10-7 and 0751.60.

3. Requirements

Customers are responsible for providing National Electrical Code (NEC)-sized service conduits and cables from the service termination point to the customer's switchgear. Tables 3a. and 3b. show allowable conductor sizes.

Route cable through the incoming conduit and coil excess cable equal to the sum of the length and width of the vault. In the case of a padmount transformer, provide 8 feet. The additional cable will insure SCL crews can arrange equipment where it is most practical for installation and maintenance. The additional cable may be cut at any point, so it shall not be used as additional impedance for the customer switchgear fault current calculation. Visibly mark each cable indicating phase and service being fed.
### Table 3a. Allowed Cables in Looped Radial System

<table>
<thead>
<tr>
<th></th>
<th>Copper</th>
<th>Aluminum</th>
<th>Compact Stranded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concentric Round Stranded</td>
<td>Concentric Round Stranded &amp; Compressed Stranded</td>
<td></td>
</tr>
<tr>
<td>#2 AWG</td>
<td>OK</td>
<td>OK</td>
<td>–</td>
</tr>
<tr>
<td>#1 AWG</td>
<td>–</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>1/0 AWG</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>2/0 AWG</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>3/0 AWG</td>
<td>OK</td>
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<td>OK</td>
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<tr>
<td>4/0 AWG</td>
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</tr>
<tr>
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<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>300 kcmil</td>
<td>OK</td>
<td>OK</td>
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<tr>
<td>350 kcmil</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>400 kcmil</td>
<td>–</td>
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<td>500 kcmil</td>
<td>OK</td>
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<td>750 kcmil</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>800 kcmil</td>
<td>–</td>
<td>OK</td>
<td>OK</td>
</tr>
</tbody>
</table>

Note: 600-800 kcmil cables are only allowed on large projects with prior SCL approval.

### Table 3b. Allowed Cables in Network System

<table>
<thead>
<tr>
<th></th>
<th>Copper (Stranded)</th>
<th>Aluminum (Stranded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4 AWG</td>
<td>OK</td>
<td>–</td>
</tr>
<tr>
<td>#2 AWG</td>
<td>OK</td>
<td>–</td>
</tr>
<tr>
<td>#2/0 AWG</td>
<td>OK</td>
<td>–</td>
</tr>
<tr>
<td>#4/0 AWG</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>250 kcmil</td>
<td>OK</td>
<td>–</td>
</tr>
<tr>
<td>350 kcmil</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>500 kcmil</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>750 kcmil</td>
<td>–</td>
<td>OK</td>
</tr>
</tbody>
</table>

Note: No compact sector cables are allowed.

### 4. Sources

**Hanson, Brett**: SCL Standards Engineer and originator for 0473.50 (brett.hanson@seattle.gov)

**Perander, Eivind**: SCL North Distribution Supervisor and subject matter expert for 0473.50 (eivind.perander@seattle.gov)
1. Scope

This standard covers the installation, clearance and equipment requirements for a dry vault service entrance bus duct located in the Seattle City Light (SCL) Looped Radial or Network System.

Dry vaults are those above grade or otherwise not subject to flooding or wet interior conditions.

Minimum vault dimensions are outside the scope of this standard.

2. Application

This standard provides direction to SCL crews and customers about how to design and build the dry vault service entrance bus duct to meet SCL requirements and applicable codes. The goal is to inform the customer of the requirements and available options as well as giving the crews defined requirements to reference.
3. Requirements

3.1 City Light will determine the number of cable connections per phase and neutral.

3.2 The bus shall extend a maximum of 18 inches from the vault wall as shown in Figures 3.10b and 3.10e.

3.3 The ceiling clearance for the bus shall be a minimum distance of 18 inches from the top of the bus to the ceiling unless otherwise accepted by SCL. This 18-inch clearance must extend for a minimum distance of four feet in front of the bus, away from the wall.

3.4 The minimum horizontal distance between two adjacent service entrance buses shall be 3 feet. See Figure 3.10i. Confirm bus duct height and vault dimensions with SCL Engineer prior to construction. For electrical clearances, see SCL 0751.77. Mount adjacent buses at the same height above finished floor.

3.5 The minimum distance between bus phases shall be 8 inches. See Figures 3.10c and 3.10e.

3.6 Buses or connector plates shall be drilled to accept NEMA two-hole connectors. Each connector space on the plate shall be drilled with two 9/16-in holes, spaced 1-3/4 inches on center. Each connector space shall be offset 2-1/4 inches from adjacent connector spaces. See Figures 3.10g and 3.10h.

3.7 Each bus shall have a placard identifying the unique load it serves, ampacity, voltage, and phases. Each phase shall also be labeled. The placard shall be red phenolic with white letters 1 in tall minimum and be mounted adjacent to or below each bus. See Figure 3.7a.

**Figure 3.7a. Example Placard for Dry Vault Service Entrance Buses**

![Placard Example](image)

3.8 Customer shall submit a dimensioned sketch of customer service bus duct design, location of service bus, and bus rating to SCL Engineer for review and approval.

3.9 The customer shall furnish and install fire stop insulating material per NEC 300.21 requirements for service bus duct installed by the customer. Prior to acceptance of the vault by SCL, the customer shall have the fire protection material inspected and approved by the Authority Having Jurisdiction (AHJ).

3.10 The customer shall be responsible for assuring that water never enters the building and service entrance equipment from SCL vaults.
Figure 3.10a. Bus Bars Parallel to Floor

Figure 3.10b. Bus Bars Parallel to Floor, Plan View (Cables Parallel to Floor)

Figure 3.10c. Bus Bars Parallel to Floor, Elevation View (Cables Parallel to Floor)
Figure 3.10d. Bus Bars Perpendicular to Floor

Figure 3.10e. Bus Bars Perpendicular to Floor, Plan View

Figure 3.10f. Bus Bars Perpendicular to Floor, Elevation View (Cables Parallel to Floor)
Figure 3.10g. Hole Spacing, Two-Hole Horizontal Connection

Figure 3.10h. Hole Spacing, Two-Hole Vertical Connection

Figure 3.10i. Adjacent Service Entrance Bus Spacing
4. References

SCL Construction Standard 0751.77, “In-Building Vault Electrical Equipment Clearances”

5. Sources

Hanson, Brett: SCL Standards Engineer and subject matter expert for 0474.08 (brett.hanson@seattle.gov)

NESC 2011 Section 124; “Guarding Live Parts”; NESC; 2012

NEC 2014 Section 300.21; “Spread of Fire or Products of Combustion”; NEC; 2014


Youngs, Rob: SCL Electrical Inspector and subject matter expert for 0474.08 (rob.youngs@seattle.gov)
Transformer Pad, Installation and Grounding, Single Phase, 25-167 kVA

1. Scope
This standard provides the requirements for the installation of transformer pads for 25 through 167 kVA single phase padmount transformers. The document includes civil construction and grounding work.

2. Application
This document provides direction to SCL contractors and customers about how to properly install a transformer pad and its grounding for SCL pad mount transformers.

3. Construction Notes
3.1. Install bollards per U10-7.
3.2 Conduits shall extend 3 inches above the surface of the pad. Grout and use petroleum-resistant sealant around conduits.
3.3 Elbows shall be rigid galvanized steel per SCL 0224.05.
3.4 All metallic conduits shall have a grounding bushing or a bushing plus a ground clamp.
3.5 Ground bus must form a complete rectangle as shown in Figure 1, and when tested by SCL, provide a resistance to ground of 25 ohms or less.
3.6 All below-grade connections shall be done by exothermic weld per SCL 0468.90.
3.7 Three-inch high capital letters, “SCL,” shall be cast in the concrete pad surface, facing the outside, centered between the long side of the conduit opening and the nearest outside edge of the pad.
3.8 For the primary conduit duct bank that enters the transformer terminal compartment, install 50 ft of bare 250 kcmil wire in the bottom of that duct bank to form a concrete-encased electrode. Wire must be straight and positioned to ensure it is surrounded by 2 in of concrete on all sides when concrete is poured. From the duct bank electrode, extend 6 ft of additional wire into the transformer primary terminal compartment to connect it to the transformer grounding lug.

4. Material List

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Stock No.</th>
<th>Material Standard</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>Single-phase transformer pad</td>
<td>013721</td>
<td>7203.76</td>
</tr>
<tr>
<td>2</td>
<td>40 ft</td>
<td>Wire, #2 AWG bare, 7-strand, soft-drawn copper</td>
<td>610434</td>
<td>6103.90</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Connector, 2-bolt parallel tap</td>
<td>669379 E</td>
<td>6693.70</td>
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<tr>
<td>4</td>
<td>4</td>
<td>Exothermic weld mold, #2 AWG-5/8 in ground rod</td>
<td>013580 E</td>
<td>6762.90</td>
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<td>5</td>
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<td>Ground Rod, 5/8 in by 8 ft</td>
<td>564238 E</td>
<td>6762.25</td>
</tr>
</tbody>
</table>

5. References
Lu, Curtis; SCL Standards Engineer, subject matter expert and originator for 0652.01 (curtis.lu@seattle.gov)

SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”

SCL Construction Standard 0468.90; “Exothermic Connection System”

SCL Construction Guideline U10-1.3; “Transformer Pad Construction Residential, 1Ø, 25 kVA Through 167 kVA” (canceled)

SCL Construction Guideline U10-1.4; “Padmount Transformer Installation, Grounding and Connections 240/120 V, 1Ø, 3 W, 25 Through 167 kVA”

SCL Construction Guideline U10-7; “Requirements for Transformer Pads and External, Below-Grade Transformer Service Vaults, Looped Radial System”
Figure 1
Transformer Pad, Installation and Grounding, 
Three-Phase, 150-300 kVA

1. Scope
This standard provides the requirements for the installation of transformer pads for 150 through 300 kVA three-phase padmount transformers. The document includes civil construction and grounding work.

2. Application
This document provides direction to SCL contractors and customers about how to properly install a transformer pad and its grounding for SCL pad mount transformers.

3. Construction Notes
3.1. Install bollards per U10-7.
3.2 Conduits shall extend 3 inches above the surface of the pad. Grout and use petroleum-resistant sealant around conduits.
3.3 Elbows shall be rigid galvanized steel per SCL 0224.05.
3.4 All metallic conduits shall have a grounding bushing or a bushing plus a ground clamp.

3.5 Ground bus must form a complete rectangle as shown in Figure 1, and when tested by SCL, provide a resistance to ground of 25 ohms or less.

3.6 All below-grade connections shall be done by exothermic weld per SCL 0468.90.

3.7 Three-inch high capital letters, “SCL,” shall be cast in the concrete pad surface, facing the outside, centered between the long side of the conduit opening and the nearest outside edge of the pad.

3.8 For the primary conduit duct bank that enters the transformer terminal compartment, install 50 ft of bare 250 kcmil wire in the bottom of that duct bank to form a concrete-encased electrode. Wire must be straight and positioned to ensure it is surrounded by 2 in of concrete on all sides when concrete is poured. From the duct bank electrode, extend 6 ft of additional wire into the transformer primary terminal compartment to connect it to the transformer grounding lug.

4. Material List

<table>
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<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Stock No.</th>
<th>Material Standard</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1</td>
<td>Three-phase transformer pad</td>
<td>013722</td>
<td>7203.76</td>
</tr>
<tr>
<td>2</td>
<td>55 ft</td>
<td>Wire, #2 AWG bare, 7-strand, soft-drawn copper</td>
<td>610434</td>
<td>6103.90</td>
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<tr>
<td>3</td>
<td>1</td>
<td>Connector, 2-bolt parallel tap</td>
<td>669379</td>
<td>E 6693.70</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Exothermic weld mold, #2 AWG– 5/8 in ground rod</td>
<td>013580</td>
<td>6762.90</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>Ground rod, 5/8 in by 8 ft</td>
<td>564238</td>
<td>E 6762.25</td>
</tr>
</tbody>
</table>

5. References
Lu, Curtis; SCL Standards Engineer, subject matter expert and originator of 0652.03 (curtis.lu@seattle.gov)
SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”
SCL Construction Standard 0468.90; “Exothermic Connection System”
SCL Construction Guideline U10-7; “Requirements for Transformer Pads and External, Below-Grade Transformer Service Vaults, Looped Radial System”
SCL Construction Guideline U10-1.5; “Transformer Pad Construction and Grounding, 150 through 300 kVA, 3Φ” (canceled)
Transformer Pad, Installation and Grounding,
Three-Phase, 500-1500 kVA

1. Scope
This standard provides the requirements for the installation of transformer pads for 500 through 1500 kVA three-phase padmount transformers. The document includes civil construction and grounding work.

2. Application
This document provides direction to SCL contractors and customers about how to properly install a transformer pad and its grounding for SCL pad mount transformers.

3. Construction Notes

3.1. Install bollards per U10-7.

3.2. Conduits shall extend 3 inches above the surface of the pad. Grout and use petroleum-resistant sealant around conduits.

3.3. Elbows shall be rigid galvanized steel per SCL 0224.05.

3.4. All metallic conduits shall have a grounding bushing or a bushing plus a ground clamp.

3.5. Ground bus must form a complete rectangle as shown in Figure 1, and when tested by SCL, provide a resistance to ground of 25 ohms or less.

3.6. All below-grade connections shall be done by exothermic weld per SCL 0468.90.

3.7. Three-inch high capital letters, “SCL,” shall be cast in the concrete pad surface, facing the outside, centered between the long side of the conduit opening and the nearest outside edge of the pad.

3.8. For the primary conduit duct bank that enters the transformer terminal compartment, install 50 ft of bare 250 kcmil wire in the bottom of that duct bank to form a concrete-encased electrode. Wire must be straight and positioned to ensure it is surrounded by 2 in of concrete on all sides when concrete is poured. From the duct bank electrode, extend 6 ft of additional wire into the transformer primary terminal compartment to connect it to the transformer grounding lug.

4. Material List

<table>
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<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Stock No.</th>
<th>Material Standard</th>
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<td>Ground Rod, 5/8 in by 8 ft</td>
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<td>6762.25</td>
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</tbody>
</table>

5. References

Lu, Curtis; SCL Standards Engineer, subject matter expert, and originator of 0652.05 (curtis.lu@seattle.gov)

SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”

SCL Construction Standard 0468.90; “Exothermic Connection System”

SCL Construction Guideline U10-1.6 “Transformer Pad Construction and Grounding, 150 through 300 kVA, 3Ф” (canceled)

SCL Construction Guideline U10-7; “Requirements for Transformer Pads and External, Below-Grade Transformer Service Vaults, Looped Radial System”
Figure 1

Seattle City Light

CONSTRUCTION STANDARD
Transformer Pad, Installation and Grounding, Three Phase, 500-1500 kVA

Standard Number: 0652.05
Superseding: December 22, 2016
Effective Date: November 9, 2017
Page: 2 of 2
Transformer Pad, Installation and Grounding,
Three Phase, 2000-2500 kVA

1. Scope
This standard provides the requirements for the installation of transformer pads for 2000 through 2500 kVA three-phase padmount transformers. The document includes civil construction and grounding work.

2. Application
This document provides direction to SCL contractors and customers about how to properly install a transformer pad and its grounding for SCL pad mount transformers.

3. Construction Notes
3.1. Install bollards per U10-7.
3.2 Conduits shall extend 3 inches above the surface of the pad. Grout and use petroleum-resistant sealant around conduits.
3.3 Elbows shall be rigid galvanized steel per SCL 0224.05.
3.4 All metallic conduits shall have a grounding bushing or a bushing plus a ground clamp.
3.5 Ground bus must form a complete rectangle as shown in Figure 1, and when tested by SCL, provide a resistance to ground of 25 ohms or less.
3.6 All below-grade connections shall be done by exothermic weld per SCL 0468.90.
3.7 Three-inch high capital letters, “SCL,” shall be cast in the concrete pad surface, facing the outside, centered between the long side of the conduit opening and the nearest outside edge of the pad.
3.8 For the primary conduit duct bank that enters the transformer terminal compartment, install 50 ft of bare 250 kcmil wire in the bottom of that duct bank to form a concrete-encased electrode. Wire must be straight and positioned to ensure it is surrounded by 2 in of concrete on all sides when concrete is poured. From the duct bank electrode, extend 6 ft of additional wire into the transformer primary terminal compartment to connect it to the transformer grounding lug.

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5. References

Lu, Curtis; SCL Standards Engineer, subject matter expert and originator of 0652.07, (curtis.lu@seattle.gov)
SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”
SCL Construction Standard 0468.90; “Exothermic Connection System”
SCL Construction Guideline U10-1.6 "Transformer Pad Construction and Grounding, 150 through 300 kVA, 3Φ” (canceled)
SCL Construction Guideline U10-7; “Requirements for Transformer Pads and External, Below-Grade Transformer Service Vaults, Looped Radial System”
In-Building Vault Lighting and Receptacle Requirements, Looped Radial System

1. Scope

This standard outlines the lighting and receptacle requirements for a dry, in-building, transformer vault in the Seattle City Light (SCL) looped radial system. It also includes application notes specific to SCL.

2. Application

This standard is directed at personnel who install the light fixtures and receptacles, in dry in-building transformer vaults in the SCL looped radial system. Seattle City Light shall make final connections to power once the light fixtures and receptacles have been installed and wired.

3. Lighting requirements

Surface-mount a plastic lampholder (Cooper Wiring S1174W) centered on each wall at 8 feet above finished floor. If a wall exceeds 15-feet in length, install lampholders 10 feet on center. Install a light switch (lighted handle, Leviton 1201-LHW or equal) inside each door at 42 inches above finished floor. Provide 3-way or 4-way switches as necessary. Furnish and install lamps for the fixtures (TCP 28968 51K). If vault walls are 8 feet tall or less, mount lampholders on the ceiling, 12 inches away from the wall.
4. Receptacle requirements

Surface-mount one duplex NEMA 5-20R receptacle below each lampholder at 42 inches above finished floor.

5. Wiring requirements

Circuits shall be routed within EMT 1/2-inch conduit (minimum) that is mounted to the surface of the vault walls. Homerun junction boxes shall be installed at 42 inches above finished floor. All junction boxes shall be 4-inch square steel and furnished with coverplates. Light fixtures shall be connected to one circuit including dedicated hot, neutral, and ground conductors. Receptacles shall be connected to a separate circuit including dedicated hot and neutral conductors.

Lighting and receptacle circuits shall be installed using different colored jackets to distinguish the hot and neutral conductors of each circuit. All conductors shall be #12 THWN and 3 feet of extra conductor shall be left at the homerun junction boxes for final connection by Seattle City Light. Seattle City Light crews shall connect to the homeruns via fuses and use #4 THWN conductors if the 120-volt source is outside the vault.

Permanent power for the vault lighting and receptacles shall be supplied directly from SCL equipment.

6. References

SCL Construction Standard U10-6, "Lighting and Sump Pump Installation for Single Transformer Vaults" (canceled)

Youngs, Rob; SCL Inspector and subject matter expert for 0674.06 (rob.youngs@seattle.gov)

Hanson, Brett; SCL Standards engineer and originator of 0674.06 (brett.hanson@seattle.gov)
Oil Containment Systems

1. **Scope**

This standard covers the oil containment system requirements for transformers that are mounted at-grade or on a pad in the Seattle City Light (SCL) distribution system.

2. **Application**

This standard provides customers with the requirements for oil containment systems. An oil containment system shall be installed to support every oil-filled padmounted transformer.

3. **Industry Standards**

Oil containment systems shall meet the applicable requirements of the following industry standard:

**Code of Federal Regulations (CFR)**, Title 40, Chapter 1, Subchapter D, Part 112, Subpart A, 112.7 General Requirements for Spill Prevention, Control, and Countermeasure Plans

4. **General Requirements**

The customer shall design, install, and maintain the oil containment system to contain any and all oil spilled by the transformer. The customer shall design the system to meet the requirements of 40 CFR 112.7 with the following clarification: oil containment is required for all oil-filled transformers of any capacity. All transformer pad penetrations shall be sealed.
5. Capacity Requirements

The system shall contain all spilled oil and all oil-contaminated rainwater until cleanup. Transformer oil capacity will be communicated by SCL during the design process. Since this containment system is subject to rain and snow accumulation, provisions shall be made to handle water runoff.

6. System Review

The oil containment system design shall be designed and stamped by a qualified Professional Engineer licensed in the State of Washington and submitted to the SCL Electrical Service Representative (ESR) or Electrical Service Engineer (ESE) for review prior to construction.

The SCL ESR or ESE shall submit the design to the SCL Environmental Review Project Lead for review. The SCL Environmental Review Project Lead shall consult with the Environmental and Civil Engineering Leads for Spill Prevention Control and Countermeasures (SPCC).

7. System Inspection

The customer shall notify the SCL ESR or ESE of the oil containment system installation schedule. SCL will inspect the oil containment system prior to transformer installation and liner cover, if applicable.

8. System Design Options

The oil containment system can potentially be constructed of any of the following products, another product designed for this purpose, or an alternate spill prevention system listed in 40 CFR 112.7(c)(1):

- Oil water separator
- Impervious barriers with Solidification Products International, Inc. (SPI) Petro-Plugs or CI Agent HFF Oil Stop Valves on the outlets. See Figure 8a.
- Containment blankets made with C.I. Agent Polyvinyl or SorbWeb Plus material. See Figure 8b.

If containment design is an at-grade basin, provide sufficient slope to prevent standing water. Maximum slope shall not exceed 2%.

Figure 8a. SPI Petro-Plug and CI Agent HFF Oil Stop Valve
9. System Maintenance

The customer shall conduct periodic maintenance on the system to ensure adequate secondary containment.

10. Sources

Garcia, Larry; SCL Environmental analyst and subject matter expert for 0735.50 (larry.garcia@seattle.gov)

Hamlin, Pam; SCL Engineer and subject matter expert for 0735.50 (pam.hamlin@seattle.gov)

Hanson, Brett; SCL Engineer and originator of 0735.50 (brett.hanson@seattle.gov)
Customer Requirements, In-Building Transformer Vaults, Network and Loop Radial Systems

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2. Scope

This standard provides the requirements for Seattle City Light (SCL) Network and Looped Radial (formerly URD) transformer, in-building vaults. These vault rooms contain SCL owned or maintained equipment.

Network-ready vaults shall meet Network vault requirements.

An in-building transformer vault is a special room inside a building in which oil-filled transformers and related electric power distribution equipment are housed.

Concurrent vault requirements are listed in SCL 0751.60. Topics include vault grounding, lighting, ducts, cables, bus ducts, etc. SCL 0751.60 also lists required customer submittals and SCL provided project-specific requirements.

Electrical vaults within buildings that contain equipment owned and maintained by others are not covered by this standard.

3. Application

An in-building vault is required if the customer’s electrical load exceeds the limits listed in Requirements for Electrical Service Connection, Table 5-1 and the customer cannot provide exterior space for the installation of SCL transformers and associated equipment on the project premises.

Vault requirements unique to either Network or Looped Radial (URD) systems are clearly indicated. All other requirements are applicable for both Network and Looped Radial systems.

This standard is intended for use by customers and SCL engineering, customer service, inspecting, reviewing, and operations personnel.

4. Conflict

Where conflict exists between SCL requirements, the following order of precedence shall apply:

1. Project specific Customer Requirements Package, including the Service Construction Letter and Drawing
2. SCL 0751.00
3. Seattle Building Code, 2006, Section 422 (within the City of Seattle)
4. SCL 0751.60
5. Other SCL construction guidelines or construction standards
6. SCL Requirements for Electric Service Connection (RESC), 2007
7. Other industry standards
5. Accessibility

5.1 Seattle City Light prefers that SCL trucks be able to access the door or hatch of the in-building vault. Looped Radial equipment hatches shall be outside of the in-building vault.

5.2 In-building vaults shall be located no more than one floor below the building’s exterior finished grade.

For a Network or Network-ready vault located such that it is not readily accessible for the oil servicing hose and the 12-foot-tall oil pump van, a 6-inch diameter oil hose access to the in-building transformer vault shall be installed for use by SCL crews. The oil hose access shall be routed exterior to the in-building vault and provide a maximum hose length distance of 75 feet from the vault to an area accessible to the oil truck. The openings shall be located near the equipment access and the customer is responsible for grouting and waterproofing around the opening. Location shall be coordinated with SCL prior to construction.

5.3 Network: One or more door(s) or ceiling hatch shall be provided for every in-building vault.

5.4 Loopied Radial (formerly referred to as URD): One or more door(s) shall be provided for every in-building vault.

5.5 The opening shall be adequate in size to permit the installation and removal of the equipment located in the vault.

5.6 The door access shall be kept unobstructed at all times.

5.7 An unobstructed level area shall be provided at the entrance to the in-building vault.

5.8 The level area shall be large enough for moving SCL equipment into and out of the in-building vault.

5.9 All in-building vaults shall be readily accessible to SCL personnel at all times.

5.10 If it is necessary to pass through locked doors to reach the in-building vault, keys for those locked doors shall be kept in a readily accessible key box near the first locked door. A spare set shall also be provided.

5.11 Non-SCL personnel shall not enter the in-building vault without SCL personnel after the vault has been accepted by SCL.

5.12 There shall be a permanent, clear equipment access path between the vault and the building exterior or right-of-way.

5.12.1 Sufficient horizontal and vertical clearance shall be provided for electrical equipment and machinery to move the equipment without interrupting other energized equipment. See SCL 0751.77.

5.12.2 The path floor shall be smooth, without seams or ridges or pads.

5.12.3 Customer shall move transformers to in-building vault. See Section 5.13.

5.12.4 The path floor shall be designed to support the weight of the electrical equipment and machinery to move the equipment. Transformers can weigh up to 30,000 pounds and have dimensions up to 12 feet long by 8 feet wide by 9 feet tall.

5.13 Equipment transportation agreement is required for in-building vaults. An equipment transportation agreement makes the property owner responsible for moving equipment between the right-of-way and the in-building vault.

The property owner shall sign a legally binding Equipment Transportation Agreement that will be attached to the property title. The Agreement requires the building owner to move
transfomers into and out of the building, to and from the transformer vault, to a mutually agreed upon location on, or in the vicinity of, the owner’s property from which SCL is able to deliver or pick up the transformers using normal transporting methods and equipment. Any damage that occurs to the transformers during transportation by the building owner and any additional expense incurred as a result of damage shall be paid by the building owner. A copy of the agreement shall be included in the vault document enclosure, see 0751.60 Section 14. Install Equipment Transportation Agreement sign, see SCL 7651.25.

6. Location

6.1 In-building vaults shall be located such that they can be ventilated to the outside without using ducts, if practical.

6.2 In-building vaults shall be dry and not subject to running, standing, flooding, or infiltration of water.

6.3 Exact location of in-building vault shall be determined for each specific project.

6.4 If the in-building transformer vault is located below grade level, an above-grade pulling vault is required to help prevent water intrusion.

Above-grade pulling vault shall be accessible. See Section 5 Accessibility.

Vault shall be a minimum of 5 feet deep by 7 feet wide by 8 feet tall. If the vault is used to connect to a high-voltage switch in the building or contains multiple feeders, additional space shall be required. Confirm dimensions with City Light engineer.

Vault walls shall be concrete or concrete filled CMU. See Section 7 Construction.

Vault door shall be 42 inches wide by 80 inches tall per SCL Standard 0751.49. The door shall be able to swing open 120 degrees.

Install a UV-resistant sign on the exterior side of the door, stating “DO NOT BLOCK DOOR”. Sign shall be a red phenolic resin sheet 6 mils thick with white one inch tall lettering.

Install pulling irons in the ceiling, opposite the incoming conduits per SCL NCI-62. See section 4 of NCI-62 for ceiling design requirements.

Primary conduits shall enter the vault through the floor and shall extend 10 inches above the floor.

A two-inch conduit shall be routed from the vault to the in-building transformer vault for utility equipment grounding. Conduit bends shall be rigid galvanized steel.

Conduits penetrating the floor shall be rigid galvanized steel and encased in a housekeeping pad with end bells flush with the top of the pad. See Figure 6.4 below. End bells shall meet SCL 7055.09. Encasement shall not protrude into the door passageway.
Figure 6.4 Above-Grade Pulling Vault

- Pulling iron in the ceiling, directly above the conduits.
- One 2" grounding conduit to in-building vault.
- Two high-voltage conduits to in-building vault.
- Concrete encasement around the conduits, flush with the end-bells.
- Two high-voltage conduits to the SCL facility in the R-O-W.
7. Construction (Walls, Roofs, and Floors)

7.1 Floors, walls, and ceilings of in-building vaults shall have a minimum three-hour fire resistance rating.

7.2 All penetrations shall be sealed to be three-hour fire rated.

7.3 Network: The bottom 8 ft of wall, minimum, shall be solid concrete at least 6 in thick. Above the solid concrete wall, it may be solid concrete or concrete filled masonry units at least 6 in thick.

7.4 Floors and ceilings of in-building vaults shall be constructed of solid concrete at least 6 in thick.

7.5 Looped Radial (URD): Walls of in-building vaults shall be constructed of solid concrete or concrete-filled masonry units at least 6 in thick.

7.6 Network: Seismic anchors shall be embedded in the floor. See U10-5.3/NTP-40.

7.7 Steel support channels shall be embedded in the ceiling for ceiling-supported cable hangers per SCL 0257.06. For Looped Radial vaults, channel layout shall be parallel to the wall that service enters. For Network vaults, channel layout shall be determined by SCL for each specific project.

7.8 Pre-tensioned or post-tensioned concrete shall have the cable locations permanently marked with red epoxy paint on the surface of the concrete over the encased tendons.

7.9 In-building vault dimensions shall depend on the equipment and working clearances required. See SCL 0751.77.

7.10 The maximum ceiling height is 18 feet.

7.11 For working space for all equipment 600 V and under, see SCL 0751.77.

7.12 The vault floor shall be smooth, without seams, ridges, or pads. The floor shall slope toward the sump 1/2 inch for every 10 feet. Topping slabs and skim coats are prohibited.

7.13 Pulling Irons

7.13.1 Pulling iron(s) shall be installed per SCL NCI-62 opposite and centered on the primary cable duct bank entrance(s). Additional pulling irons may be required.

7.13.2 Pulling irons shall have an ultimate (breaking) strength of 10,000 lb.

7.13.3 Pulling irons shall provide a minimum 3-in diameter round gap for hook or shackle attachment.

7.13.4 For Looped Radial vaults with a six foot or wider equipment access doorway, provide an additional pulling iron. Pulling iron shall be located opposite and centered on the doorway and meet SCL NCI-62.
8. Doorways and Openings

8.1 Doorways

8.1.1. Looped Radial (URD): SCL requires an equipment access door. If equipment access is provided by a drop-in hatch outside the vault, a separate personnel door that permits egress through the building is required. The number of personnel access doors shall be determined for each specific project by SCL.

8.1.2. Network: SCL requires two doors for personnel egress; one of which may also be the equipment access door.

8.1.3. Personnel access doorways shall be at least 3 ft 6 in wide and 6 ft 8 in high.

8.2 Doors, Frames, and Door Hardware

8.2.1. For all door, frame, and door hardware requirements, see SCL 0751.49.

8.3 Sills

8.3.1. All in-building vault doorways shall have a removable oil containment sill of 6 in (minimum).

8.3.2. The sill shall be made of 6-in angle iron and painted safety yellow. The sill shall extend past door frame 6 inches.

8.3.3. The sill shall be installed behind each door and be connected to the wall with flush mount internal-threaded anchors. See SCL 7801.10.

8.3.4. The sill shall be installed after the installation of the electrical equipment and prior to energization.

8.3.5. The sill shall be sealed to the floor and wall with oil-resistant caulk.

8.4 Equipment Installation, Access, and Removal

8.4.1. Equipment access doorways shall be sized to accommodate the installation and removal of electrical equipment (including the installation machinery).

8.4.1.1. If vault contains single phase transformers only, the doorway shall be at least 3 ft 6 in wide and 6 ft 8 in high.

8.4.1.2. All other doorways shall be sized by SCL, as needed.
9. Ventilation

9.1 Ventilation systems shall be provided to dispose of heat from transformer total losses without creating a temperature rise that exceeds the transformer rating.

9.2 The owner is responsible for maintaining the vault ventilation system to ensure proper and continued operation.

9.3 Method of ventilation

9.3.1 Utility in-building vaults shall be mechanically ventilated.

9.3.2 Positive or negative pressure ventilation systems shall supply air for in-building vaults.

9.3.3 Ventilation system shall supply a minimum of 1.6 cfm of air per kVA of transformer capacity.

9.4 Location

9.4.1 Exhaust ventilation openings and duct terminations shall be located a minimum of 10 ft above adjoining grade and finished walking surfaces. Exhaust openings and duct terminations shall be located a minimum of 10 feet from fire escapes, means of egress, combustible materials, any doors, windows, or openings, and property lines. Confirm additional exhaust clearances with the Authority Having Jurisdiction.

9.4.2 Exhaust outlets shall be located on the exterior of the building.

9.5 Arrangement (of ventilation equipment)

9.5.1 Fans and thermostats

9.5.1.1 The in-building vault ventilation fans shall be installed outside of the vault.

9.5.1.2 The in-building vault ventilation fans shall be controlled by thermostats located inside the vault.

9.5.1.3 Remote temperature controller shall be installed.

9.5.1.4 A dedicated thermostat will activate the fans at 70 degrees F.

9.5.1.5 The second dedicated thermostat will turn off the fans at 140 degrees F.

9.5.1.6 Thermostats shall be analog (dial) type (Honeywell T631A-C type Farm-O-Stat, Model No. T631A1022). Locate thermostats on an interior wall within 3 ft of an entry door, 5 ft above finished floor, and in dead air space. Confirm final location with SCL prior to rough-in.

9.5.1.7 Looped Radial (URD)/Network-Ready: Install a combination visible/audible alarm (Edwards Signal 868STRR-N5) and connect it to a dedicated circuit. Install a sign outside of the vault below the alarm that reads “If alarm operates, call Seattle City Light at 206-625-4448.” If the ventilation system becomes inoperable or does not turn on at 70°F, or if the vault temperature exceeds 140°F, the visible alarm shall be configured to activate. Confirm with the inspector whether the audible alarm function is required.

9.5.1.8 Network: No visible or audible customer installed alarm required. SCL installs monitoring equipment.

9.5.1.9 The building owner is responsible for providing power and maintaining the vault ventilation system, including the fans.

9.5.1.10 Looped Radial (URD): The building owner may monitor vault fan alarm signal, but shall not control vault fan or alarm.
9.5.2. Vents

9.5.2.1. Intake air shall be drawn from an exterior air source such as the building exterior or garage. It shall not be drawn from conditioned air in the building.

9.5.2.2. Intake vents shall be located at least 18 in above the exterior floors.

9.5.2.3. The intake vents shall be located in the lower third of the interior walls of the vault. The bottom of the vent shall be located 18–24 inches above the finished vault floor.

9.5.2.4. The exhaust vents shall be as near to the ceiling as possible (in the upper third of the wall) or in the roof or ceiling of the vault.

9.5.2.5. Exhaust shall vent directly to the outside of the building or shall be ducted, using three-hour rated material.

9.5.2.6. Exhaust cannot vent to a covered parking area or garage.

9.5.3. The ventilation system shall cause air to flow across the cooling fins of the transformers. For each transformer rated 500 kVA and above, provide an intake vent mounted low behind the transformer.

9.5.4. Ventilation system shall direct airflow uniformly across the vault.

9.5.5. The vault ventilation system shall be controlled independently of the building ventilation system.

9.5.6. No ducting shall be installed within the vault.

9.5.7. Vents shall not allow water to enter the vault.

9.5.8. Exhaust vents shall be 3 ft away from non-combustible surfaces and 10 ft away from combustible surfaces.

9.6 Ventilation Covering

9.6.1. Interior vault face ventilation openings shall be covered with a 0.12-in diameter minimum metal gratings with 1/2-in maximum mesh openings to prevent rodent intrusion. Gratings shall be McNichols Wire Mesh 3658220041 or 3658220048 or equal with approval prior to rough-in. Grating shall be flush with wall.
9.6.2. Exterior vault face ventilation openings shall be covered with fixed inverted V-shaped louvers that eliminate visual see-through and prevent rain from entering the vault. Louvers and frames shall be fabricated of 3/16-in thick (minimum) galvanized angle iron or equal with approval prior to rough-in. Louvers shall be supported and anchored to prevent unauthorized access to the vault. Any carriage bolts used shall be secured from within the vault.

9.7 Dampers

9.7.1. Intake vents in the vault walls shall have automatic closing fire dampers rated for three-hour fire resistance.

9.7.2. Damper actuating device shall function at 140°F if electrically controlled. Any electrical dampers shall remain open for passive ventilation under normal conditions.

9.8 Ducts

9.8.1. If used, exhaust ducts shall have a three-hour fire resistance rating.

9.8.2. Exhaust ducts shall extend from the vault to the outside of the building.

9.8.3. Exhaust ducts shall be used exclusively for vault ventilation.

9.8.4. No fire dampers shall be installed in exhaust ducts.

10. Drainage

10.1 Drains are prohibited in all in-building vaults.

10.2 Sumps

10.2.1. All in-building vaults shall have a dry sump.

10.2.2. Network and Network-Ready: The sump shall have a minimum capacity of 8 cubic ft.

10.2.3. Looped Radial (URD): The sump shall have a minimum capacity of 2.25 cubic ft.

10.2.4. Sumps shall have an opening with 18 in minimum in both length and width and have a depth of at least 12 in.

10.2.5. Sumps shall be equipped with a removable galvanized steel grate that is flush with the floor and capable of supporting 400 lb.

10.2.6. Sumps shall have a grouted bottom.

10.2.7. At least one sump shall be located near the personnel door but not in the equipment access path or in front of the door.

10.2.8. The floor shall slope at least 1/2 inch in ten ft towards the sump.
11. Pipes and Ducts (Water Pipes and Accessories)

11.1 No pipes or foreign ducts shall pass or enter the in-building vault.

11.2 Electrical conduits terminating in the vault shall be sealed with a listed three-hour fire rated material.

12. Storage in Vaults

12.1 No material shall be stored in any in-building vault.

13. Sprinkler Systems

13.1 Sprinkler systems shall not be installed within an in-building vault.

13.2 In-building vaults shall be maintained in a dry condition.

14. Heat Sensors

14.1 If used, heat sensors shall be located near the door, away from electrical penetrations and equipment. All conduit and associated boxes shall be embedded in the concrete structure. Confirm locations with the inspector prior to rough-in.

14.2 The sensor shall be able to be tested from outside the vault without an SCL standby.

15. References

SCL Construction Standard 0257.06; “Ceiling Channel for In-Building Vaults”

SCL Construction Standard 0751.49; “In-Building Transformer Vault Doors”

SCL Construction Standard 0751.60; “Concurrent Customer Requirements for In-Building Transformer Vaults”

NFPA 70 - NEC; National Electrical Code; 2008

Requirements for Electric Service Connection (RESC); Seattle City Light, 2007

Seattle Building Code; Section 422; 2006

16. Sources

Hanson, Brett; SCL Standards Engineer and subject matter expert for 0751.00 (brett.hanson@seattle.gov)

Edwards, Tommy; SCL Electrical Reviewer and subject matter expert for 0751.00 (tommy.edwards@seattle.gov)


SCL Construction Guideline U2-8 (canceled); “In-Building Transformer Vaults (Non-Network Area)”

SCL Construction Guideline U10-2 (canceled); “Transformer Service Vaults and Padmounts, Customer’s Responsibility, Outside Network Area”

SCL Construction Guideline U10-2.1 (canceled); “Transformer Service Vault, In-Building, Dry, Outside Network Area”

SCL Construction Guideline U10-2.2 (canceled); “Transformer Service Vault In-Building, With Outdoor, Below Ground Access, Outside Network Area”
In-Building Transformer Vault Doors

1. Scope

This standard details the performance and hardware requirements for in-building vault doors.

2. Application

This standard applies to all new and retrofit doors for vaults in the Network and Looped Radial systems. This standard will be used by building owners and their contractors as well as Seattle City Light (SCL) engineers, crews, and inspectors.

3. Industry Standards

Vault doors shall meet the applicable requirements of the following industry standards:

- ANSI/BHMA A156.3-2008; Exit Devices
- ANSI/BHMA A156.4-2014; Door Control-Closers
- NFPA 80; Standard for Fire Doors and Other Opening Protection
- UL 10C; Standard for Positive Pressure Fire Tests of Door Assemblies
- UL 1784; Air Leakage Tests of Door Assemblies

Standards Coordinator
Brett Hanson

Standards Supervisor
John Shipek

Unit Director
Darnell Cola
4. Definitions

**Active leaf or active door** – the door in a double-door assembly that is actively used. The active leaf contains the lock and door handle.

**Astragal** – a molding or strip whose purpose is to cover or close the gap between the edges of a pair of doors. The astragal can help prevent lock picking.

**Construction core** – a small format, interchangeable core for temporary use prior to vault acceptance when a permanent core will be installed.

**Coordinator** – a device used on a pair of doors to ensure that the inactive leaf is closed before the active leaf. A coordinator is necessary when an astragal is present on a set of double doors and an exit device is installed on the inactive door.

**Dogged / dogging** – manually securing the crash bar in the unlocked position from inside the room.

**Inactive leaf or inactive door** – the door in a double-door assembly that does not contain a lock, but is bolted when closed, and to which the strike is fastened to receive the latch or bolt of the active door.

**Leaf** – each of the two doors that make up a double-door assembly.

**Storeroom function** – door hardware is always in locked position and opening requires a key.

5. General Requirements

5.1 Doors and Frames

All doors shall be NFPA 80 Class A and have a 3-hour fire rating and be compatible with the installed hardware. In-building vault doors shall not have any vents or other types of openings. All doors shall be painted to prevent corrosion.

All single doors shall swing out 120 degrees from the vault opening. All double doors shall swing out 180 degrees from the vault opening. Door swing shall be protected by bollards if vehicles or mobile equipment could enter the door swing area.

In an existing vault where new hardware is being installed in a reused door, cover unused holes with material that maintains the fire rating and security requirements outlined in this standard and satisfies the requirements of the Authority Having Jurisdiction (AHJ).

Head and jamb frame throats shall be treated with a bituminous coating. Frame cavity shall be filled with grout.

5.2 Door Hardware

5.2.1. Hinges

Hinges shall be extra heavy-weight steel or stainless steel with bearings and non-removable pins. Furnish and install a minimum of one hinge for every thirty inches of door height.

Hinges shall be one of the following products or an equal approved by SCL prior to construction:

- McKinney T4A3786 4-1/2 x 4-1/2 NRP US26D (steel for interior conditioned spaces)
- McKinney T4A3386 4-1/2 x 4-1/2 NRP US32D (stainless steel for exterior and unconditioned spaces)
5.2.2. Locks

Locks shall be ANSI A156.3-Grade 1, fire-rated exit devices.

Mortise-type locks shall be used for single doors.

Mortise-type locks shall be used for the active leaves of door pairs. Surface vertical rod-type locks shall be used for the inactive leaves of door pairs.

Double-door assembly shall include overlapping astragals, coordinators, and carry bars.

For 7-ft high doors, there shall be one guide for the bottom rod and one guide for top rods. For doors over 7 ft high, there shall be one guide for the bottom rod and two guides for top rods.

The pull side trim shall be a pull type. On pairs, only the active leaves shall have pull trim.

Doors shall be equipped with panic bars that are normally latched but open under simple pressure, never binding.

For larger doors, supply Grade 1 fire-rated exit devices that are listed for use with those door dimensions. Confirm manufacturer and product numbers prior to ordering.

Locks shall be one of the following products or an equal Grade 1 lock approved by SCL prior to construction:

**Single doors**

- Sargent 12-8904 (x MAL or 824 pulls) 72-41 US32D (storeroom function locks with anti-pick function). Single door locks shall be kept locked at all times.

**Door pairs**

- Sargent 12-8904 72-41 US32D (x MAL or VRT26 Rockwood pulls cut short on edge for fit with astragal) for active leaves (storeroom function locks with anti-pick function). Door pair locks shall be kept locked at all times.
- Sargent 12-8710 (exit only, no pulls) US32D. This lock shall be used for inactive leaves.

Construction cores shall be furnished and installed by the building owner prior to vault acceptance. The owner shall provide adequate keys (two minimum) for the construction phase.

Permanent cores, SFIC 7-Pin Best type, will be supplied and installed by SCL.

5.2.3. Door Closers

Door closers shall be ANSI A156.4-Grade 1, parallel arm application with heavy duty rigid arms.

Door closers shall be one of the following products or an equal approved by SCL prior to construction:

- Norton PR7500 689
- Sargent 351-P10 EN (25-year warranty)

5.2.4. Astragals

Overlapping astragals are required on the active leaf of pairs.

Astragals shall be Pemko 357SP or an equal approved by SCL prior to construction. See Figure 5.2.4.
5.2.5. Coordinators

Door coordinators shall be installed for all door pairs. Soffit plates shall be attached. Soffit plates shall be Rockwood 2601 AB or C soffit plate brackets or an equal approved by SCL prior to construction. See Figure 5.2.5.

Figure 5.2.5. Door Coordinator

Coordinators shall be one of the following products or an equal approved by SCL prior to construction:
- Rockwood 2600 Series with wear plates on door faces
- Rockwood 2672 for doors with a 72-in opening width

5.2.6. Carry Bars

Carry bars shall be installed for all door pairs. Carry bars shall be Rockwood 1100 or an equal approved by SCL prior to construction. See Figure 5.2.6.

Figure 5.2.6. Carry Bar

5.2.7. Wall Stops

Wall stops shall be installed where necessary to cushion the contact between trim and the wall. Wall stops are not required for doors without pull side trim. For example, wall stops are not required for the door leaf of a pair that does not have trim. Wall stops shall be Rockwood 400 US26D or an equal approved by SCL prior to construction.
5.2.8. Gasketing

Gasketing shall be provided including self-adhesive backing on frame stops and the edge of active leaves of pairs. Gasketing shall be fire rated in accordance with UL 10C and smoke tested in accordance with UL 1784. Gasketing shall be Pemko S88D or an equal approved by SCL prior to construction.

6. Testing and Acceptance

6.1 Single Door Testing

The following functionality will be tested and confirmed by SCL prior to vault acceptance:

- Small format interchangeable cylinder, 7-pin is installed
- Lockset installed is Storeroom Function and always in the locked position
- Crash bar allows free egress and is never binding
- Door closer pulls the door to latch every time from every position
- Anti-pick function of the lock works
- Panic hardware dogging function is not installed
- Daylight is not visible around the door when the door is closed from the inside of the room

6.2 Double Door Testing

The following functionality will be tested and confirmed by SCL prior to vault acceptance:

- Small format interchangeable cylinder, 7-pin, is installed
- Lockset installed is Storeroom Function and always in the locked position
- Crash bar allows free egress and is never binding
- Door closer pulls the door to latch every time from every position
- Anti-pick function of the lock works
- Panic hardware dogging is not installed
- Daylight is not visible around the door when the door is closed from the inside of the room
- Vertical rods are adjusted properly so that they:
  - Drop deep enough to catch and hold.
  - Retract high enough for a smooth, safe exit.
- Door coordinator functions regardless of which door is used to exit, and the carry bar is installed properly
- Astragal does not prevent exiting from fixed leaf

7. References

SCL Construction Standard 0751.00; “Customer Requirements, In-Building Transformer Vaults, Network and Looped Radial System”

8. Sources

Hanson, Brett; SCL Standards Engineer, subject matter expert, and originator of 0751.49 (brett.hanson@seattle.gov)
Concurrent Customer Requirements, In-Building Transformer Vaults

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1. Scope

This standard covers requirements for in-building transformer vaults. The topics addressed are listed in the Table of Contents above.

This standard shall be used in conjunction with Seattle City Light (SCL) 0751.00 which states and discusses other requirements, including Accessibility, Location, Construction (Walls, Roof, and Floors), Doorways and Openings, Ventilation, Drainage, Pipes and Ducts, Storage in Vaults, and Sprinkler Systems.

Network-ready vaults shall meet Network vault requirements.

This standard does not apply to in-building vaults that contain switchgear.

2. Application

This standard lists the SCL requirements for in-building vaults. An in-building vault is required if (1) the customer’s electrical load exceeds the limits listed in Requirements for Electrical Service Connection, Table 5-1, and (2) the customer cannot provide exterior space for the installation of SCL transformers and associated equipment of the project premises.

This standard is for use by customers and SCL engineering, customer service, inspection, review, and operations personnel.
3. Conflict

Where conflict exists the following order of precedence shall apply:

1. Project-specific Customer Requirements Package, including the Service Construction Letter and Drawing
2. SCL 0751.00
3. Seattle Building Code, 2006, Section 422 (within the city of Seattle)
4. SCL 0751.60
5. Other SCL construction standards
6. SCL Requirements for Electric Service Connection (RESC), 2007
7. Other industry standards

4. SCL Project-Specific Requirements

When necessary, Seattle City Light Engineering will provide the following project-specific requirements for in-building vaults:

4.1 Minimum vault dimensions, including the height of ceilings
4.2 Direction and location of ceiling channel
4.3 Location and number of vault pulling irons
4.4 Locations for transformer seismic anchors
4.5 Locations and number of ground rods
4.6 Location, size, and number of doors
4.7 Required air flow for vault ventilation (in CFM)
4.8 Location and type of customer’s service connection (Service Entrance)
4.9 Routing of high voltage conduit from the SCL distribution system to the customer’s in-building vault, including conduit on poles

5. Other Agency Requirements

5.1 Before a customer can be connected to the SCL electrical system, the building electrical system must pass electrical inspection by the Authority Having Jurisdiction. (Refer to the agency issuing the electrical permit.)

5.2 Before a customer can be connected to the SCL electrical system within the City of Seattle, the in-building vault must pass vault inspection by the Department of Planning and Development inspector.

5.3 The customer is responsible for the in-building vault to satisfy applicable laws, ordinances, and requirements regarding sound and vibration levels. (Refer to the Washington Administrative Code, King County Ordinances, and city ordinances)
6. Required Customer Submittals

In addition to the submittals required in the SCL Application for Electric Service packet, the following submittals must also be received and approved by SCL before construction of the in-building vault room:

6.1 The customer’s in-building ventilation system shall be designed by a qualified HVAC consultant.

6.2 The customer shall submit drawings showing the design of the in-building vault ventilation system, including intake and exhaust, fans, louvers, dampers, thermostats, air flow direction, etc. Location of all devices and apparatus shall be shown on a plan drawing.

6.3 All topics addressed in the SCL project-specific requirements section shall be shown on customer drawings of the in-building vault room.

7. SCL Required Points of Inspection

Before a customer can be connected to the Seattle City Light electrical system, Seattle City Light personnel must inspect and approve:

7.1 Vault Construction per SCL Construction Requirements Package and SCL Construction Standards and Construction Guidelines.

7.2 Grounding

7.2.1. Grounding resistivity shall be 25 ohms or less

7.2.2. Exothermic welds, if any, before they become inaccessible

7.3 Duct Bank Installation

7.3.1. Trench

7.3.2. Bedding

7.3.3. Backfill

7.4 Conduits

7.4.1. Cleaning and mandreling

7.4.2. Pull Tape installation

8. Easements

8.1 Seattle City Light requires an easement if SCL equipment is needed to serve more than one parcel and that equipment is located on private property. In that case, an easement is required over the entire area in which the SCL distribution system will be located.

8.2 If required, a new easement must be secured, or the customer shall provide proof of an existing easement to Seattle City Light before the service will be connected.

8.3 The easement document is prepared separately from the project specific Customer Requirements Package.
9. General Requirements

Figure 9a. Preferred Layout for a Loop Radial In-Building Transformer Vault
9.1 In-building vaults shall be dry spaces, and no standing water shall accumulate in the vault. The customer shall take adequate measures to prevent water from entering the in-building vault via wall, floor, or ceiling penetrations or via seepage. It is the responsibility of the customer to maintain the vault as a dry space.

9.2 The vault is not to be used for any other purpose except for SCL electrical distribution equipment.

9.3 The vault shall conform to the requirements of Figure 9a or Figure 9b.

10. Vault Grounding

10.1 General Requirements

10.1.1 A driving head shall be used to prevent damage to the ground rod threads.

10.1.2 The space between the rods and the floor shall be caulked and grouted to prevent the entrance of water.

10.1.3 The grounding electrode system shall be constructed to ensure it has a resistance to ground of 25 ohms or less prior to connecting the neutral or service. SCL shall test to confirm compliance. If the electrode system does not result in a resistance to ground of
10.2 Vaults with Floor Contacting Soil

10.2.1. Grounding for the vault shall consist of four, 5/8 inch by 8-foot copper-clad steel ground rods (Stock No. 564238 or equal) driven into compacted soil near the corners of the vault. See SCL 6762.25.

10.2.2. Each rod shall be placed 6 inches (plus/minus 1/2 inch) from the walls.

10.2.3. Rods shall extend 6 inches above the vault floor.

10.3 Vaults with Floor Not Contacting Soil

10.3.1. Grounding for the vault shall consist of four, 5/8 inch by 8 foot copper-clad ground rods, driven into compacted soil within 50 feet of the vault floor and within the building footprint. Exact location will be shown on project specific drawing. Ground rod connections shall be by exothermic weld. See SCL 0468.90.

10.3.2. Ground rods shall be spaced a minimum of 8 feet apart.

10.3.3. Install one 500 kcmil, 600 V insulated copper, soft drawn, concentric-stranded conductor, to each pair of the ground rods. These two 500 kcmil conductors shall extend 6 feet into the vault from opposite corners. Each conductor shall be attached to each pair of ground rods with an exothermic weld.

10.3.4. The two grounding conductors shall be kept 8 feet apart from each other and be electrically isolated from any other electrical ground cable and building steel.

10.3.5. Outside the vault, the grounding conductors shall be embedded in the concrete building structure with a minimum of 4 inches of cover.

11. Vault Lighting

11.1 For Looped Radial vaults, the customer shall install vault lighting and receptacles per SCL 0674.06.

11.2 For Network vaults, SCL shall install vault lighting and receptacles.

11.3 SCL will connect the power for the lights and receptacles.

12. Vault High Voltage (Primary) Entrance

12.1 General Requirements

12.1.1. All conduit bends shall be rigid galvanized steel.

12.1.2. Provide and install conduits from the customer vault to the utility’s facility specified by the SCL engineer.

12.1.3. For Looped Radial vaults, a maximum of three 90-degree bends (a maximum of 270 degrees of bends total) are allowed in the primary conduit run.

12.1.4. For Network vaults, a maximum of 180 degrees of bend is allowed in the primary conduit run.

12.1.5. After conduit installation, the conduit shall be cleaned and mandreled per SCL U2-11.40/NDK-40.

12.1.6. Install a pulling hand-line and marking tape. See SCL 0222.02 and U2-11.40/NDK-40.
12.2 Conduit in Right-of-Way and Easements

12.2.1. Install and terminate below-grade conduit in Public Right-of-Way and Easements per SCL 0214.00 and 0222.02.

12.2.2. Provide and install conduit risers on pole per SCL 0224.34. Exact location shall be included in the project specific Customer Requirement Package.

12.3 Conduit on Private Property, including within the in-building vault

12.3.1. Install below-grade conduit on private property per SCL 0224.05.

12.3.2. Starting at one foot outside the building and continuing into the vault, conduit shall be rigid galvanized steel conforming to SCL 7050.05. Conduits shall be isolated from building steel.

12.3.3. Conduit shall be encased within a minimum of 6 in of concrete within building. Red dye shall be added at the equivalent of 4 lb of red oxide per cubic yard. Maximum aggregate size shall not exceed 3/8 in.

12.3.4. If surface of concrete encased conduit bank is visible within building it must be visibly marked with permanent “DANGER—High Voltage” signs over the concrete encased conduit bank’s entire path within building to vault. Letters shall be 2 inches tall minimum. Install signs once per room and every 10 ft.

12.3.5. High voltage or primary entrances into vaults are cables in conduits.

12.3.6. Conduits entering the vault shall be supplied with closing plugs.

12.3.7. Conduit shall enter the vault perpendicular to the vault wall no more than 18 inches from the adjacent wall. Conduits shall be terminated flush to the wall.

12.3.8. A minimum of 6 inches shall be required between the closest edge of the conduit and the adjacent ceiling or walls. A minimum of 18 inches shall be required between the closest edge of the conduit and the floor.

12.3.9. Conduits entering the vault shall be provided and installed with end bells conforming to SCL 7055.09 and shall be grouted both inside and outside the vault per SCL U2-11.3/NDK-30.

12.3.10. Conduits entering the same vault corner but on adjacent walls shall be staggered and shall not enter at the same elevation.

12.3.11. Conduits entering through the floor shall extend 8–10 in above the floor.

12.3.12. Conduits shall be effectively bonded prior to vault entry. Connect ground clamp (Stock No. 676286) to a #2 AWG insulated copper bonding jumper and extend into the vault. Conductor shall extend into the vault and be long enough to reach the floor plus 5 feet of coiled conductor.
13. Customer’s Service Connection (Service Entrance)

13.1 General Requirements

13.1.1. Seattle City Light prefers that the customer provide NEC-sized bus duct into the in-building vault. NEC-sized cables in conduit are also acceptable.

13.1.2. All service entrance penetrations shall be sealed, including bus duct, conduits, and cables.

13.1.3. Rotation of service bus bars or cables shall be clearly identified by the customer and in case of multiple services, it shall be consistent across all services.

13.1.4. Each service shall be labeled. Include the service and ampacity.

13.2 Service Entrance using Bus Duct

13.2.1. Provide and install NEC-sized secondary bus duct into the vault per SCL 0474.08. Bus duct penetrations shall not exceed bus duct dimensions by more than 2 inches (width or height).

13.2.2. Brace and support the bus duct.

13.2.3. Label each bus bar for phasing.

13.2.4. For multiple bus ducts, label each bus duct with the service being fed, phasing, and ampacity.

13.2.5. The bus duct is centered on the wall.

13.3 Service Entrance using Cables in Conduit

13.3.1. Provide and install NEC-sized service conduits and cable from switchgear into vault per SCL 0473.50. Customer shall furnish cable limiters.

13.3.2. Conduits entering the vault shall be supplied with closing plugs.

13.3.3. Conduit shall enter the vault perpendicular to the vault wall no more than 18 inches from a corner.

13.3.4. Conduits entering the vault shall be provided and installed with PVC end bells and shall be grouted both inside and outside the vault per SCL U2-11.3/NDK-30.

13.3.5. Conduits entering the same vault corner but on adjacent walls shall be staggered and not enter on the same elevation.

13.3.6. If conduit is entering through the floor, it shall extend 8–10 inches above the floor.

13.3.7. Label each cable to identify phasing.

13.3.8. If multiple services, label each set of cables with the service being fed.

13.3.9. Fire seal the cable installed in conduit for a three-hour rating using rated grout or fire-barrier caulk in order to protect migration of fire, smoke, and gas.


14.1 Install a permanent, weatherproof clear document enclosure box on the vault wall near the light switch or the thermostats.

14.2 The document enclosure shall be adequate for permanently storing 8-1/2 by 11-inch documents.
15. Requirements of Other Utilities

15.1 SCL construction standards and guidelines do not cover the installation of telecommunications or any other utility’s equipment serving a project.

15.2 Seattle City Light does not coordinate with other utilities for installations in the public right-of-way.

16. References

SCL Construction Standard 0222.02; “Requirements for Duct Banks in the Public Right-of-Way”

SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”

SCL Construction Standard 0224.34; “Steel Conduit Risers”

SCL Construction Standard 0468.90; “Exothermic Connection System”

SCL Construction Standard 0473.50; “Looped Radial and Network Service Entrance Cables in Conduit”

SCL Construction Standard 0474.08; “Looped Radial and Network Dry Vault Service Entrance Bus Duct”

SCL Construction Standard 0674.06; “In-Building Vault Lighting and Receptacle Requirements, Looped Radial System”

SCL Construction Standard 0751.00; “Customer Requirements, In-Building Transformer Vaults, Network and Looped Radial Systems”

SCL Construction Guideline U2-11.3/NDK-30, “Termination of Existing Ducts in New Vaults or Manholes”

SCL Construction Guideline U2-11.40/NDK-40; “Mandreling and Cleaning of Ducts and Conduits”

SCL Material Standard 6762.25; “Ground Rods, Copper-Covered, Sectional”

SCL Material Standard 7050.05; “Zinc-Coated Steel Conduit and Fittings”

SCL Material Standard 7055.09; “DB120, PVC Conduit Fittings”

17. Sources

Edwards, Tommy; SCL Electrical Reviewer and subject matter expert for 0751.60 (tommy.edwards@seattle.gov)

Hall, Alan; SCL Engineer and subject matter expert for 0751.60 (alan.hall@seattle.gov)


Requirements for Electric Service Connection; Seattle City Light

SCL Construction Standard U2-10/NDK-50 (canceled); “Electrical Conduit and Facilities in Public Rights-of-Way”

SCL Construction Guideline U2-8 (canceled); “In-Building Transformer Vaults (Non-Network Area)”

SCL Construction Guideline U7-10/NDK-70 (canceled); “Conduit Risers on Poles”
SCL Construction Standard U7-10.2/NDK-90 (canceled); “Primary Conduit Riser Pole Base Detail”

SCL Construction Guideline U10-2 (canceled); “Transformer Service Vaults and Padmounts, Customer’s Responsibility, Outside Network Area”

SCL Construction Guideline U10-2.1 (canceled); “Transformer Service Vault, In-Building, Dry, Outside Network Area”

SCL Construction Guideline U10-2.2 (canceled); “Transformer Service Vault In-Building, With Outdoor, Below Ground Access, Outside Network Area”

SCL Construction Guideline U2-8 (canceled); “In-Building Transformer Vaults (Non-Network Area)”


Siddiqi, Uzma: SCL Standards Engineer, subject matter expert, and originator of 0751.60 (uzma.siddiqi@seattle.gov)
In-Building Vault Equipment Clearances

1. Scope

This standard covers the requirements for minimum working spaces around electrical equipment to be installed in Seattle City Light (SCL) Network and Looped Radial (URD) in-building vaults. This standard should be used to evaluate the site-specific equipment layout and size of in-building vaults.

2. Application

The intended audience for this standard is SCL engineers, electrical service engineers and representatives, and customer engineering consultants who are involved with the planning and construction of in-building vaults.

3. Discussion

SCL in-building vaults present arc flash and exposed live parts hazards to the crews that construct and maintain them. The purpose of this standard is to define working spaces for crews to perform work during three distinct phases of operation:

1. Initial vault construction
2. Periodic electrical equipment maintenance while the vault is energized
3. Major equipment maintenance or removal when the vault may or may not be energized
Acronyms used in this section include:

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSB</td>
<td>Customer Service Bus (or bus duct)</td>
</tr>
<tr>
<td>WMB</td>
<td>Wall Mounted Bus</td>
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<tr>
<td>BTS</td>
<td>Bus Tie Switch</td>
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<tr>
<td>XFMR</td>
<td>Transformer (acronym used in tables but not in text)</td>
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<td>IWCB</td>
<td>Integral Web Channel (or Collector) Bus</td>
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<td>NP</td>
<td>Network Protector</td>
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<tr>
<td>HVAC</td>
<td>Heating Ventilation and Air Conditioning</td>
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</tbody>
</table>

### 3.1 Width of Working Space

Working space widths are summarized in Table 3.1. Distances are horizontal (regardless of elevation) and are given from the nearest edge of the equipment. This is because the CSB and WMB have exposed live parts on all sides.

If there are elevation changes within the vault that require stairs or landings, additional working space will be required.

<table>
<thead>
<tr>
<th>See Figure</th>
<th>CSB</th>
<th>WMB</th>
<th>Adjacent Wall</th>
<th>Column</th>
<th>HVAC Grille</th>
<th>Door</th>
<th>BTS</th>
<th>IWCB</th>
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<td>6</td>
</tr>
<tr>
<td>WMB</td>
<td>3.4b</td>
<td>6</td>
<td>N/A</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>N/A</td>
<td>4</td>
</tr>
</tbody>
</table>

### 3.2 Depth of Working Space

Working space depths are summarized in Table 3.2. Distances are horizontal (regardless of elevation) and are given from the nearest edge of the equipment because the CSB and WMB have exposed live parts on all sides. Transformers have exposed live parts at their ends where primary and secondary connections are made.

If there are elevation changes within the vault that require stairs or landings, additional working space will be required.

<table>
<thead>
<tr>
<th>See Figure</th>
<th>CSB</th>
<th>WMB</th>
<th>Opposite Wall</th>
<th>Column</th>
<th>HVAC Grille</th>
<th>Door</th>
<th>BTS</th>
<th>IWCB</th>
<th>Cables in Conduit</th>
<th>XFMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSB</td>
<td>3.3b</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>1.5</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>IWCB</td>
<td>3.5b</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>N/A</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>XFMR</td>
<td>3.6b, 3.7b</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
3.3 Customer Service Bus (CSB) Working Space

The CSB connects SCL’s in-building vault bus to the customer’s main switchboard for service. See Figure 3.3a.

The CSB connects to the Integral Web Channel (or Collector) Bus (IWCB) using heavy cables overhead and requires a lift to train and connect the cables.

The CSB requires side access to make connections, so working space is required in Table 3.1 to enable a worker to stand next to the CSB. See Figures 3.3b and 3.3c.

Figure 3.3a. CSB

Figure 3.3b. CSB Working Space, Plan View
Figure 3.3c. CSB Working Space, Elevation

Note: HVAC grille clearance can be reduced for intake grilles per the figure above. See additional requirements in SCL 0751.00.
3.4 Wall Mounted Bus (WMB) Working Space

When only a small service is required, a WMB might be installed instead of an IWCB. The WMB connects SCL’s in-building vault transformers to the customer service bus using cables. See Figure 3.4a.

The WMB connects to the transformers and CSB using heavy cables overhead and requires a lift to train and connect the cables.

The WMB requires side access to make connections. Therefore, working space as defined in Table 3.1 is required to enable a worker to stand next to the WMB. See Figure 3.4b.

Figure 3.4a. WMB

Figure 3.4b. WMB Working Space, Plan View
3.5 Integral Web Channel Bus (IWCB) Working Space

The IWCB connects SCL’s in-building vault transformers to the customer service bus using cables. See Figure 3.5a.

The IWCB connects to the transformers and CSB using heavy cables overhead and requires a lift to train and connect the cables.

The IWCB requires side access in each direction to make connections. Therefore, working space as defined in Table 3.1 is required to enable a worker to stand next to the IWCB. See Figure 3.5b.

**Figure 3.5a. IWCB**

![IWCB](image1)

**Figure 3.5b. IWCB Working Space, Plan View**

![Plan View](image2)
3.6 Network Transformer Working Space

The Network transformer connects SCL’s in-building vault primary service to the customer 480 V or 208 V service bus using cables, WMB, or IWCB. See Figure 3.6a.

The transformer connects to the primary service and IWCB using heavy cables overhead and requires a lift to train and connect the cables. The primary side of the transformer contains a switch to disconnect the unit when it is de-energized. Therefore, workers need space in front of the switch to operate it.

The secondary side of a Network transformer has a Network Protector (NP) mounted to it. The NP is a three-phase breaker intended to disconnect power when a fault is detected. The NP has a door that swings out 90 degrees and components that rack out for periodic maintenance. Therefore, working space is required in front of it. See Table 3.2.

Each transformer is mounted to seismic rails which are anchored or welded to the floor in the vault to prevent movement or damage during a seismic event. These rails extend 4 inches past the case or radiator fins of the transformer. Three feet of clearance between transformers is required from anchor to anchor so that a lift can be moved between transformers. See Figure 3.6b.

Figure 3.6a. Network Transformer
Figure 3.6b. Network Transformer Working Space, Plan View
3.7 Looped Radial Transformer Working Space

Transformers connect the SCL in-building vault primary service to the customer 480 V or 208 V service bus using cables. See Figure 3.7a.

The transformer connects to the primary service and customer gear using heavy cables overhead and requires a lift to train and connect the cables.

Each three-phase transformer is mounted to seismic rails, which are anchored or welded to the floor in the vault to prevent movement or damage during a seismic event. These rails extend 4 inches past the case or radiator fins of the transformer. Three feet of clearance between transformers is required from anchor to anchor so that a lift can be moved between transformers. See Figure 3.7b.

For single-phase (cylindrical type) transformer installations, see figures 3.7c and 3.7d.

Figure 3.7a. Looped Radial Three-Phase Transformer
Figure 3.7b. Looped Radial Three-Phase Transformer Working Space, Plan View

Figure 3.7c. Looped Radial Single-Phase Transformer Working Space, Plan View
Figure 3.7d. Looped Radial Multiple Single-Phase Transformer Working Space, Plan View

4. References

SCL Construction Standard 0751.00: “Customer Requirements, In-Building Transformer Vaults, Network and Looped Radial Systems”

5. Sources

Arya, Shayan; SCL Network Engineer and subject matter expert for 0751.77 (arya.shayan@seattle.gov)

Edwards, Tommy; SCL Inspector, originator and subject matter expert for 0751.77 (tommy.edwards@seattle.gov)

Hanson, Brett; SCL Standards Engineer, subject matter expert for 0751.77 (brett.hanson@seattle.gov)

Kuhnly, Steve; SCL Network Crew Chief and subject matter expert for 0751.77 (steve.kuhnly@seattle.gov)

Legall, Gerard; SCL Electrical Service Engineer and subject matter expert for 0751.77 (Gerard.legall@seattle.gov)
Customer Requirements for Underground Residential Service Entrance, Single or Dual Meters

1. Scope

This standard covers Seattle City Light (SCL) requirements for the permanent installation of underground residential service entrances to a single or dual meter, for 200A and 320A, on private property.

The service entrance includes risers, the meter socket, and the meter enclosure.

Refer to the SCL “Requirements for Electrical Service Connection” (RESC) for general information and request for underground secondary service.

Refer to SCL 0224.01 for additional information related to customer requirements for underground secondary service.

Service termination facilities for three or more meters are outside the scope of this standard. See SCL 1561.07.

2. Application

This standard is for use by SCL customers, engineers, electric service representatives, and operations personnel.

3. Conflict

Where conflict exists between requirements, the following order of precedence shall apply:

1. Project-specific Customer Requirements Package, including the service construction drawing
4. Requirements

4.1 General

The legal service termination point shall be at the meter enclosure.

SCL shall determine the service point (the point in the right-of-way where the customer service conduit is terminated).

The customer shall provide and install one 3-inch conduit from the meter enclosure to the service point per SCL 0224.01.

The customer shall provide and install all service entrance equipment per this standard, the Customer Requirements Package, and the RESC.

The customer is responsible for ensuring against entry of water into the building, into or through service equipment, or other location where the entry of water could be considered a problem.

Direct buried conductors shall not be allowed.

All service secondary risers into the meter enclosure shall be rigid galvanized steel (RGS).

All conduits shall be 3 inches in diameter.

All 90-degree bends shall have a 36-inch radius.

Where meter location presents a potential for damage, the meter shall be recessed in the wall or protected with bollards to meet the clearance requirement (see Section 4.3).

A pulling handhole shall be required to reduce length of conduit run to 150 feet or less, or to reduce the number of conduit bends to 270° (equivalent to three 90° bends) or less.

Mandreling and cleaning of conduit shall be done per SCL U2-11.40/NDK-40. This includes pulling-tape requirements.

Manual bypass meter sockets are encouraged but not required. If a manual bypass is installed, the bypass section shall be accessible to SCL.

Services with provisions for alternate power sources shall be designed to eliminate any possibility of back feed into the distribution power system.

Only 200 A and 320 A four-terminal meter bases shall be allowed.

Meters shall be installed only in sockets which are level, plumb, and secured to a structural wall or pedestal.

Meters mounted on concrete or masonry walls shall be fastened by stainless or galvanized metal machine screws in lead sleeve, wedge-type expansion anchors or quick bolts.

Dual meter enclosures shall be permanently labeled with the residential unit served.
4.2 Mounting Height

Mounting height requirements shall be as shown in Table 4.2.

<table>
<thead>
<tr>
<th>Mounting Type</th>
<th>Height from Final Grade to Center of Meter (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Recessed (wall)</td>
<td>4</td>
</tr>
<tr>
<td>Surface (wall)</td>
<td>4</td>
</tr>
<tr>
<td>Pedestal</td>
<td>3</td>
</tr>
<tr>
<td>Dual meter (wall)</td>
<td>4</td>
</tr>
</tbody>
</table>

4.3 Clearances

Meters shall have an 18-in minimum clearance on both sides of the meter and a 36-in minimum clearance above the meter (measured from the center). This clearance is required for installation and maintenance.

Meters shall be installed no less than 36 inches from natural gas meters (measured from edge to edge).

Meters shall be installed with no less than 36 inches of working space in front of the meter or metering equipment (measured from the front of the meter glass).

Recessed-mount meter bases shall be similar to those shown in Figure 4.3a with the additional clearances shown in Figure 4.3b.

**Figure 4.3a. Clearance Requirements**
Notes:
1. The depth (D) of the exterior siding or façade shall not exceed 9 inches.
2. All recessed openings shall provide a 3-inch minimum gap around the meter enclosure to the outer wall and façade. The sealing ring shall not contact the wall or façade.

4.4 Wall-Mount Meters

Wall-mount meters include both surface-mount and recessed-mount types.

For single, 200 A meters, meter enclosure dimensions shall be, at a minimum, 11 in (W) by 14 in (H) by 4-1/2 in (D).

For single 320 A meters, meter enclosure dimensions shall be, at a minimum, 14 in (W) by 32 in (H) by 6 in.

4.4.1. Surface-Mount Meters

A minimum of two conduit straps shall be required to secure riser conduit to the structural wall with 1/4-in lag screws or equivalent.

Surface-mount meter service entrances shall be installed as shown in Figure 4.4.1.
Figure 4.4.1. Surface-Mount Meter Installation

Notes:
1. For meter heights above grade, see Table 4.2.
2. For meter enclosure, conduit, and bends requirements, see Section 4.1.

4.4.2. Recessed-Mount Meters

Recessed-mount meter service entrances shall be installed as shown in Figure 4.4.2.

Siding or exterior finish shall not contact the meter enclosure or sealing ring.

The riser shall be 3-in rigid steel.

Recessed-mount meters shall be readily removable.

Recessed-mount meters shall be visible (not hidden, covered, obstructed, camouflaged, or painted).
4.5 Wiring, Grounding, and Conduit Termination

For 200 A class sockets, the supply (line side) conduit shall enter through the left or the right knockout at the bottom of the meter enclosure.

The supply (line side) conductors to the meter socket shall be connected to the top terminals. The load conductors shall be connected to the bottom terminals. See Figure 4.5.

The load side wires shall enter through the side opposite to the supply conductor side and shall not block the path of the supply side conductors.

For 320 A class sockets, the supply conduit shall enter the center knockout at the bottom of the meter enclosure.

The neutral wire shall be grounded in the meter socket.

All meters, sockets, enclosures, and conduit shall be bonded and effectively grounded in accordance with NEC Article 250 and WAC 296-46B-250.
4.6 Pedestal Mount Meters

Pedestal mount meters consist of a 200 A configuration and a 320 A configuration.

This mounting option is for metering permanent residential loads where the meter location is NOT at the load location or structure. The conductors that run from the meter to the load location shall be installed, owned, and maintained by the property owner.

See Section 4.3 for clearance requirements.

Conduits straps shall be rigidly fastened to the post support with 1/4-in lag screws or equivalent.

A minimum of 4 inches of concrete shall be poured around the base of the pedestal. The poured concrete shall be crowned and tapered away from the post above final grade.

4.6.1. Pedestal-Mount Meters, 200 A

Meters shall be installed as shown in Figure 4.6.1.

The meter enclosure dimensions, shall be, at a minimum, 11 in (W) by 14 in (H) by 4-1/2 in (D).

The meter pedestal at a minimum, shall be a 6 in by 6 in by 10 ft fully pressure-treated wood post in a concrete-poured base.

The conduit termination shall enter through the left or the right knockout at the bottom of the meter enclosure. See Section 4.5.
Figure 4.6.1. Pedestal-Mount Meter, 200 A

Notes:
1. For mounting heights above grade, see Table 4.2.
2. For meter enclosure, conduit, and bends requirements, see Section 4.1.
4.6.2. Pedestal-Mount Meter, 320 A Configuration

Pedestal-mount meters for a 320 A configuration shall be installed as shown in Figure 4.6.2.

The meter enclosure dimensions shall be, at a minimum, 14 in (W) by 32 in (H) by 6 in (D).

The meter pedestal, at a minimum, shall consist of two 6 in by 6 in by 10 ft fully pressure-treated, ground contact posts in a concrete-poured base.

Figure 4.6.2. Pedestal-Mount Meter, 320 A

Notes:
1. For mounting heights above grade, see Table 4.2.
2. For meter enclosure, conduit, and bends requirements, see Section 4.1.

5. References


Requirements for Electrical Service Connection (RESC); Seattle City Light, latest reversion

SCL Construction Standard 0224.01; “Customer Requirements for Underground Secondary Service, Looped Radial System”

SCL Construction Standard 0224.05; “Requirements for Underground Services on Private Property”
SCL Construction Standard 1561.07; “Customer Requirements for Underground Secondary Service Termination Facilities”

SCL Construction Standard U2-11.40/NDK-40; Mandreling and Cleaning of Ducts”


6. Sources

Edwards, Tommy; SCL Electrical Reviewer and subject matter expert for SCL 1561.05; (tommy.edwards@seattle.gov)

Electric Utility Service Equipment Requirement Committee (EUSERC); “EUSERC Drawing 300”, www.euserc.com

National Electrical Safety Code (NESC) C2-2012 Edition; Institute of Electrical and Electronics Engineers (IEEE), 2011

National Electrical Manufacturers Association (NEMA) TC 2-2013; Electrical Polyvinyl Chloride (PVC) Conduit

Neuansourinh, Ponet; SCL Standards Engineer and originator of SCL 1561.05; (ponet.neuansourinh@seattle.gov)

Perander, Eivind; SCL North Distribution Supervisor and subject matter expert for 1561.05 (eivind.perander@seattle.gov)

SCL Construction Guideline DU13-4/NMT-30; “Meter Base Arrangements”

SCL Construction Guideline U12-1.3/NMT-10 (canceled); “Meter Location and Conduit Entrance Details for Secondary Underground Residential Service, Class 320 Maximum”

SCL Construction Guideline U12-5/NMT-20; “Meter Socket Connections and Conductor Identification, 200 Ampere Maximum”

SCL Work Practice 0035.13; “Voltage Zones”

UL414; “Underwriters Laboratories Standard for Meter Sockets”

WAC 296-45-325; “Working on or Near Exposed Energized Parts”; Washington Administrative Code
Customer Requirements for
Underground Secondary Service Termination Facilities

This standard outlines Seattle City Light (SCL) requirements for the permanent installation of underground secondary service termination facilities, including:

- Service termination enclosures
- Current transformers (CT) enclosures
- Switchboards
- Handholes

Underground secondary service termination points are only applicable to services located on private property, and where the SCL service point is located in the public right-of-way or SCL easement area.

Single- and dual-meter residential services up to 320 A are outside the scope of this standard. See SCL 1561.05.

Services where the customer provides a facility on private property to house SCL transformers are outside the scope of this standard.

2. Application

This standard is intended for use by customers and SCL engineering, electric service representatives (ESRs), and operations personnel.
3. Conflict

Where conflict exists between SCL requirements, the following order of precedence shall apply:

1. Project-specific Customer Requirements Package, including the Service Construction Drawing
2. SCL 1561.07
3. SCL Requirements for Electric Service Connection (RESC)
4. Other SCL standards

4. Requirements

All customer-installed equipment shall meet SCL requirements.

The service termination facility shall be provided and installed by the customer per the Customer Requirements Package and the RESC.

Customer-owned cable shall comply with the National Electrical Code (NEC) and shall be visibly marked at the point of termination (service point) to indicate phase and service being fed.

The service termination facility shall not be placed in depressions or low areas that tend to fill with water or silt. SCL strongly suggests that the service termination facility is located at an elevation above the elevation of the right-of-way in order to avoid water flowing into the building through service conduit(s). It is the customer’s responsibility to install conduits and equipment at elevations that prevent water from entering the building.

The conduit riser on the building shall be rigid galvanized steel. The conduit shall be securely fastened to a wall by a minimum of two conduit straps.

The 90-degree conduit bend under the service termination facility shall have the bell end toward the property line.

See Chapter 11 of the RESC for additional metering requirements.

5. Service Termination Requirements

Wall-mounted service termination facilities shall meet the requirements shown in Figure 5.
Figure 5. Wall-Mounted Service Entrance Requirements

5.1 Multi-Unit Meter Bank

A multi-unit meter bank is defined as three or more meters. These installations require a service termination enclosure. See Section 5.2.

5.2 Service Termination Enclosure

The minimum interior dimensions of a service termination enclosure are based upon the number of cables entering the enclosure. Table 5.2 shows required dimensions for service termination enclosures.

Table 5.2. Service Termination Enclosure Sizing

<table>
<thead>
<tr>
<th>Maximum Amps</th>
<th>Maximum NEC Wires from Customer</th>
<th>Size (W x H x D) (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>2</td>
<td>24 x 32 x 11</td>
</tr>
<tr>
<td>400</td>
<td>2</td>
<td>30 x 36 x 11</td>
</tr>
<tr>
<td>600</td>
<td>3</td>
<td>36 x 36 x 11</td>
</tr>
<tr>
<td>600</td>
<td>2</td>
<td>36 x 36 x 11</td>
</tr>
<tr>
<td>1000</td>
<td>4</td>
<td>48 x 48 x 11</td>
</tr>
</tbody>
</table>
Conduits shall enter near the corners of the service termination enclosure but not through the back of the enclosure. Conduits shall not enter the same corner of the enclosure from two directions.

Conduits shall not enter the building more than 18 inches.

### 5.3 Current Transformer Enclosure

Install a CT enclosure that meets the requirements found in the RESC, Chapter 11.

The minimum interior dimensions are based on the service size. Table 5.3 shows required dimensions for current transformer enclosures.

**Table 5.3. Current Transformer Enclosure Sizing**

<table>
<thead>
<tr>
<th>Maximum Service</th>
<th>Size (W x H x D) (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-phase, 400 A</td>
<td>24 x 48 x 11</td>
</tr>
<tr>
<td>Single-phase, 600 A</td>
<td>36 x 48 x 11</td>
</tr>
<tr>
<td>Three-phase, 800 A</td>
<td>36 x 48 x 11</td>
</tr>
</tbody>
</table>

A switchboard termination is required for current transformers rated above 800 amperes.

### 5.4 Handhole

A handhole used as a service termination facility shall be installed at the location shown on the SCL Site Plan of the Customer Requirements Package.

The handhole type shall be provided, installed, and grounded by the customer per SCL 0224.01.
The minimum interior dimensions are based upon the number of cables entering the handhole. Table 5.4 shows required dimensions for service termination handholes.

Table 5.4. Handhole Sizing

<table>
<thead>
<tr>
<th>Maximum Service</th>
<th>Maximum NEC Wires from Customer</th>
<th># of Sets</th>
<th>kcmil</th>
<th>Size (W x L x D) (in)</th>
<th>Material</th>
<th>Material Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-phase, 600 A</td>
<td>3</td>
<td>4/0</td>
<td>17 x 28 x 24</td>
<td>Concrete</td>
<td>7203.10</td>
<td></td>
</tr>
<tr>
<td>Single-phase, 600 A</td>
<td>3</td>
<td>4/0</td>
<td>17 x 30 x 24</td>
<td>Fiberglass</td>
<td>7203.12</td>
<td></td>
</tr>
<tr>
<td>Single-phase, 600 A</td>
<td>4</td>
<td>4/0</td>
<td>30 x 30 x 24</td>
<td>Concrete</td>
<td>7203.04</td>
<td></td>
</tr>
<tr>
<td>Three-phase, 1000 A</td>
<td>4</td>
<td>350</td>
<td>24 x 36 x 36</td>
<td>Concrete</td>
<td>7203.08</td>
<td></td>
</tr>
<tr>
<td>Single-phase, 1000 A</td>
<td>4</td>
<td>350</td>
<td>24 x 36 x 36</td>
<td>Fiberglass</td>
<td>7203.12</td>
<td></td>
</tr>
<tr>
<td>Three-phase, 1000 A</td>
<td>4</td>
<td>500</td>
<td>48 x 48 x 48</td>
<td>Concrete</td>
<td>7203.26</td>
<td></td>
</tr>
</tbody>
</table>

Precast concrete handholes are allowed in walkways, sidewalks, and areas subject to minor, incidental vehicular traffic.

Composite fiberglass handholes shall only be located in landscaped areas.
6. Conduits

Conduits shall be installed from the service termination point to an SCL distribution facility per SCL 0224.01. See the project-specific requirements package for the location of the distribution facility.

If the SCL distribution facility is located across the street, two conduits shall be required.

Customer shall provide conduits per Table 6.

<table>
<thead>
<tr>
<th>Maximum Service</th>
<th>No. of Conduits</th>
<th>Size (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-phase, 400 A</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Single-phase, 600 A</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Three-phase, 600 A</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Three-phase, 1000 A</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

7. Service Conduits and Cables

Customers are responsible for providing National Electrical Code (NEC)-sized service conduits and cables from the service termination point to the customer’s switchgear. Table 7 shows allowable conductor sizes.

<table>
<thead>
<tr>
<th>Conductor Size</th>
<th>Copper Concentric Round Stranded</th>
<th>Copper Concentric Round Compressed Stranded</th>
<th>Aluminum Compact Stranded</th>
</tr>
</thead>
<tbody>
<tr>
<td>#2 AWG</td>
<td>OK</td>
<td>OK</td>
<td>–</td>
</tr>
<tr>
<td>#1 AWG</td>
<td>–</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>1/0</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>2/0</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>3/0</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>4/0</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>250 kcmil</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>300 kcmil</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>350 kcmil</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>400 kcmil</td>
<td>–</td>
<td>OK</td>
<td>OK</td>
</tr>
<tr>
<td>500 kcmil</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
</tr>
</tbody>
</table>

The customer shall extend eight feet of excess cable per conductor into the service termination enclosure or handhole for connection by SCL.

8. References

Requirements for Electrical Service Connection (RESC); Seattle City Light, 2007

SCL Construction Standard 0224.01; “Customer Requirements for Underground Secondary Service, Looped Radial System”

SCL Construction Standard 1561.05; “Customer Requirements for Underground Single or Dual Meters, Residential Service”
9. Sources

Chao, Yaochiem; SCL Standards Engineer, originator, and subject matter expert for 1561.07 (yaochiem.chao@seattle.gov)

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Customer Requirements for Underground Secondary Service Termination Handholes in the Public Right-of-Way

1. **Scope**

   This standard covers the requirements for the construction and installation of underground secondary service terminations in the public right-of-way in the Seattle City Light (SCL) service territory. This standard only applies to underground service installations where the point of termination is in the right-of-way.

   For underground secondary services on private property, refer to SCL 0224.01.

2. **Application**

   This standard provides direction to engineers, consultants, contractors and customers about how to properly install an underground secondary service in the public right-of-way.

   This standard also provides the details to be used for inspection by SCL electric service representatives/engineers, civil inspectors and electrical reviewers.

3. **General Requirements**

   Customer shall meet underground secondary service requirements. See SCL 0224.01.

   Customer shall meet clearances between SCL underground structures and other utility structures in the public right-of-way. See SCL 0214.00.

   Customer shall meet termination handhole installation requirements. See SCL 0231.01.

   See Figure 3 for SCL and customer responsibilities.
Figure 3. Basic Infrastructure of a Customer System in the Right-of-Way

<table>
<thead>
<tr>
<th>Item</th>
<th>Vault, handhole, or conduit riser</th>
<th>Conduit</th>
<th>Cable</th>
<th>Handhole</th>
<th>Conduit and cable</th>
<th>Pedestal</th>
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<tbody>
<tr>
<td>Specified by</td>
<td>SCL</td>
<td>SCL</td>
<td>SCL</td>
<td>SCL</td>
<td>Customer</td>
<td>Customer</td>
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<tr>
<td>Furnished and installed by</td>
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<td>Customer</td>
<td>SCL</td>
<td>Customer</td>
<td>Customer</td>
<td>Customer</td>
</tr>
</tbody>
</table>

4. Detailed SCL Responsibilities

SCL equipment, including the termination handhole, is covered by the NESC.

SCL shall designate service points for customer electrical services from a distribution source. Streetlight circuits shall not be tapped for customer equipment or loads.

An SCL electrical reviewer shall inspect and test systems before service connections are made.

5. Detailed Customer Requirements

Customer shall install a pedestal-mounted, external service disconnect or other approved service disconnect. The pedestal shall be above grade.

The service equipment pedestal or other approved service disconnect shall be located after the termination handhole (service point).

Meter requirements shall be determined by SCL Customer Engineering.

The Authority Having Jurisdiction (AHJ) shall inspect and approve each customer electrical installation before service connections are made by SCL.

All conductive components in termination handholes shall be bonded to the grounding electrode.

Connections to the grounding electrode shall be made by irreversible means. Above grade connections may be irreversibly bolted or exothermically welded. Below grade connections shall be exothermically welded.

Customer shall determine if service overcurrent protection will be either fuses or a circuit breaker. Customer overcurrent devices shall be installed in the customer service equipment pedestal.

Customer shall furnish and install NEC-sized conductors from the termination handhole to the customer service pedestal. SCL shall install conductors from the SCL source to the termination handhole and make all connections in the termination handhole and at the SCL source.

Customer equipment from the customer conductors in the termination handhole and downstream is covered by Seattle Electrical Code Article 80 and the NEC.

Customer service bond shall be located at the customer service metered pedestal or other approved disconnect.
6. References

SCL Construction Standard 0214.00; “Clearances between SCL Underground Structures and Other Utility Structures in the Public Right-of-Way”

SCL Construction Standard 0224.01; “Customer Requirements for Underground Secondary Service, Loop Radial System”

SCL Construction Standard 0231.01; “Secondary Handhole Installation”

7. Sources

Hanson, Brett; SCL Standards Engineer and originator of 1561.09 (brett.hanson@seattle.gov)

Chao, Yaochiem; SCL Standards Engineer and subject matter expert for 1561.09 (yaochiem.chao@seattle.gov)

Borek, Tom; SCL Streetlight Engineer and subject matter expert for 1561.09 (tom.borek@seattle.gov)

Perander, Eivind; SCL Service Engineer and subject matter expert for 1561.09 (eivind.perander@seattle.gov)

SCL Construction Standard 0222.02; “Requirements for Duct Banks in the Public Right-of-Way”

SCL Construction Standard 0224.07; “Requirements for Secondary Conduits in the Right-of-Way”

SCL Construction Standard 0233.05; “Secondary Handhole Grounding”

SCL Construction Standard 0461.10; “Grounding Electrodes for Handholes and Vaults”

SCL Construction Standard 0468.90; “Exothermic Connection System”

SCL Construction Standard U2-11.40/NDK-40; “Mandreling and Cleaning of Ducts and Conduits”

Zhuang, Liman; SCL Service Engineer and subject matter expert for 1561.09 (liman.zhuang@seattle.gov)
METER BASE ARRANGEMENTS

Notes:
1. When nonmetallic conduit is used between C.T. can and meter socket, add 1 #12 or larger solid green wire for ground. Applies to all “B” Figures.
2. When neutral is insulated, it shall be bonded to the socket. All sockets shall be U.L. listed. Applies to all Figures.
3. Circuit closing devices are not approved. Applies to all Figures.
4. All 480V services 200 amps or less require a 200 amp continuous duty safety socket.
5. All commercial services 200 amps or less and under 300 volts require a continuous duty block bypass socket.
6. All Delta services (240/120V or 480/240V 3 phase 4 wire) up to 200 amps shall have the high leg on the right hand jaws of the 7-terminal meter socket. Applies to Figure 6A.
7. All residential 120/208V single phase services up to 400 amps shall have the 5th terminal at the 9 o’clock position, and wired to the neutral in the meter socket. Applies to Figure 6A.
8. All commercial 120/208V single phase services up to 200 amps shall have the 5th terminal at the 9 o’clock position, and wired to the neutral in the meter socket. Applies to Figure 5A.
9. All EUSERC requirements refer to the latest revisions of EUSERC documents. Typical EUSERC drawing number 339.
10. C.T. secondary wire sizes increase for 50 feet and greater.
11. Block bypass sockets are recommended for all residential use.

<table>
<thead>
<tr>
<th>Types of Service</th>
<th>Maximum Metering Capacity Up to 400 Amp</th>
<th>Metering Capacity Over 400 Amp</th>
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<tr>
<td><strong>1 Ø 3W 120/240V</strong></td>
<td><img src="image" alt="Fig. 1A" /> Up to 225 Amps</td>
<td><img src="image" alt="Fig. 1B" /> #12 AWG Cu 1 Black 1 Red #10 AWG Cu 1 Black 1 Red 1 White</td>
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<td><img src="image" alt="302B" /> Test Switch</td>
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<tr>
<td><img src="image" alt="302A" /> 302A (up to 225 amps) or 302B (over 225 amps and up to 400 amps).</td>
<td><img src="image" alt="302B" /> Fig. 1A</td>
<td><img src="image" alt="302B" /> Fig. 1B</td>
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<td>EUSERC Compliance</td>
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<td><img src="image" alt="302B" /> Fig. 2A</td>
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<td><img src="image" alt="302B" /> Fig. 2B</td>
<td><img src="image" alt="302B" /> Fig. 2B</td>
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<tr>
<th>ORIGINATOR</th>
<th>STANDARDS COORDINATOR</th>
<th>STANDARDS SUPERVISOR</th>
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<tbody>
<tr>
<td>Ted Allestad</td>
<td>Charles L. Shaffner</td>
<td>John L. Chinman</td>
<td>Harold King</td>
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### Commercial Metering Requirements

<table>
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<th>Maximum Metering Capacity Up to 200 Amp</th>
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<tr>
<td><strong>1 Ø 2W 120V</strong></td>
<td>![Diagram](3A 120V) #12 AWG Cu</td>
<td>![Diagram](3B 120V) #10 AWG Cu</td>
</tr>
<tr>
<td><strong>1 Ø 2W 277V</strong></td>
<td>![Diagram](3A 277V) 1 Black, 1 Red*</td>
<td>![Diagram](3B 277V) 1 Black, 1 White</td>
</tr>
</tbody>
</table>

**EUSERC Compliance**
- Fig. 3A EUSERC Dwg. F-1 Code 4 with EUSERC Dwg. 302B (up to 200 amps and 120 V) or Dwg. 305 (up to 200 amps and 277 V or higher).
- Fig. 3B EUSERC Dwg. F-1 Code 5A with EUSERC Dwg. 339 (over 200 amps).

| **1 Ø 3W 120/240V** | ![Diagram](4A 120/240V) #12 AWG Cu | ![Diagram](4B 120/240V) #10 AWG Cu |
| **1 Ø 3W 240/480V** | ![Diagram](4A 240/480V) 1 Black, 1 Red | ![Diagram](4B 240/480V) 1 Black, 1 Red, 1 White |

**EUSERC Compliance**
- Fig. 4A EUSERC Dwg. F-1 Code 4 with EUSERC Dwg. 305 (up to 200 amps).
- Fig. 4B EUSERC Dwg. F-1 Code 6 with EUSERC Dwg. 339 (over 200 amps).

| **1 Ø 3W 120/208V** | ![Diagram](5A 120/208V) #12 AWG Cu | ![Diagram](5B 120/208V) #10 AWG Cu |
| **1 Ø 3W 277/480V** | ![Diagram](5A 277/480V) 1 Black, 1 Red, 1 White | ![Diagram](5B 277/480V) 1 Black, 1 Red, 1 White |

**EUSERC Compliance**
- Fig. 5A EUSERC Dwg. F-1 Code 5A with EUSERC Dwg. 305 (up to 200 amps).
- Fig. 5B EUSERC Dwg. Code 13 (Code 15 Alternate) with EUSERC Dwg. 339 (over 200 amps).

| **3 Ø 4W 208Y/120V** | ![Diagram](6A 208Y/120V) #12 AWG Cu | ![Diagram](6B 208Y/120V) #10 AWG Cu |
| **3 Ø 4W 240/120V**delta | ![Diagram](6A 240/120V) 1 Black, 1 Red, 1 Blue, 1 White | ![Diagram](6B 240/120V) 1 Black, 1 Red, 1 Blue, 1 White |
| **3 Ø 4W 240Y/138V** | ![Diagram](6A 240Y/138V) 1 Black, 1 Red, 1 Blue, 1 White | ![Diagram](6B 240Y/138V) 1 Black, 1 Red, 1 Blue, 1 White |
| **3 Ø 4W 480Y/277V** | ![Diagram](6A 480Y/277V) 1 Black, 1 Red, 1 Blue, 1 White | ![Diagram](6B 480Y/277V) 1 Black, 1 Red, 1 Blue, 1 White |
| **3 Ø 4W 480/240V**delta | ![Diagram](6A 480/240V) 1 Black, 1 Red, 1 Blue, 1 White | ![Diagram](6B 480/240V) 1 Black, 1 Red, 1 Blue, 1 White |

**EUSERC Compliance**
- Fig. 6A EUSERC Dwg. F-1 Code 7 with EUSERC Dwg. 305 (up to 200 amps).
- Fig. 6B EUSERC Dwg. F-1 Code 13 (Code 15 Alternate) with EUSERC Dwg. 339 (over 200 amps).
Pulling Iron Installation for In-Building Vaults, Network System

1. Scope

This standard covers proper installation of pulling irons during construction of in-building vaults to facilitate pulling Seattle City Light (SCL) electrical cable. The number, location, and height shall be determined for each project by the SCL engineer. The pulling irons are not intended to be used to pull out lodged cable or to move heavy equipment.

2. Application

This standard provides requirements for the installation of pulling irons (also known as pulling eyes, item 1 in the material list).

A form (item 2 in the material list) is used to create the pulling iron recess.

A cover (item 3 in the material list) is used to conceal the floor-mounted pulling irons.

This standard is intended for use by SCL engineers, SCL inspectors, SCL civil crews, and contractors who approve, inspect, build, and construct in-building and cast-in-place vaults.

Additional Network vault requirements are found in SCL NVH-80. SCL U1-4.11/NCI-60 describes cable pulling tension calculations.

3. Material List

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<thead>
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<th>Item</th>
<th>Description</th>
<th>Stock No.</th>
<th>Quantity</th>
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<td>1</td>
<td>Pulling iron, stainless steel</td>
<td>720235</td>
<td>Project specific</td>
</tr>
<tr>
<td>2</td>
<td>Form for embedded pulling iron</td>
<td>013525</td>
<td>&quot;</td>
</tr>
<tr>
<td>3</td>
<td>Pulling iron cover</td>
<td>720236</td>
<td>&quot;</td>
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</tbody>
</table>
4. Installation Notes

4.1 General

The following requirements shall be met when installing pulling irons:

- Pulling irons shall be installed behind concrete reinforcing steel (rebar). (See Figure 4b.)
- Spacing and size of rebar shall be determined by a licensed civil engineer.
- Pulling irons shall be tied to the rebar.
- Pulling iron installation shall be rated and labeled in the vault as 5000 lb maximum working tension.
- The vault wall, ceiling, and floor shall be designed so that each pulling iron obtains a 10,000-lb ultimate strength.
- Rubber forms shall be used to create the pulling iron recess shown in Figure 4a.
- If a pulling iron is installed in the floor, install a recessed pulling iron cover to avoid a tripping hazard.

Figures 4a and 4b show a pulling iron embedded in a concrete vault, behind and tied to rebar. Pulling irons are typically opposite the entry or conduit entrance.

**Figure 4a. Pulling Iron, Inset View**

**Figure 4b. Pulling Iron, Vault Interior, Front and Side Views**

4.2 Installation in New Construction

Pulling irons for rigging equipment shall be installed minimally, without duplication, and as follows:

- Opposite each conduit entrance at approximately the same height.
- Inset into a recess in the vault wall so that the eye is exposed and flush with the interior wall (see Figure 4b).
Locations for pulling irons can vary depending on the vault plan and configuration (entry door, conduit entrance, hatch, and transformer locations). SCL prefers that pulling irons on walls shall optimally match the height of the conduits, or as the next preferred option, the pulling iron shall be just below the conduit entrance.

If the vault is constructed of concrete blocks, with engineering pre-approval irons may be floor-mounted. One pulling iron cover shall be provided for each pulling iron installed in the vault floor.

4.3 Installation on an Existing Wall (Retrofit)

Installation of a pulling iron on an existing vault wall shall meet the following requirements:

- Pulling iron and wall design calculation and drawings shall be stamped by a licensed Civil Engineering PE. These calculations and drawings shall be submitted to SCL for review and approval.
- Drawing detail shall include pulling iron detail, anchor detail, and existing wall details, as well as layout of the pulling iron and the cable entrance.
- The concrete masonry unit (CMU) wall that a pulling iron will be anchored to shall be fully grouted.
- A pulling test shall be required for any pulling iron installed on an existing wall.
- Pulling iron installation shall meet a minimum testing load of 7500 lb.

5. Labeling

Using a stencil, paint 2-inch tall letters near the pulling iron indicating "5000 LB MAX. WORKING."

6. References

**SCL Construction Guideline U1-4.11/NCI-60;** “Cable Pulling Calculations: Maximum Pulling Tensions for Installing Electrical Wire and Cables (Underground)"

**SCL Construction Guideline NVH-80;** “Network Area Requirements for Panel or Cast-In-Place Vaults"

7. Sources

Lee, Dennis; Network Service Supervisor, subject matter expert, and originator of NCI-62 (dennis.lee@seattle.gov)

Ng, Sharon; Sr. Civil Engineer and subject matter expert for NCI-62 (sharon.ng@seattle.gov)

Siddiqi, Uzma; SCL Standards Engineer and subject matter expert for NCI-62 (uzma.siddiqi@seattle.gov)

Youngs, Rob; Crew Chief and subject matter expert for NCI-62 (rob.youngs@seattle.gov)
Mandreling and Cleaning of Ducts and Conduits

1. After the concrete has been poured or the trench backfilled over conduit, each duct run and conduit shall be tested for obstructions or flattening by pulling a proofing mandrel sized and constructed per Material Standard 7645.40 through the duct or conduit within 5 days of installation. If an obstruction is found in a duct or conduit, that section shall be replaced.

2. Cleaning ducts shall be performed by drawing a brush with stiff bristles and a swab through each duct and conduit to make certain no foreign materials are left in the duct.

3. Conduit runs of 5 inches or larger shall be flushed with a water jet type system such as the “Jet Rodder” equipment. Completion subject to SCL inspector’s approval.

4. Cleaning and mandreling operations may be performed simultaneously.

5. After cleaning and mandreling, each conduit shall have left in it a flat, pre-lubricated, polyester or Aramid pull tape of 2,500 lb. minimum tensile strength (Fibertek Inc. or equal; City Light Stock Nos. 012293 and 012480. Note: there is no material standard for these items.) The pull tape shall be printed with sequential footage markings. Every conduit not part of a duct bank shall contain a 3-inch wide detectable underground marking tape, red-colored, Reef Industries “Sentry Line” #42-0110 or Pro-Line Safety or equal (City Light Stock No. 736800. Note: there is no material standard for this item.)

6. After cleaning and mandreling, each conduit shall be plugged with plugs of the type and manufacturer specified in Seattle City Light Material Standard 7055.09.
Vault Installation

Figure 1.

- Concrete or finished grade set top to finished grade
- Grout all joints with 1:3 mortar
- Compacted sub grade
- Select compacted backfill
- 2-1/2% grade between sidewalk & curb
- Set top 1/2" above surrounding grade
- Curb
- Sidewalk
- Dry pack
- End view in planting strip
- Custom, poured in place concrete sloping riser section in 1:3 mortar to adjust frame to grade
- Finished grade see note 4
- Plate adjustment details

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

2. Concrete shall be Class 5.5 as specified in “City of Seattle Standard Plans and Specifications”. Trowel smooth.

3. Drypack and seal all holes tight after installation to prevent water intrusion.

4. When adjusting the vault entrance to a sloping grade, install a sloping riser section and a poured-in-place collar. Do not use brick and mortar slope adjustments if possible. Minimize the use of mortar adjustments and in no case shall the mortar thickness exceed one inch. Cast-in-place 42-in round and 54-in by 96-in rectangular risers shall comply with Construction Standard 0231.03. For in-street use, a properly engineered sloping riser section is required. Where the riser section is specified at 12 inches deep or more, order a length of Unistrut cast into the side wall of the riser.

5. On sloping grade installations, hinge vault covers as noted. Hinged vault hatches shall be placed so that they lie flat when opened. Load break vaults shall not be installed if the grade exceeds 5.6% in any direction. This is to ensure proper hot stick operations.

6. The divider, when used, must come up tight to the vault cover. Brick up as necessary, or if over 4 inches of increase is required, order a special divider.

7. For transformer and J-Box combinations in the 577 vault, install rigid steel conduit through the transformer section of the vault as shown on page 1 of U9-5.

8. The preferred vault orientation for combination transformer and J-Box in the 577 vault is the length of the vault perpendicular to the curb. See SCL 0232.05.

9. The length of the grated vent slots must run perpendicular to the dominant direction of travel of sidewalk traffic.

10. Grounding Electrode System

   Install and test grounding electrodes per SCL 0461.10.

11. Engineers shall specify conduit entrance locations into vault on work order. Contractors/installers shall verify before installation.

12. All covers (other than vented grates) shall have a slip resistant surface which has been approved by City Light Standards. If round lids are used, pave the area around the lid a minimum of four inches.

13. References

   SCL Construction Standard 0231.03; “Cast-in-Place Risers”
   SCL Construction Standard 0232.05; “Underground Residential Equipment Location of 577 Vaults and Secondary Handholes”
   SCL Construction Standard 0461.10; “Grounding Electrodes for Handholes and Vaults”
   SCL Construction Guideline U9-5; “577 Vault Transformer and Junction Box Installation, Grounding and Connections”
   SCL Construction Guideline U9-6; “577 Vault with Three Loadbreak Junction Boxes Installation, Grounding and Connections”
   SCL Design Standard 9702.30; “Grounding and Bonding, Fundamentals and Detailed Requirements”
INSTALLATION OF RING TYPE VAULTS

Figure 1. Typical Vault Installation
Vault configurations vary. Ring vaults are not acceptable in the Network area.

IMPORTANT:
DO NOT PUT HATCH IN GUTTER OR IN ALLEY CENTER. IF HATCH MUST GO IN ALLEY CENTER, GRADE ALLEY RUNOFF AROUND HATCH (RAISE HATCH AS NECESSARY - 2" MAXIMUM.) HINGED VAULT HATCHES SHALL BE PLACED SO THEY WILL LIE FLAT WHEN OPENED. HINGED VAULT HATCHES AND RING VAULTS ARE NOT TO BE USED IN THE NETWORK AREA.
1. **Codes**


2. **Cover**

   The dimension from the vault top at the point of least depth to the pavement or ground above shall be as specified by Seattle City Light Work Order and/or construction drawings. Any deviation from this specification shall have the prior approval of the Seattle City Light Engineer.

   All covers (other than vented grates) shall have a slip-resistant surface which has been approved by City Light Standards.

3. **Excavation**

   3.1 Excavate so there is not less than 24 inches nor more than 30 inches between ends and sides of vault and the vertical sides of excavation or shoring unless larger excavation is authorized by the Engineer.

   3.2 Remove shoring before backfilling.

   3.3 If excavation bottom is saturated prior to placing bedding material, then over-excavate area as directed by the Engineer and place cobbles (3-inch to 8-inch stone – no broken concrete).

4. **Bedding**

   4.1 If excavation is not saturated prior to placing bedding material, compact bottom of excavation with two full compacting operations at right angles to each other with a mechanical compactor.

   4.2 Place a layer of crushed rock (aggregate grade of 1-1/4 inches minus), screed and compact to a minimum thickness of 4 inches, and add 1/2 to 1-1/2 inches of sand to create a level surface.

5. **Installation**

   5.1 **Setting Tolerances**

      5.1.1 **Horizontal alignment:** end to end ± 1/8 in per 1-ft length of vault.

      5.1.2 **Vertical alignment**

         ▪ Ring Vault 687 and larger with single-piece floor has a built-in sloped floor toward the sump; therefore, the bedding shall be level. Vertical slope tolerance: 3/8 inches per 10-ft length toward the sump.

         ▪ Multi piece ring vault floor does not have a built-in sloped floor; therefore, the bedding shall be even and slope toward the sump to ensure proper drainage. Vertical slope tolerance: 1/4 in ± 1/8 inches in 10 ft toward the sump.

5.2 **Vault Parts**

   a. Do not install parts cracked or otherwise damaged so that watertightness may be impaired, or parts with reinforcing exposed.

   b. If a sump is specified by the SCL engineer, refer to Construction Guideline U2-12.1/NVH-60 for installation. Locate sump at same end as personnel hatch (see below, 5.3.).

   c. For 814 and 818 vaults, place General Sealant G.S. No. 4 in joints between vault sections. For other vaults, place 5/8-inch by 1-inch butyl rubber “RUBATEX” gasket on the outer ridge of the interlocking joint.

5.3 **Frame and Cover (Solid or Grate)**

   a. **In streets, alleys, parking lots, and other vehicle areas,** to match slope of vault entrance with surrounding grade, the acceptable methods are:

      1. Precast concrete sloping riser section
      2. Cast-in-place concrete sloping riser section

   b. **In sidewalks and other non-vehicle areas,** to match slope of vault entrance with surrounding grade, the acceptable methods are:

      1. Brick and mortar if the mortar is less than 1 inch thick
      2. Precast concrete sloping riser section
      3. Cast-in-place concrete sloping riser section

   c. Whenever the final grade of the hatch exceeds 10 percent (6 degree slope), the hinge side of the personnel hatch shall be located on the downhill side.

   d. **Maximum slope of frame and grate shall not exceed 2 inches in 12 inches without permission of SCL engineer.** Load break vaults shall not be installed if the grade exceeds 5.6 percent in any direction. This is to insure proper hot stick operation.

   e. Where the riser section is specified at 12 inches deep or more, order a length of Unistrut cast into the side wall of the riser.

   f. **Set riser in 1 inch of mortar (1 part cement to 3 parts sand with polyvinyl acetate bonding agent).**

   g. Adjust between 1/4-inch and 3/8-inch above grade to prevent water from entering vault, but not to cause a hazard. Ramp concrete to top of frame for gradual transition. Do not put hatch in gutter area. Put hatch 18 inches minimum away from curb line.
5. Installation, continued

5.4 Seal Mortar
Place 2-inch, plus or minus, mortar filets to seal out water at joints between vault top, cover slab, risers, and frame.

5.5 Concrete Collar
Furnish and install a rectangular concrete slab centered on the vault lid to prevent damage to the lid. The concrete slab shall be 10-feet by 10-feet and a minimum of 6-inches thick, with Class 4000 concrete meeting the requirements of section 6-02 of the City of Seattle Standard Specifications. The concrete shall be reinforced with (10) #4 reinforcing bars in each direction equally spaced at the mid-height of the slab. When installed in a roadway that exceeds the structural requirements of the above, concrete structure including material, reinforcement, thickness, and bedding material shall match roadway structure and be per Seattle City Light work order and construction drawings. Concrete shall have a broom finish perpendicular to the direction of traffic or match the roadway finish when installed in a concrete roadway.

5.6 Filling Spaces
Fill spaces between ground rods and floor slab and other spaces through walls, tops and slabs with dry pack mortar mixed with “Weldcrete” polyvinyl acetate bonding agent in accordance with the manufacturer’s directions.

5.7 Ladder
Install a permanent ladder in the vault if the distance from the top of the cover to the vault floor exceeds 12 feet 6 inches. See Seattle City Light Drawing D-28304.

5.8 Conduit Entrances
SCL engineers shall specify the locations where the conduit enters the vault on the work order. Contractors/installers shall verify location before installation.

6. Backfill
Backfill with trench-type, controlled-density fill (CDF) that conforms to the City of Seattle Standard Specifications. Low-strength fluidized thermal backfill (FTB) that conforms to SCL Material Standard 7150.00 may be substituted with the permission of the SCL engineer. Place backfill so that no voids are left under the reinforcing ribs or riser sections. The contractor/installer with the assistance of a Licensed Professional Engineer shall consult with the vault manufacturer to assure proper installation of the vault. Backfilling with some specified materials may require a multi-stage compaction processes to avoid damage to vault walls.

7. Vault Damage
Structurally damaged vaults shall be replaced or repaired. If the vault is to be repaired then a Washington State licensed professional engineer shall certify that the vault meets the original structural design parameters. For this Standard, vaults with exposed rebar are considered to be damaged under any circumstances.

8. Grounding Electrode System
Install and test grounding electrodes per SCL 0461.10.

9. Sources
City of Seattle; “Standard Specifications for Road, Bridge, and Municipal Construction,” 2011
Hanson, Brett; SCL Standards Engineer and subject matter expert for U2-15.1 (brett.hanson@seattle.gov)
Ng, Sharon; SCL Civil Engineer and subject matter expert for U2-15.1 (sharon.ng@seattle.gov)
SCL Construction Guideline NCB-20; “Grounding Network System Transformer Vaults, Wet, Dry, or Spot - Copper Bus”
SCL Construction Standard NCB-30; “Grounding Network System, Wet Vault, Non-Transformer, One or Two 48-Inch Bus Bars”
SCL Construction Guideline NDK-10; “Installation of Nonmetallic Conduit with FTB Concrete Encasement”
SCL Construction Standard U2-11; “Installation of Nonmetallic Conduit with Concrete, FTB Encasement”
SCL Construction Guideline U2-12.1/NVH-60; “Sump Pump Pipe Installation, Vaults and Manholes”
SCL Construction Guideline U9-7.3; “Grounding and Connection Diagram, Single Phase 26 kV Distribution Transformer”
SCL Construction Standard 0461.10; “Grounding Electrodes for Handholes and Vaults”
SCL Design Standard 9702.30; “Grounding and Bonding, Fundamentals and Detailed Requirements”
SCL Material Standard 7150.00; “Fluidized Thermal Backfill”
SCL Material Standard 7204.70; “Frames and Covers, 42-Inch Round, Iron”
Transformer Pad, Commercial and Industrial Underground from Overhead

Section "A-A"

1. Pad and Apron Dimensions for (site location)

- Pad and Apron Dimensions for (site location)
- Standards Coordinator: Laura Vanderpool
- Standards Supervisor: John Shipek
- Unit Director: Darnell Cola

Section "B-B"

- Ground each fence section, see note H.
- 3" minimum (typical) 1 ft above top of pad.
- 2-4 primary conduits extend below top of pad.
- Oil containment barrier - curbing, berm or other, see note C.
- Customer installed secondary conduits to extend 9 to 12 ft above top of pad, secured top and bottom with rigid mechanical support. See note F and "A-A" detail below.

APRON EXTENSION OUTSIDE FENCE WITH BARRIER AND DRAIN PIPE. 4" DRAIN PIPE CLEANOUT WITH GRATED COVER. CUSTOMER'S RESPONSIBILITY TO MAINTAIN. SEE NOTE C.

- PCB label on sign visible to fire fighters.
- 10" x 14" sign on gate.
- 8" gate or easily removable framed section. See note D.
- "Call before you dig" label on sign.
- Ground each fence post, see note H.

w = ______ x = ______

y = ______ z = ______

Leaves 9' min. pig tail, tank & neut. ground.

Concrete 6" min.

6" minimum thickness 1-1/4" minus crushed rock (Seattle Spec No. 2).

Support attachment.

6 rows of barbed wire.

7 min. fence fabric.

Paved apron - slope and provide continuous drainage per note C.

OIL CONTAINMENT BARRIER.

APRON EXTENSION OUTSIDE FENCE WITH BARRIER AND DRAIN PIPE. 4" DRAIN PIPE CLEANOUT WITH GRATED COVER. CUSTOMER'S RESPONSIBILITY TO MAINTAIN. SEE NOTE C.

- Customer installed secondary conduits to extend 9 to 12 ft above top of pad, secured top and bottom with rigid mechanical support. See note F and "A-A" detail below.

GROUND EACH FENCE SECTION, SEE NOTE H.

- 3" minimum (typical) 1 ft above top of pad.
- 2-4 primary conduits extend below top of pad.
- Oil containment barrier - curbing, berm or other, see note C.
- Customer installed secondary conduits to extend 9 to 12 ft above top of pad, secured top and bottom with rigid mechanical support. See note F and "A-A" detail below.
Notes:

A. **Concrete Transformer Pad.** The concrete pad shall be located so that the closest edge of the pad will be 10-foot minimum from combustible buildings and all exterior doors and windows, and 3-foot minimum from non-combustible buildings. See guideline U10-2.

**Reinforcing Bars** shall be placed within the concrete pad in an 18-inch maximum grid approximately 3 inches above the bottom of the concrete slab (18” O.C.E.W.). The pad shall be a minimum of 6 inches thick.

The pad shall be poured on a 6-inch bed of crushed rock, minimum.

The pad shall be poured around two 5-foot long **Steel Beams** (W5 x 16). The tops of the beams shall be set at 1/8” to 1/4” above the top of the pad. See the drawing on page 1 and the above W5 x 16 beam detail.

B. **Paved Apron.** The concrete transformer pad shall be surround by a paved apron that it will be impervious to spilled oil. The apron will extend a minimum of 3 feet from the pad edge. See the section below on fencing the apron and pad.

Gravel on bare soil for the apron area is not sufficient to meet the intent of the appropriate oil spill regulations (see below) unless soils data is provided by and stamped by a professional engineer registered in the State of Washington that certifies that the soil is sufficiently impervious to prevent the escape of oil from the containment system before cleanup occurs.

C. **Oil Containment System.** The concrete transformer pad; the paved apron; the surrounding curb, dyke, berm or other appropriate barrier; and any oil/water collection and separation system shall, together, constitute an oil containment system. The intent of the oil containment system shall be to contain all spilled oil and oil-contaminated rainwater prior to cleanup. Since this containment system is subject to rain and snow accumulation, provision is required for handling water runoff.

The oil containment system shall conform to the current requirements of the Clean Water Act, Title 40 of the Code of Federal Regulations, Part 112 (see 40 CFR 112.7(c)) as amended. For convenience, pertinent language from 40 CFR 112.7(c), current as of July 17, 2002, is quoted in part, as follows, or review the EPA web site http://www.epa.gov/oilspill/spcc.htm.

... The entire containment system ... must be capable of containing oil ... so that any discharge ... will not escape ... before cleanup occurs. At a minimum, you must use one of the following prevention systems or its equivalent:

- Dikes, berms, or retaining walls sufficiently impervious to contain oil;
- Curbing;
- Culverting, gutters, or other drainage systems;
- Weirs, booms, or other barriers;
- Spill diversion ponds;
- Retention ponds; ...

The criteria for regulation under 40 CFR 112 takes into consideration the potential for oil spill discharge into navigable waters. In the SCL service area, discharge to navigable waters would typically be of concern if there is potential discharge to storm drain systems.

Responsibility for Design, Construction, Operations and Maintenance. Design, construction, operation and maintenance of oil containment systems shall be the responsibility of the property owner including appropriate provisions for oil and water run-off and separation of oil from water and periodic collection and proper disposal of oil and oil-contaminated water.

**Spill Prevention, Control and Countermeasure (SPCC) Plans.** For Seattle City Light-owned transformers located on private property, preparation of SPCC plans in conformance with 40 CFR 112 shall be the responsibility of the property owner.
D. **Fence.** The pad and apron shall be enclosed by a fence of Cyclone quality or equal. The fence fabric shall be a minimum of 7-foot high (NESC required) to be topped by another foot of barbed wire. The fence line shall be set at a minimum of 3 feet from the pad edge. The fence shall be placed along and outside the oil-stop barrier such as a curb of concrete or asphalt (See Oil Containment System, above).

**Gate.** The fence shall contain a 3-foot, 6-inch gate. The gate shall have provision for a padlock.

**Eight-Foot Opening.** In addition to the main gate, the fence shall include another gate or easily removable and framed section to be 8 feet wide.

**Grounding Fence and Gate.** Each section of fence wire fabric shall be grounded with No. 8 or larger copper to fence post ground wire. Grounding is to include the gate and removable sections. Reference NESC Rule 92E4.

E. The primary **Terminal Pole** shall be designated by Seattle City Light.

F. **Secondary Conduit and Conductors.** If conduit is installed instead of bus duct by the customer, the customer shall furnish and install the phase and neutral conductors of sufficient length to connect to the transformer terminals with a maximum of 6 conductors per phase and neutral and a maximum size of 750 kcmil. Conduit for secondary shall extend 9 to 12 feet above the pad (9 feet minimum) and shall be secured top and bottom with rigid mechanical support. If the pad is adjacent to the service building, the secondary conduits may extend, above ground, from the building (inside the pad) before extending vertically to the proper height. If the secondary conduits are laid out in rows extending outward from the pad, the height of the tops (weatherhead) should be staggered in height with the back row higher than the front row (from the pad edge). The location of the customer-installed secondary conduit shall be determined by Seattle City Light.

G. **Secondary Bus Duct.** If bus duct is installed instead of conduit and cable by the customer, Seattle City Light shall furnish and install the phase and neutral conductors from the transformer to the bus duct. The customer shall provide approved compression type terminals on the bus duct. The number of terminals and size shall be determined by Seattle City Light. The bus duct shall extend approximately 18 inches beyond the fence. The bottom of the bus shall be 9 feet above the concrete pad.

H. **Grounding.** Eight ground rods shall be driven at the corners, 4 inside the fence and 4 outside the fence, using a driving head to prevent damage to the ground rod threads. See drawing on page 1 for details.

The resistance of the grounding system shall not exceed 25 ohms. Install additional ground rods or other grounding electrodes (with prior approval from SCL engineering) until resistance is below 25 ohms. Reference 2007 NESC Rule 96D.

The **Ground Wire** shall not be spliced.

Ground each fence post to a ground rod. Reference 2007 NESC Rule 92E5.

Ground each section of fence wire strand with No. 8 or larger copper to fence post. Grounding is to include the gate and removable sections with flexible braid as required. Reference NESC Rule 92E4.

If grounding is under concrete or asphalt, all connections shall be done by exothermic welding (Cadweld or better).

I. **Signs** Seattle City Light will install the following signs on the pad fence:

- **PCB content** label (one sign from item 9). Choose from one of four different pressure sensitive labels indicating PCB content ranges matching the PCB content of the energized transformer coolant. Note, the PCB label must show the same PCB levels as indicated on the transformer label. See the material list for content labels. Mount two appropriate labels on 7” x 10” fiberglass signs (item 11) and hang the signs on the pad fence with cable ties. Locate the signs where they will be visible to fire fighters.

- "**Call Before You Dig**" pressure sensitive label. Mount two labels on 7” x 10” fiberglass signs (item 11) and hang on the pad fence with cable ties. Where appropriate, one sign can face the street and other can face the customer’s building.

- **Signs, Danger Hazardous Voltage, 7 in x 10 in, Rigid.** Use for mounting the above labels – items 9 and 10.

- **Signs, Danger Hazardous Voltage, 10 in x 14 in, Rigid;** item 13. Mount this sign on the pad gate with cable ties.

Tie wraps shall be used to attach all of these above signs.

In addition to the above signs, a **"Danger Hazardous Voltage"** pressure sensitive label (item 8) is to be mounted on the transformer.
J. All **Structural Steel** used in the installation shall be per ASTM A 36. Paint with one coat of Devoe Coatings Bar-Rust 235.

K. **Gravel and Crushed Rock** (Section “A-A”) shall be per City of Seattle Standard Specifications Section 9-03.16 Mineral Aggregate Chart.

L. **Material List**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
<th>Material Std.</th>
<th>Stock No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>GROUND ROD, 5/8” X 8’, copper clad steel, sectional</td>
<td>6762.25</td>
<td>564238 E</td>
</tr>
<tr>
<td>2</td>
<td>200’ (est.)</td>
<td>WIRE, 2/0 bare stranded copper, SD</td>
<td>6103.90</td>
<td>610425</td>
</tr>
<tr>
<td>3</td>
<td>10’ (est.)</td>
<td>WIRE, #2 bare stranded copper, SD</td>
<td>6103.90</td>
<td>610434</td>
</tr>
<tr>
<td>4</td>
<td>6 (est.)</td>
<td>CONNECTOR</td>
<td>6762.7</td>
<td>676271</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>CONNECTOR, 2 cables (#4 thru 2/0) to 5/8” rod</td>
<td>6762.7</td>
<td>676551</td>
</tr>
<tr>
<td>6</td>
<td>as req’d.</td>
<td>FENCE fabric, 7”, 9 gauge, with 3 strands of barbed wire on support pipe with 3” spacing between strands, Cyclone or equal.</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>7</td>
<td>as req’d.</td>
<td>REINFORCING BAR, #5</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>LABEL, &quot;Danger Hazardous Voltage&quot;, pressure sensitive, to be mounted on transformer.</td>
<td>7651.27</td>
<td>765182</td>
</tr>
</tbody>
</table>
| 9    | 2        | LABEL, pressure sensitive. Label states PCB content in energized transformer coolant. Mount labels on a 7” x 10” fiberglass sign (item 11) and hang on the pad fence with cable ties. Locate the signs (2) where visible to fire fighters. *PCB label must show the same PCB level as that on the transformer:*

  - transformer with PCB content of 500 ppm or greater (yellow) | – | 765201 |
  - transformer with PCB content from 50 to less than 500 ppm (white) | – | 765208 |
  - transformer with PCB content of 1 to less than 50 ppm (blue) | – | 765206 |
  - transformer with PCB content less than 1 ppm (green) | – | 765211 |
| 10   | 2        | LABEL, "Call Before You Dig." Mount labels on a 7” x 10” fiberglass sign (item 11) and hang on the pad fence with cable ties, one sign, facing street, one facing the customer’s installation. | – | 765255E |
| 11   | 4        | Signs, Danger Hazardous Voltage, 7 in x 10 in, Rigid Use for mounting labels – items 9 and 10 above. | 7651.23 | 765181 |
| 12   | 20       | TIE, Cable, black, 7” | 7358.1 | 735805E |
| 13   | 1        | Signs, Danger Hazardous Voltage, 10 in x 14 in, Rigid Mount sign on the pad gate with cable ties. | 7651.19 | 765212 |
| 14   | as req’d. | CONCRETE, Class B – 6-sack mix | City of Seattle Std. Specs. 6-02.3(2)A | – |
REQUIREMENTS FOR TRANSFORMER PADS AND EXTERNAL, BELOW-GRADE TRANSFORMER SERVICE VAULTS, LOOPED RADIAL SYSTEM

1. Scope
This Construction Guideline provides the requirements for Seattle City Light (SCL) looped radial system transformer pads and below-grade transformer service vaults. This Construction Guideline does not provide requirements for in-building vaults. See SCL 0751.00 and 0751.60.

2. Requirements and Codes
All work, including shoring and bracing, shall be in compliance with the latest editions of the State of Washington Department of Labor and Industries Chapter 296-155 WAC “Safety Standards for Construction Work” and the Seattle Department of Transportation “Street and Sidewalk Pavement Openings and Restoration Rules.” The below-grade vault location shall conform to the clearances shown in this Guideline. The vault size, ventilation, access, and grounding shall be approved by SCL. See Figures 9.1a, 9.1b, and 9.2.

3. General Requirements
See project specific construction package for:
- Below-grade vault, if required
- Transformer pad location, if required
- Bollards, if required

4. Primary Conduit
The customer shall furnish and install two conduits from the pad location, vault floor, or wall to a point one conduit length up the utility pole per SCL 0224.34. The conduit size and location shall be designated by SCL. Below-grade, the conduits must be separated from each other by a minimum of two inches of concrete.

5. Secondary with Conduit and Cable
The customer shall furnish and install conduit and phase and neutral conductors of sufficient length to connect to the transformer terminals. See SCL 0473.50 for cable options. The conduit location shall be designated by SCL. If more than six conductors per phase and neutral are installed, the customer may be required to provide a suitable tap box or collector bus with compression-type connectors on the bus of the size, type and number designated by SCL.

6. SCL Access
Provide properly supported, unobstructed access from the right-of-way to the transformer pad/vault for SCL equipment-handling machinery. SCL must be able to move to the transformer pad/vault, or remove from the transformer pad/vault, all electrical equipment, including tall, heavy transformers, and to service electrical equipment using SCL equipment-handling machinery.

Provide 25 feet clear space above each vault so that SCL can move transformers using SCL equipment-handling machinery.

Provide a permanent, level, unobstructed, 8-ft wide working area around the vault.

7. Below-Grade Transformer Service Vault Requirements
7.1 Confirm minimum vault dimensions with SCL Engineer.
7.2 Minimum of one 42-inch round hatch with vented cover required.
7.3 All conduits shall enter no more than 18 inches from vault corner.
7.4 The customer shall furnish and install fire stop insulating material per NEC requirements for service conduits and service bus duct that are installed by the customer in the customer’s building or service equipment.
7.5 It shall be the customer’s responsibility to assure that water does not enter the building and does not enter service entrance equipment from SCL vaults.
7.6 Sump and Grate shall be located underneath the hatch, next to the nearest wall.
7.7 Provide grounding per SCL 0461.10.
8. Pad-Mounted Transformer Service Requirements

8.1 Pad Location

Provide a minimum of 10 feet unobstructed working clearance on the conduit-opening side of the pad, and a minimum of 3 feet of clear space on the three other sides of the pad, for SCL crew's working-space and the pad's ground ring. If curbs are used for protection instead of bollards, any side of the transformer pad exposed to traffic shall have a continuous minimum 8 inch tall structural curb installed 10 feet from the nearest edge of the pad.

Foundations, footings, structures, tanks, piping, etc. are not allowed under the footprint of the transformer pad or grounding ring.

Maintain a minimum of 25 feet unobstructed vertical working clearance from the top of the pad to any trees.

Transformer pad must be a minimum of:

- 10 feet from any property line between private properties.
- 10 feet from building doors or windows.
- 10 feet from combustible structures.
- 7 feet from noncombustible conductive (metal) structures except where such structures are bonded to the SCL transformer grounding system around the pad.
- 3 feet from noncombustible nonconductive structures and combustible nonconductive structures that have a 3 hour fire protection rating.
- 10 feet horizontally from any trees. The distance shall be measured from the tree's root ball to the nearest edge of the pad.

8.2 Protective Guard Posts (Bollards)

After the transformer has been set on the pad, install 4-inch diameter by 8-foot long rigid steel posts to protect the transformer from vehicles. Insert posts to a depth of 4 feet and fill with concrete.

Locate bollards outside of the oil containment system.

Locate bollards a minimum of 4 feet away from the transformer door side of the pad so that the doors will open 180 degrees.

Locate bollards a minimum of 3 feet away from the transformer pad on the other three sides of the transformer.

Exothermically weld a #2 AWG bare, stranded copper wire from each metallic bollard to the ground ring.

See project-specific construction package for bollard locations.

8.3 Grounding

Provide grounding per SCL 0652.01, 0652.03, 0652.05, or 0652.07.

8.4 Soundproofing

Isolate transformer pad so that sound and vibration levels from transformers satisfy applicable laws and ordinances of the State of Washington, King County, and the appropriate municipality.

8.5 Oil Containment

Provide oil containment per SCL 0735.50.
9. Figures, Clearances of Vaults and Padmounted Enclosures from Buildings

**Figure 9.1a.** Noncombustible Structures (Structures Designed to Resist Fire for Three Hours), plan view
(for combustible structures, see Figure 9.2)

**Figure 9.1b.** Noncombustible Structures (Structures Designed to Resist Fire for Three Hours), elevation view
(for combustible structures, see Figure 9.2)
9. Figures, Clearances of Vaults and Padmounted Enclosures from Buildings, continued

Figure 9.2. Combustible Structures, elevation view

10. References

SCL Construction Standard 0751.00; “Customer Requirements, In-Building Transformer Vaults, Network and Looped Radial Systems”

SCL Construction Standard 0751.60; “Concurrent Customer Requirements, In-Building Transformer Vaults”

SCL Construction Standard 0224.34; “Steel Conduit Risers”

SCL Construction Standard 0461.10; “Grounding Electrodes for Handholes and Vaults”

SCL Construction Standard 0473.50; “Looped Radial and Network Service Entrance Cables in Conduit”

SCL Construction Standard 0652.01; “Transformer Pad, Installation and Grounding, Single Phase, 25-167 kVA”

SCL Construction Standard 0652.03; “Transformer Pad, Installation and Grounding, Three-Phase, 150-300 kVA”

SCL Construction Standard 0652.05; “Transformer Pad, Installation and Grounding, Three-Phase, 500-1500 kVA”

SCL Construction Standard 0652.07; “Transformer Pad, Installation and Grounding, Three-Phase, 2000-2500 kVA”

SCL Construction Standard 0735.50; “Oil Containment Systems”

SCL Construction Standard U10-2 (canceled); “Transformer Service Vaults and Padmounts, Customer's Responsibility, Outside Network Area”
METER SOCKET CONNECTIONS AND CONDUCTOR IDENTIFICATION
200 AMPERE MAXIMUM

3Ø 3-Wire POWER LOAD

3Ø 4-Wire LIGHT & POWER LOAD

3Ø 3-Wire LOAD 120/208V

3Ø 4-Wire LIGHT & POWER LOAD

1Ø 3-Wire LOAD 120/240V

1Ø 2-Wire LOAD 120

Color coding must be as shown.

Potential tap must be as shown for corner grounded supply transformers.

January 9, 1963
July 10, 2002
1. **Scope**
   This standard covers the requirements for bare, copper, soft-drawn, stranded wire.
   This standard applies to the following Seattle City Light Stock Numbers:

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Size, AWG/kcmil</th>
<th>Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>610434</td>
<td>#2</td>
<td>reel</td>
</tr>
<tr>
<td>610425</td>
<td>2/0</td>
<td>reel</td>
</tr>
<tr>
<td>610414</td>
<td>4/0</td>
<td>reel</td>
</tr>
<tr>
<td>610412</td>
<td>250</td>
<td>reel</td>
</tr>
<tr>
<td>610397</td>
<td>500</td>
<td>reel</td>
</tr>
</tbody>
</table>

2. **Application**
   For grounding, jumpers, and other general use.

3. **Industry Standards**
   Cable shall meet the applicable requirements of the following industry standards:
   - NEMA WC 26-2000 (EEMAC 201-2000) Binational Wire and Cable Packaging Standard

4. **Construction**
   Wire shall meet the requirements of ASTM B8 and Table A with the following clarifications:
   Conductor alloy shall be soft or annealed, uncoated copper.

   **Table A**

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Size, AWG/kcmil</th>
<th>Number of Strands</th>
<th>Class</th>
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<tbody>
<tr>
<td>610434</td>
<td>#2</td>
<td>7</td>
<td>B</td>
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<td>610425</td>
<td>2/0</td>
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<td>A</td>
</tr>
<tr>
<td>610414</td>
<td>4/0</td>
<td>19</td>
<td>B</td>
</tr>
<tr>
<td>610412</td>
<td>250</td>
<td>37</td>
<td>B</td>
</tr>
<tr>
<td>610397</td>
<td>500</td>
<td>37</td>
<td>B</td>
</tr>
</tbody>
</table>

5. **Packaging**
   **5.1 Quantity**
   Actual quantity per reel may vary from the quantity stated on the Purchase Order by plus or minus 10%.

   **5.2 Reels**
   Reels shall be reusable wood type, Class 1 or 2.
   Reels may be new or recycled.
   Recycled reels (when provided) shall be have the surface of both outside flanges painted over with a solid color.
5. Packaging, continued

5.2 Reels, continued

Recycled reels (when provided) shall be equivalent to new in quality and strength.
Reels shall be protected for shipment with coverings consistent with the recommendations of NEMA WC-26, Section 4.
Reels shall be provided with metal bushings if the gross weight of the reel exceeds 1,000 pounds.

5.3 Securing of Cable Ends

The inner end of the cable shall be brought to the outside of the reel flange and securely fastened with appropriately sized steel staples.
The outer end shall be securely fastened with appropriately sized steel staples to the inner side of the flange or tied off and secured as with plastic wrap.

5.4 Marking

Each reel shall be legibly marked with the following information:
- Manufacturer's identification
- Product description
- Shipping length of cable on reel
- Gross weight
- Tare weight
- Net weight
- Date of manufacture
- Reel identification according to NEMA WC-26, Section 5
- Seattle City Light's Purchase Order Number
- Seattle City Light's Stock Number

5.5 Detailed Requirements

Wire shall be packaged on reels according to the requirements of NEMA WC-26 and Table B.

Table B

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Size, AWG/ kcmil</th>
<th>Length per Reel ± 10%, ft</th>
<th>Outside Flange Diameter, Maximum, in</th>
<th>Inside Traverse Width, Maximum, in</th>
<th>Weight per 100 ft, Approx., lbs</th>
<th>Weight per Reel, Approx., lbs</th>
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<tbody>
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<td>154</td>
<td>2,310</td>
</tr>
</tbody>
</table>

6. Shipping

Reels shall be shipped and delivered in the upright position (on the flange edges) on open flatbed trucks suitable for side unloading by forklift.
Reels shall not be strapped or palleted.
Wire shall be shipped to the address specified on the Purchase Order.

7. Issuance

FT

8. Approved Manufacturers

Nehring Electrical Works Company
Service Wire
Southwire
Ground Rods, Copper-Covered, Sectional

1. **Ground Rods** shall be fabricated from cold-finished carbon steel shafting in accordance with ASTM Specification A 108, as it applies to Grade 1018.

2. **Construction:** The covering of the steel core shall be a molecularly-bonded sheath of electrolytic-grade copper having a minimum thickness of 0.010". The rods shall have rolled threads at each end for joining together with couplings. The rods shall conform to the applicable requirements of Underwriters' Laboratories UL-467, except as modified herein.

3. **Couplings** for sectional rods shall be made of high-strength, corrosion-resistant bronze, internally threaded to fit standard rods.

4. **Driving Studs** shall be made of high-strength, hardened steel of SAE 1045 or equal quality.

5. **Packaging:** The threaded rod ends shall be protected to prevent thread damage during shipment.

6. **Reference Specifications:**
   - ASTM A 108, SAE 1045, latest revisions
   - NEMA Standard Publication GR 1-2001
   - Underwriters' Laboratories UL-467

7. **Stock Unit:** EA

8. **Approved Manufacturers:**

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Hubbell</th>
<th>Eritech</th>
<th>Galvan Industries, Inc.</th>
<th>Southern Grounding Products</th>
<th>Wilcor</th>
</tr>
</thead>
<tbody>
<tr>
<td>564235</td>
<td>5/8-in x 5-ft ground rod</td>
<td>–</td>
<td>635850</td>
<td>6255-10MS</td>
<td>CS 586</td>
<td>WA 585CT</td>
</tr>
<tr>
<td>564238</td>
<td>5/8-in x 8-ft ground rod</td>
<td>C635880</td>
<td>635880</td>
<td>6258S</td>
<td>CS 588</td>
<td>WA 588CT</td>
</tr>
<tr>
<td>564260</td>
<td>3/4-in x 10-ft ground rod</td>
<td>C633400</td>
<td>633400</td>
<td>7510S</td>
<td>CS 3410</td>
<td>WA 3410CT</td>
</tr>
<tr>
<td>564074</td>
<td>5/8-in coupling</td>
<td>CTC58</td>
<td>CR-58</td>
<td>60-C</td>
<td>58C</td>
<td>C 158</td>
</tr>
<tr>
<td>564075</td>
<td>3/4-in coupling</td>
<td>CTC34</td>
<td>CR-34</td>
<td>70-C</td>
<td>34C</td>
<td>C 134</td>
</tr>
<tr>
<td>564604</td>
<td>5/8-in driving stud</td>
<td>CTDH58</td>
<td>DS58</td>
<td>60-DS</td>
<td>DS 58</td>
<td>D 358</td>
</tr>
<tr>
<td>013282</td>
<td>3/4-in driving stud</td>
<td>CTDH34</td>
<td>DS34</td>
<td>70-DS</td>
<td>DS 34</td>
<td>D 334</td>
</tr>
</tbody>
</table>

In October 2015, this standard was renumbered from 5642.10 to 6762.25.
Schedule 40 PVC Conduit and Fittings

1. Scope

This standard covers the requirements for Schedule 40 extruded rigid polyvinyl chloride (PVC) conduit and fittings consisting of elbows, couplings, adapters.

2. Application

Schedule 40 PVC conduit and fittings are used to construct smooth raceways for the pulling in of cable installed in a variety of looped radial and network system applications:

- Service
- Secondary
- Primary
- Communication
- Control

Refer to SCL 0222.02.

Five-inch (IPS) size conduit is specified with both ends straight cut to minimize the gap at the conduit joints. Minimized gaps are less likely to catch debris during construction and lead to damaged cable.

Elbows are also known as bends. Large radius elbows are also known as sweeps.

The straight cut end of a section of conduit or elbow is also known as the spigot end.
3. Industry Standards

Schedule 40 PVC conduit and fittings shall meet the requirements of the following industry standard:


The following clarifications apply:

- Five inch (IPS) size shall meet the requirements for specific applications, Section 4.5 (straight cut, without couplings or adapters).
- All other (IPS) sizes shall meet the requirements for general use, Section 4.6 (one bell end).

4. Detailed Requirements

4.1 General

Conduit and fittings shall be suitable for above ground use indoors or outdoors exposed to sunlight and weather, and for underground use by direct burial or encasement in concrete.

Conduit and fitting dimensions shall conform to UL 651 and the Iron Pipe Standard (IPS), where dimensions are based on outside diameters of iron pipe sizes.

Conduit and fitting color shall be medium to dark gray.

Conduit and fittings shall not have any features that can abrade or otherwise damage cable.

All straight-cut ends from conduit, reducers, and elbows with a diameter of 2 in (IPS) and larger shall be chamfered according to Figure 4.1.

Conduit, elbows, and fittings shall be designed and manufactured to be a system intended to guarantee complete interchangeability and compatibility between components.

**Figure 4.1. Chamfer Detail**
4.2 Conduit

Conduit shall be certified by Underwriters Laboratories (UL) or one of the following NRTLs (Nationally Recognized Testing Laboratories) as meeting the minimum requirements of Standard UL 651:

- CSA (Canadian Standards Association)
- ETL
- NSF International

Manufacturer shall inform SCL in writing of all design changes that could affect the product's understood or published capabilities or attributes.

Dimensional information cited in Sections 4.2, 4.3, and 4.4 should be consistent with UL requirements and is provided for the convenience of SCL design engineers, construction crews, inspectors, and quality assurance personnel who do not have ready access to UL 651.

Conduit shall meet the performance requirements as described in Table 4.2a

**Table 4.2a. Conduit performance requirements**

<table>
<thead>
<tr>
<th>Description</th>
<th>UL 651 Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength</td>
<td>7</td>
</tr>
<tr>
<td>Deflection under heat and load</td>
<td>8</td>
</tr>
<tr>
<td>Extrusion process</td>
<td>9</td>
</tr>
<tr>
<td>Low-temperature handling</td>
<td>10</td>
</tr>
<tr>
<td>Water absorption</td>
<td>11</td>
</tr>
<tr>
<td>Resistance to crushing</td>
<td>12</td>
</tr>
<tr>
<td>Resistance to impact</td>
<td>13</td>
</tr>
<tr>
<td>Flame</td>
<td>14</td>
</tr>
<tr>
<td>Conduit for use with 90 degree C wire</td>
<td>17</td>
</tr>
<tr>
<td>Resistance to specific reagents</td>
<td>18</td>
</tr>
<tr>
<td>Sunlight resistance</td>
<td>19</td>
</tr>
<tr>
<td>Pipe stiffness</td>
<td>20</td>
</tr>
<tr>
<td>Pull-joint separation</td>
<td>21</td>
</tr>
<tr>
<td>Bending and pull-joint separation</td>
<td>22</td>
</tr>
<tr>
<td>Joint water tightness</td>
<td>23</td>
</tr>
<tr>
<td>Elastomeric materials accelerated aging</td>
<td>24</td>
</tr>
<tr>
<td>Permanency of printing</td>
<td>25</td>
</tr>
</tbody>
</table>
### Table 4.2b. Conduit Dimensions, Straight (str)

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size, IPS (in)</th>
<th>End #1</th>
<th>End #2</th>
<th>Outside Diameter, Min (in)</th>
<th>Outside Diameter, Average, (in)</th>
<th>Outside Diameter, Max (in)</th>
<th>Inside Diameter, Min, Average (in)</th>
<th>Wall Thickness, Min (in)</th>
<th>Weight, Nominal, (lb / ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>734525</td>
<td>1/2</td>
<td>Bell</td>
<td>Str cut</td>
<td>0.832</td>
<td>0.840</td>
<td>0.848</td>
<td>0.578</td>
<td>0.109</td>
<td>0.16</td>
</tr>
<tr>
<td>734526</td>
<td>3/4</td>
<td>&quot;</td>
<td>&quot;</td>
<td>1.040</td>
<td>1.050</td>
<td>1.060</td>
<td>0.780</td>
<td>0.113</td>
<td>0.22</td>
</tr>
<tr>
<td>734527</td>
<td>1</td>
<td>&quot;</td>
<td>&quot;</td>
<td>1.305</td>
<td>1.315</td>
<td>1.325</td>
<td>1.004</td>
<td>0.133</td>
<td>0.32</td>
</tr>
<tr>
<td>734528</td>
<td>1-1/4</td>
<td>&quot;</td>
<td>&quot;</td>
<td>1.648</td>
<td>1.660</td>
<td>1.672</td>
<td>1.335</td>
<td>0.140</td>
<td>0.43</td>
</tr>
<tr>
<td>734529</td>
<td>1-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>1.888</td>
<td>1.900</td>
<td>1.912</td>
<td>1.564</td>
<td>0.145</td>
<td>0.52</td>
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<tr>
<td>734530</td>
<td>2</td>
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<td>&quot;</td>
<td>2.363</td>
<td>2.375</td>
<td>2.387</td>
<td>2.021</td>
<td>0.154</td>
<td>0.70</td>
</tr>
<tr>
<td>734531</td>
<td>2-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>2.860</td>
<td>2.875</td>
<td>2.890</td>
<td>2.414</td>
<td>0.203</td>
<td>1.11</td>
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<tr>
<td>734532</td>
<td>3</td>
<td>&quot;</td>
<td>&quot;</td>
<td>3.485</td>
<td>3.500</td>
<td>3.515</td>
<td>3.008</td>
<td>0.216</td>
<td>1.45</td>
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<tr>
<td>734533</td>
<td>3-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>3.950</td>
<td>4.000</td>
<td>4.050</td>
<td>3.486</td>
<td>0.226</td>
<td>1.74</td>
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<td>734523</td>
<td>4</td>
<td>&quot;</td>
<td>&quot;</td>
<td>4.450</td>
<td>4.500</td>
<td>4.550</td>
<td>3.961</td>
<td>0.237</td>
<td>2.10</td>
</tr>
<tr>
<td>734524</td>
<td>5</td>
<td>Str cut</td>
<td>&quot;</td>
<td>5.513</td>
<td>5.563</td>
<td>5.613</td>
<td>4.975</td>
<td>0.258</td>
<td>2.80</td>
</tr>
</tbody>
</table>

### 4.3 Elbows

#### Table 4.3a. Elbow Dimensions, 90 and 45 Degree

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size, IPS (in)</th>
<th>Degree Bend</th>
<th>End #1</th>
<th>End #2</th>
<th>Radius (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>734551</td>
<td>1/2</td>
<td>90</td>
<td>Bell</td>
<td>Str. cut</td>
<td>4</td>
</tr>
<tr>
<td>734671</td>
<td>3/4</td>
<td>90</td>
<td>&quot;</td>
<td>&quot;</td>
<td>4-1/2</td>
</tr>
<tr>
<td>734550</td>
<td>1</td>
<td>90</td>
<td>&quot;</td>
<td>&quot;</td>
<td>5-3/4</td>
</tr>
<tr>
<td>734546</td>
<td>1-1/4</td>
<td>90</td>
<td>&quot;</td>
<td>&quot;</td>
<td>7-1/4</td>
</tr>
<tr>
<td>734547</td>
<td>1-1/2</td>
<td>90</td>
<td>&quot;</td>
<td>&quot;</td>
<td>8-1/4</td>
</tr>
<tr>
<td>734548</td>
<td>2</td>
<td>90</td>
<td>&quot;</td>
<td>&quot;</td>
<td>24</td>
</tr>
<tr>
<td>734549</td>
<td>2-1/2</td>
<td>90</td>
<td>&quot;</td>
<td>&quot;</td>
<td>24</td>
</tr>
<tr>
<td>734553</td>
<td>1-1/4</td>
<td>45</td>
<td>&quot;</td>
<td>&quot;</td>
<td>7-1/4</td>
</tr>
<tr>
<td>734554</td>
<td>1-1/2</td>
<td>45</td>
<td>&quot;</td>
<td>&quot;</td>
<td>8-1/4</td>
</tr>
<tr>
<td>734555</td>
<td>2</td>
<td>45</td>
<td>&quot;</td>
<td>&quot;</td>
<td>18</td>
</tr>
<tr>
<td>734557</td>
<td>3</td>
<td>45</td>
<td>&quot;</td>
<td>&quot;</td>
<td>36</td>
</tr>
<tr>
<td>73559</td>
<td>4</td>
<td>45</td>
<td>&quot;</td>
<td>&quot;</td>
<td>36</td>
</tr>
</tbody>
</table>

#### Table 4.3b. Elbow Dimensions, 22-1/2 and 5 Degree

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size, IPS (in)</th>
<th>Degree Bend</th>
<th>End #1</th>
<th>End #2</th>
<th>Radius (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>734561</td>
<td>2</td>
<td>22-1/2</td>
<td>Bell</td>
<td>Str. cut</td>
<td>18</td>
</tr>
<tr>
<td>734562</td>
<td>2-1/2</td>
<td>22-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>18</td>
</tr>
<tr>
<td>734563</td>
<td>3</td>
<td>22-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>24</td>
</tr>
<tr>
<td>734566</td>
<td>4</td>
<td>22-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>24</td>
</tr>
</tbody>
</table>
4.4 Fittings

Female adapters shall have straight threads. Coupling fittings, 2 inch (IPS) and larger, shall be of molded manufacture, not expanded.

Table 4.4a. Fittings, Female (F), Male (M), and Slip (S)

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size, IPS (in)</th>
<th>Description</th>
<th>Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>734508</td>
<td>1/2</td>
<td>Female adapter</td>
<td>S x F</td>
</tr>
<tr>
<td>734540</td>
<td>3/4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734541</td>
<td>1</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734542</td>
<td>1-1/4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734543</td>
<td>1-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734544</td>
<td>2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734545</td>
<td>2-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734537</td>
<td>3</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734539</td>
<td>4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734536</td>
<td>5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734920</td>
<td>1/2</td>
<td>Male adapter</td>
<td>S x M</td>
</tr>
<tr>
<td>734914</td>
<td>3/4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734918</td>
<td>1</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734924</td>
<td>1-1/4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734925</td>
<td>1-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734926</td>
<td>2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734921</td>
<td>3</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734923</td>
<td>4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Coupling fittings, 2 inch (IPS) and larger, shall be of molded manufacture, not expanded.

Table 4.4b. Fittings, Straight Couplings, Slip (S)

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size, IPS (in)</th>
<th>Description</th>
<th>Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>734512</td>
<td>1/2</td>
<td>Straight coupling</td>
<td>S x S</td>
</tr>
<tr>
<td>734513</td>
<td>3/4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734514</td>
<td>1</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734515</td>
<td>1-1/4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734516</td>
<td>1-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734517</td>
<td>2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734518</td>
<td>2-1/2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734519</td>
<td>3</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734521</td>
<td>4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>734522</td>
<td>5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
</tbody>
</table>
Table 4.4c. Fitting, Swedge Reducer

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size, IPS (in)</th>
<th>End #1 Description</th>
<th>End #1 Str. Cut</th>
<th>End #2 Description</th>
<th>End #2 Str. Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>734470</td>
<td>3</td>
<td>Reducer</td>
<td>Chamfered</td>
<td>Str. Cut</td>
<td>Chamfered</td>
</tr>
<tr>
<td>012503</td>
<td>4</td>
<td>Reducer</td>
<td>Chamfered</td>
<td>Str. Cut</td>
<td>Chamfered</td>
</tr>
</tbody>
</table>

Long sleeve repair couplings shall have no center stop.

Long sleeve repair couplings shall have a minimum length of 10 in.

Table 4.4d. Fittings, Long Sleeve Couplings without Center Stop, Slip (S)

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size, IPS (in)</th>
<th>Description</th>
<th>Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>013705</td>
<td>2</td>
<td>Long sleeve coupling</td>
<td>S x S</td>
</tr>
<tr>
<td>013706</td>
<td>3</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>013707</td>
<td>4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>013708</td>
<td>5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

5. Marking

Each conduit section shall be marked according to the requirements of UL 651, Section 25.

The outer surface of each conduit section shall be marked with the following minimum information:

- Trade size
- Schedule number or equivalent information
- Manufacturer’s name or symbol
- Date (or period) of manufacture
- UL or NRTL mark

Each fitting shall be marked according to the requirements of UL 651, Section 46.

The outer surface of each fitting shall be marked with the following minimum information:

- Manufacturer’s name or symbol
- Catalog number

6. Testing

Conduit and fitting test data that establishes compliance with the requirements of UL 651 and this material standard shall be provided upon request.
7. Packaging

Straight conduit shall be furnished in 10-ft sections unless specified otherwise on the purchase order.

Master bundles shall be secured with at least two bands of steel or UV-resistant plastic strapping.

Each master bundle of straight conduit shall be legibly marked with the following information:

- Manufacturer's identification
- Product description
- Seattle City Light purchase order number
- Seattle City Light stock number
- Gross, net, and tare weight

8. Shipping

Conduit may be delivered on enclosed, covered, or flatbed trucks. If conduit is delivered on a flatbed truck, conduit shall be side-loaded.

Because Washington State law requires a 10-in minimum side board when driving a forklift or pallet jack onto the bed of a truck or trailer, most flatbed trucks or trailers must be side-loaded to ease off-loading.

9. Issuance

Conduit: FT
Elbows: EA
All Other Fittings: EA

10. Approved Manufacturers

10.1 Products Approved for Purchase by SCL

**Conduit Straight Sections**

- Cantex (Mitsubishi Corp.)
- Cresline NW
- Heritage Plastics Inc. (Atkore Int'l)
- IPEX
- JM Eagle
- Prime Conduit (formerly Carlon; Mitsubishi Corp.)
- Ridgeline Pipe Mfg. (Atkore Int'l)
- Royal Pipe Systems

**Elbows**

- Cantex (Mitsubishi Corp.)
- Heritage Plastics Inc. (Atkore Int'l)
- Scepter (IPEX)
- JM Eagle
- Kraloy (IPEX)
- Raceways Technology & Mfg.
- Ridgeline Pipe Mfg. (Atkore Int'l)
- Carlon (Thomas & Betts)
- Royal Pipe Systems
All Other Fittings

- Cantex (Mitsubishi Corp.)
- Heritage Plastics Inc. (Atcore Int'l)
- Scepter (IPEX)
- JM Eagle
- Kraloy (IPEX)
- Ridgeline Pipe Mfg. (Atkore Int'l)
- Carlon (Thomas & Betts)
- Royal Pipe Systems

10.2 Products Approved for Purchase and Installation by SCL Contractors

SCL contractors may purchase and install cellular core PVC conduit straight sections from Rocky Mountain Colby Company.

SCL contractors may purchase and install solid PVC conduits, elbows, and fittings from the approved manufacturers cited in section 10.1.

SCL contractors may purchase and install 5-in conduit with belled end and spigot end from approved manufacturers cited in Section 10.1, “Conduit Straight Sections.”

11. References

- **SCL Construction Standard 0222.02**: “Requirements for Duct Banks in the Public Right-of-Way”
- **SCL Material Standard 7345.2**: “Conduit and Fittings, EPC 40 and EPC 80 Rigid Polyvinyl Chloride” (canceled)

12. Sources

- **ASTM F891**: “Standard Specification for Coextruded Poly Vinyl Chloride (PVC) Plastic Pipe With a Cellular Core”
- **Shipek, John**: SCL Standards Engineer, subject matter expert and originator of 7015.05 (john.shipek@seattle.gov)
- **Wang, Quan**: SCL Standards Engineer and subject matter expert for 7015.05
Conduit Spacers for PVC and FG Conduit

Plastic Spacers for Nonmetallic Conduit shall be of the general configuration shown, and shall be molded from a general-purpose polystyrene meeting the requirements of ASTM Standard D4549 for Type 1 molding material.

Each unit shall have two lugs for interlocking on one side and bottom, and two mating holes on the other side and top. The lugs shall fit corresponding holes snugly, permitting rapid, secure field assembly of multiple units. Separation between conduits shall be 2 inches for all sizes of spacers.


Stock Unit: EA

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Figure Number</th>
<th>Nominal Conduit Size</th>
<th>Dimensions in Inches</th>
<th>Approved Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>Intermediate</td>
<td>734669</td>
<td>2</td>
<td>3</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>734670</td>
<td>2</td>
<td>4</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>734680</td>
<td>2</td>
<td>5</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td>010447</td>
<td>2</td>
<td>6</td>
<td>8.7</td>
</tr>
<tr>
<td>Base</td>
<td>734690</td>
<td>1</td>
<td>3</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>010448</td>
<td>1</td>
<td>4</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>734692</td>
<td>1</td>
<td>5</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td>010446</td>
<td>1</td>
<td>6</td>
<td>8.7</td>
</tr>
</tbody>
</table>

* GS Industries of Bassett, Inc. GS Industries spacers marked "Underground Products" are acceptable.

These items are approved for contractor use but NOT for City Light stock.

Approved Manufacturers:
- Underground Device Inc. Wunpeece Duc Spacer SERIES
- Cantex 53360xx and 53359xx SERIES
- PWPipe 6268 and 6266 SERIES

In October 2015, this standard was renumbered from 7346.8 to 7015.80.
1. **Scope**

This standard covers the requirements for zinc-coated steel conduit and fittings consisting of elbows, couplings, and nipple stock.

2. **Application**

Zinc-coated steel conduit and fittings are used to construct smooth raceways for the pulling in of cable. Design engineers should be aware that different types of conduit have widely different physical properties that affect their application. Less expensive Schedule 40 PVC, Schedule 80 PVC, and/or fiberglass conduit systems should be considered first.

Refer to Design Standard 9220.05 for more information matching conduit with cable and application.

For new construction, design engineers are directed to utilize the following standard conduit trade sizes:

- 1/2
- 1-1/2
- 2
- 3
- 4
- 5

Design engineers should move away from utilizing these trade sizes (IPS):

- 3/4
- 1
- 2-1/2
- 3-1/2

Steel conduit is also known as electrical rigid metal conduit - steel, abbreviated ERMC-S. Conduit that is finished means it has a threaded coupling attached to one end.

Elbows are also known as bends. Large radius elbows are also known as sweeps or large sweeps. Five-inch trade size, 60-inch radius sweeps, Stock Number 734826, are used at the base of a riser pole.

Underground duct systems typically utilize elbows that are bent in the field from straight sections. Field bending elbows allows for custom angles and better nesting of multiple runs.

UL 6 defines a nipple to be a straight section of conduit 24 inches in length or less, with male pipe threads at each end. Technically, Seattle City Light purchases nipple stock, also known as running thread.

3. **Industry Standards**

Zinc-coated steel conduit and fittings shall meet the requirements of the following industry standard:


4. **Detailed Requirements**

4.1 **General**

Conduit and fittings shall be suitable for above ground use indoors or outdoors exposed to sunlight and weather, and for underground use by direct burial or encasement in concrete.

Conduit and fittings shall not have any features that can abrade or otherwise damage cable.

Conduit and fittings shall be provided with a primary coating of zinc.

Dimensional information cited in Sections 4.2 through 4.5 should be consistent with UL requirements and is provided for the convenience of Seattle City Light design engineers, construction crews, inspectors, and quality assurance personnel who do not have ready access to UL 6.
4. Detailed Requirements, continued

4.2 Straight Section Conduit

Conduit shall be listed by Underwriters Laboratories, Standard UL 6. Each straight conduit section shall be finished with one threaded coupling attached.

Table 4.2. Conduit

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size (in)</th>
<th>Outside Diameter min (in)</th>
<th>Outside Diameter average (in)</th>
<th>Outside Diameter max (in)</th>
<th>Inside Diameter nom (in)</th>
<th>Wall Thickness nom (in)</th>
<th>Weight min (lbs / ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>012085</td>
<td>1/2</td>
<td>0.825</td>
<td>0.840</td>
<td>0.855</td>
<td>0.632</td>
<td>0.104</td>
<td>0.79</td>
</tr>
<tr>
<td>012086</td>
<td>3/4</td>
<td>1.035</td>
<td>1.050</td>
<td>1.065</td>
<td>0.836</td>
<td>0.107</td>
<td>1.05</td>
</tr>
<tr>
<td>012087</td>
<td>1</td>
<td>1.300</td>
<td>1.315</td>
<td>1.330</td>
<td>1.063</td>
<td>0.126</td>
<td>1.53</td>
</tr>
<tr>
<td>734740</td>
<td>1-1/2</td>
<td>1.885</td>
<td>1.900</td>
<td>1.915</td>
<td>1.624</td>
<td>0.138</td>
<td>2.49</td>
</tr>
<tr>
<td>734741</td>
<td>2</td>
<td>2.351</td>
<td>2.375</td>
<td>2.399</td>
<td>2.083</td>
<td>0.146</td>
<td>3.32</td>
</tr>
<tr>
<td>734742</td>
<td>2-1/2</td>
<td>2.846</td>
<td>2.875</td>
<td>2.904</td>
<td>2.489</td>
<td>0.193</td>
<td>5.27</td>
</tr>
<tr>
<td>734743</td>
<td>3</td>
<td>3.465</td>
<td>3.500</td>
<td>3.535</td>
<td>3.090</td>
<td>0.205</td>
<td>6.82</td>
</tr>
<tr>
<td>734744</td>
<td>3-1/2</td>
<td>3.960</td>
<td>4.000</td>
<td>4.040</td>
<td>3.570</td>
<td>0.215</td>
<td>8.31</td>
</tr>
<tr>
<td>734745</td>
<td>4</td>
<td>4.455</td>
<td>4.500</td>
<td>4.545</td>
<td>4.050</td>
<td>0.225</td>
<td>9.27</td>
</tr>
<tr>
<td>734747</td>
<td>5</td>
<td>5.507</td>
<td>5.563</td>
<td>5.619</td>
<td>5.073</td>
<td>0.245</td>
<td>13.1</td>
</tr>
</tbody>
</table>

4.3 Elbows

Elbows shall be listed by Underwriters Laboratories, Standard UL 6. Elbow angles shall be accurate to +/- 2% of specified.

Figure 4.3a. Conduit Elbows
4. Detailed Requirements, continued

4.3 Elbows, continued

Table 4.3b. Standard Sweep Elbows

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size (in)</th>
<th>Degree Bend</th>
<th>Radius (in)</th>
<th>Straight End Length (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>734805</td>
<td>3/4</td>
<td>90</td>
<td>4-1/2</td>
<td>1-1/2</td>
</tr>
<tr>
<td>734806</td>
<td>1</td>
<td>&quot;</td>
<td>5-3/4</td>
<td>1-7/8</td>
</tr>
<tr>
<td>734808</td>
<td>1-1/2</td>
<td>&quot;</td>
<td>8-1/4</td>
<td>2</td>
</tr>
<tr>
<td>734809</td>
<td>2</td>
<td>&quot;</td>
<td>9-1/2</td>
<td>2</td>
</tr>
<tr>
<td>734810</td>
<td>2-1/2</td>
<td>&quot;</td>
<td>10-1/2</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 4.3c. Large Sweep Elbows

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size (in)</th>
<th>Degree Bend</th>
<th>Radius (in)</th>
<th>Straight End Length (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>734820</td>
<td>2</td>
<td>90</td>
<td>36</td>
<td>11</td>
</tr>
<tr>
<td>734821</td>
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<td>36</td>
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</tr>
<tr>
<td>734822</td>
<td>3</td>
<td>&quot;</td>
<td>36</td>
<td>11</td>
</tr>
<tr>
<td>734823</td>
<td>3-1/2</td>
<td>&quot;</td>
<td>36</td>
<td>11</td>
</tr>
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<td>734824</td>
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<td>11</td>
</tr>
<tr>
<td>012176</td>
<td>4</td>
<td>&quot;</td>
<td>48</td>
<td>12</td>
</tr>
<tr>
<td>734826</td>
<td>5</td>
<td>&quot;</td>
<td>60</td>
<td>12</td>
</tr>
<tr>
<td>013749</td>
<td>4</td>
<td>22-1/2</td>
<td>48</td>
<td>12</td>
</tr>
<tr>
<td>013750</td>
<td>4</td>
<td>45</td>
<td>48</td>
<td>12</td>
</tr>
</tbody>
</table>

4.4 Threaded Couplings

Threaded couplings shall be listed by Underwriters Laboratories, Standard UL 6. Threaded couplings shall be straight-tapped.

Table 4.4. Straight Threaded Couplings

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>731091</td>
<td>1/2</td>
</tr>
<tr>
<td>731092</td>
<td>3/4</td>
</tr>
<tr>
<td>731093</td>
<td>1</td>
</tr>
<tr>
<td>731094</td>
<td>1-1/4</td>
</tr>
<tr>
<td>731095</td>
<td>1-1/2</td>
</tr>
<tr>
<td>731096</td>
<td>2</td>
</tr>
<tr>
<td>731097</td>
<td>2-1/2</td>
</tr>
<tr>
<td>731098</td>
<td>3</td>
</tr>
<tr>
<td>731099</td>
<td>3-1/2</td>
</tr>
<tr>
<td>731100</td>
<td>4</td>
</tr>
<tr>
<td>731102</td>
<td>5</td>
</tr>
</tbody>
</table>
4. Detailed Requirements, continued

4.5 Nipple Stock

Nipple stock shall be provided in three-foot lengths.

Table 4.5. Nipple Stock

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Trade Size (in)</th>
<th>Threads per in</th>
</tr>
</thead>
<tbody>
<tr>
<td>734868</td>
<td>1/2</td>
<td>14</td>
</tr>
<tr>
<td>734869</td>
<td>3/4</td>
<td>14</td>
</tr>
<tr>
<td>734870</td>
<td>1</td>
<td>11-1/2</td>
</tr>
<tr>
<td>734872</td>
<td>1-1/2</td>
<td>11-1/2</td>
</tr>
<tr>
<td>734873</td>
<td>2</td>
<td>11-1/2</td>
</tr>
<tr>
<td>734874</td>
<td>2-1/2</td>
<td>8</td>
</tr>
</tbody>
</table>

5. Marking

Each straight length of finished conduit, elbow, and threaded coupling shall be marked according to the requirements of UL 6, Section 7. This marking shall include, but not be limited to:

- Manufacturer's name or symbol
- "electrical rigid metal conduit" or "ERMC-S" (conduit and elbows only)
- "EC" (couplings only)

6. Testing

Conduit and fitting test data that establishes compliance with the requirements of UL 6 and this material standard shall be provided upon request.

7. Packaging

Straight conduit shall be furnished in 10 ft sections unless specified otherwise on the purchase order. Each bundle shall be legibly marked with the following information:

- Manufacturer's identification
- Product description
- Seattle City Light's Purchase Order Number
- Seattle City Light's Stock Number
- Gross, net, and tare weight

8. Shipping

Conduit may be delivered on enclosed, covered, or flatbed trucks. If conduit is delivered on a flatbed truck, conduit shall be side-loaded.

Because Washington State law requires a 10-inch minimum side board when driving a forklift or pallet jack onto the bed of a truck or trailer, most flatbed trucks or trailers must be side-loaded to ease off-loading.

9. Issuance

Conduit: FT
Fittings: EA

10. Approved Manufacturers

Allied Tube and Conduit
Cal Conduit Products
Conduit Pipe Products
Occidental
Picoma
Republic
Steelduct
Torrance
Triangle
Western
Wheatland

11. References

7347.5: “Conduit and Fittings, Rigid Steel, Galvanized” (canceled); Material Standard; SCL
7347.6: “Elbow, 90° Large Sweep, Rigid Galvanized Steel Conduit” (canceled); Material Standard; SCL
9220.05: “Electric Power Cable and Conduit Application” (in development); Design Standard; SCL

Shipek, John; SCL Standards Engineer, subject matter expert and originator of 7050.05 (john.shipek@seattle.gov)
Cable Protectors for installation in duct and conduit ends shall be of the configuration shown, and shall be made from stress-relieved virgin nylon meeting the requirements of ASTM D789 or high-density polyethylene meeting the requirements of ASTM D1248. The material shall have the following additional requirements.

Exceptional resistance to abrasion
Low coefficient of friction
Burning rate of 1.04”/minute or slower per ASTM D635
Temperature range: -20 to +90°C., and retain uniform characteristics
Resistant to weak acids and alkalis
Color shall be white, light gray or other light colors which can be written on with a black marker. Black is unacceptable.


Stock Unit: EA

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Conduit Size (in)</th>
<th>Virginia Plastics</th>
<th>Anchor Industrial Plastics</th>
<th>Conduit</th>
<th>Electrical Materials Co. (EMCO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>731800 E</td>
<td>2 to 2½</td>
<td>LG-225</td>
<td>APCP-2</td>
<td>80423-01</td>
<td>27-2 Grey</td>
</tr>
<tr>
<td>731801 E</td>
<td>3 to 6</td>
<td>LG-345</td>
<td>APCP-3</td>
<td>80423-00</td>
<td>27-1 Grey</td>
</tr>
</tbody>
</table>

In October 2015, this standard was renumbered from 7318.1 to 7050.09.
DB120, PVC Conduit Fittings

1. **Scope:** This specification is for polyvinyl chloride (PVC) plastic utilities fittings suitable for underground installations: Type DB-120.

   The fittings shall comply with the latest revision to NEMA TC 9, "Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation."

2. **Fittings** shall be furnished in the sizes and types specified on the purchase order. Sockets shall be in accordance with Table 2-2 or 2-3 of NEMA TC 9. Plugs and end bells shall be in accordance with Tables 2-12 and 2-7 or 2-8, respectively, of NEMA TC 9.

3. **Color:** Fittings shall be medium to dark gray in color.

4. **Markings:** In addition to the marking requirements of NEMA TC 9, each shipping lot shall be marked with the City purchase order number, gross and net weights, and the name and address of the manufacturer.

5. **Reference Specification:** NEMA TC 9, ASTM D 2672, ASTM F 512 (latest revisions)

6. **Stock Unit:** EA

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Size, nominal (in)</th>
<th>Stock No.</th>
<th>Size, nominal (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>734944</td>
<td>2</td>
<td>734938</td>
<td>2</td>
</tr>
<tr>
<td>734946</td>
<td>3</td>
<td>734940</td>
<td>3</td>
</tr>
<tr>
<td>734947</td>
<td>3-1/2</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>734948</td>
<td>4</td>
<td>734942</td>
<td>4</td>
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<td>734949</td>
<td>5</td>
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<td>5</td>
</tr>
<tr>
<td>010340</td>
<td>6</td>
<td>010338</td>
<td>6</td>
</tr>
</tbody>
</table>

   **Notes**
   1. Approved end bell manufacturers: Carlon; Kraloy; PW Eagle Inc., dba PWPipe; Scepter.
   2. Approved plug manufacturer: Carlon only.
   3. For regular couplings and adapters and 45° and 90° bends, refer to SCL 7020.05..

7. **Adapter:** 3-1/2” nominal round to 3-1/2” nominal square by 24” long.

   Stock No. 734565

   Approved adapter manufacturers: Carlon; J-M Manufacturing Inc.; Picoma; PW Eagle Inc., dba PWPipe; Raceways Tech.

8. **References**

   SCL Material Standard 7015.05; “Schedule 40 PVC Conduit and Fittings”
   SCL Material Standard 7345.7; “DB120, PVC Conduit Fittings” (renamed and renumbered to 7055.09 in October 2015)
1. **Scope**

This standard covers the requirements for the formulation of thermally conductive concrete and low strength material used in the construction of encased electrical conduits (duct banks) including high strength Fluidized Thermal Backfill (FTB) and low strength Fluidized Thermal Backfill. Because FTB is a mixed-to-order product, it is not stocked in Seattle City Light (SCL) inventory.

This standard applies to the following SCL stock numbers:

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>013711</td>
<td>High strength FTB</td>
<td>CYU</td>
</tr>
<tr>
<td>013712</td>
<td>Low strength FTB</td>
<td>CYU</td>
</tr>
</tbody>
</table>

2. **Application**

Fluidized Thermal Backfill (FTB) is used to encase and cover underground power conduits that will contain transmission or distribution cables which may operate at or above normal ampere capacity (ampacity). FTB transfers heat away from power cables, allowing them to conduct more power.

Low-Strength FTB is used like controlled density fill (CDF) to backfill trenches over the high-strength FTB duct banks, and also for encasement where high-strength is not desired. It provides superior thermal properties to other backfills, and is self-compacting.

High-Strength FTB is used like concrete for duct bank encasement. It provides maximum protection against dig-ins and undermining during future excavations. As a rule, high-strength FTB is more thermally conductive than low-strength FTB, but it is much more difficult to remove in future excavations.

FTB is normally not required for vault, manhole, or handhole backfill.

Admixtures must be pre-approved by SCL.
3. Industry Standards

Backfill shall meet the requirements of the latest revisions of the following industry standards:

**ASTM C31/C31M;** Standard Practice for Making and Curing Concrete Test Specimens in the Field

**ASTM C39/C39M;** Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens


**ASTM C143;** Standard Test Method for Slump of Hydraulic Cement Concrete

**ASTM C150;** Standard Specification for Portland Cement

**ASTM C618;** Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

**ASTM C989;** Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

4. Mix Design & Requirements

4.1 General Requirements

The contractor shall provide a FTB mix design which meets the performance requirements outlined in Table 4.

FTB mix designs must specify the source of all FTB component materials, including the source pit for aggregate materials. The maximum aggregate is 3/8 in.

FTB mix designs must be engineered by a Seattle City Light-approved consultant.

FTB component materials may include:
- 3/8-in minus (medium) aggregate – ASTM C136 Sieve Analysis required for approval
- Building sand (fine aggregate) – ASTM C136 Sieve Analysis required for approval
- Portland Cement – type I per ASTM C150
- Fly Ash – Class F as per ASTM C618-05
- Ground Granulated Blast Furnace Slag – ASTM C989-05
- Water – clean potable water required, or as approved by SCL
- Red concrete dye, where specified by Seattle City Light engineering. Red dye should be added at the equivalent of 4 pounds of red oxide per cubic yard.

### Table 4. Performance Requirements

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Unit</th>
<th>Low Strength FTB</th>
<th>High Strength FTB</th>
<th>Testing Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thermal Resistivity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum at 0% Moisture Content</td>
<td>(^°C-cm)/W</td>
<td>100</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td>Maximum at Critical Moisture Content</td>
<td>(^°C-cm)/W</td>
<td>70</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td><strong>Minimum 28-Day Compressive Strength</strong></td>
<td>lb/sq-in</td>
<td>100</td>
<td>100</td>
<td>3000</td>
</tr>
<tr>
<td><strong>Maximum 28-Day Compressive Strength</strong></td>
<td>lb/sq-in</td>
<td>130</td>
<td>150</td>
<td>none</td>
</tr>
<tr>
<td><strong>Minimum Slump</strong></td>
<td>in</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td><strong>Maximum Slump</strong></td>
<td>in</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>
4.2 Mix Design Criteria
FTB mix designs shall meet or exceed the performance requirements cited in Table 4.

4.3 Air Content
The total air content of any FTB mix shall not exceed 2% by volume. No air entraining admixtures will be permitted.

4.4 Substitutions
No substitutions allowed for any component material without permission of Seattle City Light.

4.5 Withdrawal of Mix Design Approval
SCL reserves the right to temporarily suspend or permanently withdrawal approval of any mix design.

4.6 Admixtures
Admixtures must be approved for use in FTB by Seattle City Light. When allowed, the admixture shall be added per manufacturer recommendation.

4.7 Accelerating Admixture
The following accelerating admixture is approved for use in Seattle City Light FTB: Pozzolith NC 534, manufactured by BASF Admixtures, Inc.

4.8 Fluidizers
Seattle City Light-approved fluidizers may be used interchangeably where produced under the same ASTM specification. Unapproved fluidizers are not interchangeable with approved fluidizers.

For example, approved fly ash (ASTM C618) may be used in any mix design that specifies fly ash but it may not be substituted for blast furnace slag (ASTM 989) in another mix design. Also, an unapproved fly ash may not be substituted for an approved fly ash.

Fluidizer approval requires formulation of a mix design through an approved consultant, and two compliance certification reports that demonstrate consistent physical properties over a six-month period. Seattle City Light may withdraw approval at any time.

High-strength FTB mix designs may be formulated without fluidizer. Low-strength FTB mix designs must be formulated with fluidizer.

5. Producers Identification Codes
FTB mix designs must be designated as follows on all mix designs, submittals and delivery tickets:

- High Strength FTB – SCLHSFTB
- Low Strength FTB – SCLLSFTB

The addition of red dye must also be indicated.

Product codes and mix ID codes of individual suppliers will not be accepted.
6. Approval of FTB Mix Design

6.1 Submittals

The Contractor shall submit a mix design to SCL for all classes of concrete specified. The Contractor’s submittal of a mix design shall contain a unique identification, as per section 5, for each mix design, and shall include the mix proportions per cubic yard, the proposed sources, admixtures, the average 28-day compressive strength (as per ASTM C873), thermal resistivity testing including thermal dry graphs and the water cement ratio.

Test results for compressive strength and thermal resistivity included in the mix design submittal shall not be more than 60 days old.

The Contractor shall notify SCL in writing of any mix design modifications.

6.2 Expiration

Mix designs are approved for a period of one year from the date of SCL approval. Expired mix designs will not be permitted for use on Seattle City Light projects.

A mix design may be renewed by resubmitting the mix design, including up to date strength and thermal resistivity test results.

7. Approved Suppliers and Mix Designs

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Stock No. 013711 High Strength FTB Mix ID</th>
<th>Expiration Date</th>
<th>Stock No. 013712 Low Strength FTB Mix ID</th>
<th>Expiration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmon Bay Sand and Gravel</td>
<td>SCLHSFTB</td>
<td>3/30/2018</td>
<td>SCLLSFTB</td>
<td>3/30/2018</td>
</tr>
<tr>
<td>Stoneway Concrete (Plant 11)</td>
<td>SCLHSFTB</td>
<td>5/16/2018</td>
<td>SCLLSFTB</td>
<td>5/16/2018</td>
</tr>
<tr>
<td>Stoneway Concrete (Plant 14)</td>
<td>SCLHSFTB</td>
<td>5/16/2018</td>
<td>SCLLSFTB</td>
<td>5/16/2018</td>
</tr>
<tr>
<td>Cadman, Inc.</td>
<td>SCLHSFTB</td>
<td>5/16/2018</td>
<td>SCLLSFTB</td>
<td>6/16/2018</td>
</tr>
<tr>
<td>CalPortland</td>
<td>SCLHSFTB/505</td>
<td>6/16/2018</td>
<td>SCLLSFTB</td>
<td>8/22/2018</td>
</tr>
</tbody>
</table>

8. Sources

**Detter, Chris**; SCL Engineer and originator of 7150.00 (chris.detter@seattle.gov)

**Lu, Curtis**; SCL Standards Engineer and subject matter expert for 7150.00 (curtis.lu@seattle.gov)

**Read, Steven**; SPU Materials Engineering Supervisor and subject matter expert for 7150.00 (steven.read@seattle.gov)

**SCL Construction Standard 0226.06**; “Fluidized Thermal Backfill”

**Stewart, Bob**; SCL Civil Inspector, subject matter expert and major contributor to 7150.00 (bob.stewart@seattle.gov)

**Brissette, Andrew**; Civil Engineer Specialist Senior and subject matter expert for 7150.00 (andrew.brissette@seattle.gov)
1. Scope

This standard covers the requirements for 3030 precast secondary handhole bases, frames and covers. Components can be ordered separately or they can be ordered as an assembled handhole unit with cover.

This standard applies to the following Seattle City Light (SCL) stock numbers.

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013186</td>
<td>3030 handhole base with frame and cover (labeled &quot;Electric&quot;)</td>
</tr>
<tr>
<td>013187</td>
<td>3030 handhole, base only</td>
</tr>
<tr>
<td>013188</td>
<td>3030 handhole frame and cover assembly (labeled &quot;Electric&quot;)</td>
</tr>
</tbody>
</table>

2. Application

Handholes are used to house secondary service connections.

Handholes are for use in pedestrian sidewalks where an occasional car or light truck may inadvertently traverse.

3. General Requirements

This detailed standard is to be used in conjunction with the latest version of SCL Material Standard 7203.01, "Precast Reinforced Concrete Handholes – General."
4. Construction - Component Requirements

4.1 Grounding and Bonding Requirements

The handhole base shall be provided with a grounding insert.

The metal frame shall be provided with a grounding lug.

4.2 Handhole Base

The SCL 3030 handhole base (Stock No. 013187) shall have dimensions and features as shown in Tables 4.2a and 4.2b, and Figure 4.2.

**Table 4.2a. Handhole Dimensions (Nominal)**

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Item Description</th>
<th>Outside (in)</th>
<th>Inside (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length</td>
<td>Width</td>
</tr>
<tr>
<td>013186</td>
<td>Handhole base, frame and cover</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>013187</td>
<td>Handhole base only</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>013188</td>
<td>Frame and cover only</td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>

**Table 4.2b. Handhole Features**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knockouts, round</td>
<td>5 dia</td>
<td>All 4 walls, on bottom</td>
<td>2 ea side</td>
<td>8</td>
</tr>
<tr>
<td>Lift Holes</td>
<td>1-1/2 dia</td>
<td>Upper center on 2 walls, opposite</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td>Ground Inserts, bronze</td>
<td>1/4 dia</td>
<td>One wall, internal</td>
<td>1 ea side</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Approximate weight is 700 pounds.
4.3 Frame and Cover

The 3030 frame and cover assembly (Stock No. 013188) shall have dimensions and features as shown in Table 4.3 and Figure 4.3.

The cover and frame shall be made of slip resistant steel plate.

The angle frame shall be securely anchored in the concrete.

<table>
<thead>
<tr>
<th>Table 4.3. Frame and Cover Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Slip Surface, (COF)</td>
</tr>
<tr>
<td>Galvanizing</td>
</tr>
<tr>
<td>Load Rating</td>
</tr>
<tr>
<td>Grounding</td>
</tr>
<tr>
<td>Locking Device</td>
</tr>
<tr>
<td>Lift Handle</td>
</tr>
</tbody>
</table>
5. Issuance

EA

6. Approved Manufacturer

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>OldCastle Precast / Utility Vault</th>
</tr>
</thead>
<tbody>
<tr>
<td>013186</td>
<td>3030 handhole base with frame and cover</td>
<td>3030 LA Handhole – Electric</td>
</tr>
<tr>
<td>013187</td>
<td>3030 handhole, base only</td>
<td>3030-B</td>
</tr>
<tr>
<td>013188</td>
<td>3030 handhole frame and cover</td>
<td>3030-No Slip Door – Electric w/ Locking Latch</td>
</tr>
</tbody>
</table>
7. References

ASTM A123M-08; "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"

Standard Plan 550a; "Handholes;" City of Seattle; Public Utilities

Standard Plan J-40.10-00; "Locking Lid Standard. Junction Box Types 1 & 2;" Washington State Department of Transportation;

SCL Material Standard 7203.01; "Precast Reinforced Concrete Handholes - General"

Detter, Chris; SCL Distribution Engineer and subject matter expert for 7203.04
(chris.detter@seattle.gov)

Ng, Sharon; SCL Civil Engineer and subject matter expert for 7203.04
(sharon.ng@seattle.gov)

Wang, Quan; SCL Standards Engineer, originator and subject matter expert for 7203.04
(quan.wang@seattle.gov)
1. **Scope**

This standard covers the detailed requirements for the precast 231 and 233 handhole bases, covers, and hatches; and the assembled 213 and 233 handhole units. Components can be ordered separately or ordered as an assembled unit.

Manufacturers, Washington State Department of Transportation (WSDOT) and City of Seattle Standard Plan No 550A refer to the 231 handhole as a Type 3 handhole and the 233 handhole as a Type 5 handhole.

This standard applies to the following Seattle City Light (SCL) stock numbers:

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>231 and 233 Handhole Components and Assemblies</th>
</tr>
</thead>
<tbody>
<tr>
<td>013182</td>
<td><strong>Base</strong>, 231 handhole</td>
</tr>
<tr>
<td>013183</td>
<td><strong>Base</strong>, 233 handhole</td>
</tr>
<tr>
<td>013184</td>
<td><strong>Cover with hatch</strong>, &quot;Electric&quot;</td>
</tr>
<tr>
<td>013185</td>
<td><strong>Cover with hatch</strong>, &quot;SL&quot;</td>
</tr>
<tr>
<td>013484</td>
<td><strong>Cover with hatch</strong>, &quot;SL/TC&quot;</td>
</tr>
<tr>
<td>013180</td>
<td><strong>Assembly</strong>, 231 handhole base with cover, &quot;Electric&quot;</td>
</tr>
<tr>
<td>013181</td>
<td><strong>Assembly</strong>, 231 handhole base with cover, &quot;SL&quot;</td>
</tr>
<tr>
<td>720388</td>
<td><strong>Assembly</strong>, 233 handhole base with cover, &quot;Electric&quot;</td>
</tr>
<tr>
<td>013179</td>
<td><strong>Assembly</strong>, 233 handhole base with cover, &quot;SL&quot;</td>
</tr>
<tr>
<td>013485</td>
<td><strong>Assembly</strong>, 233 handhole base with cover, &quot;SL/TC&quot;</td>
</tr>
</tbody>
</table>
2. Application

Handholes are used to house secondary service and streetlight service connections. Handholes are for use in pedestrian sidewalks where an occasional car or light truck may inadvertently traverse.

3. General Requirements

This standard is to be used in conjunction with the latest version of SCL 7203.01, "Precast Reinforced Concrete Handholes - General".

4. Handhole Base

4.1 231 Handhole Base (Stock No. 013182)

Handhole base shall have four 3/4 in diameter lift inserts (2 each along the length of handhole), as shown in Figure 4.1.

Dimensions shall be as shown in Figure 4.1.

Top of handhole base shall have a key way to allow proper fit with the cover.

Figure 4.1. 231 Handhole Base

4.2 233 Handhole Base (Stock No. 013183)

233 handhole bases shall have the following attributes:

- Knockouts
  - Waffle (4–6 in squares), 12 in x 12 in on both side walls
  - Waffle (9–6 in squares), 18 in x 18 in on both end walls
  - Ground rod, 1 in diameter at 2 opposite corners of floor
- Galvanized "C" channel, embedded in walls, 18-in length, as requested per project
- Sump, round, 6 in diameter, 3 inches deep, off center on floor
- Pulling Irons, 1/2 in diameter, as requested per project
- Lift Holes, 1-1/2 in diameter on center of wall
- Ground Inserts, bronze, 1/4 in diameter, on the side wall, centered, above lift hole

Dimensions shall be as shown in Figure 4.2.
5. Covers

Cover shall consist of a concrete collar with a 24 in by 36 in slip-resistant steel hatch with steel frame.

Cover shall be of configuration as shown in Figure 5.

- Cover dimensions shall be 32-in wide by 44-in long by 6-in deep.
- Covers shall have a 3/4-in lift insert at each corner on the top.
- Caps shall be provided to cover the lift inserts.
- Cover shall have a keyway to ensure a tight fit.
- A 1/4 in diameter ground insert shall be embedded in the cover on the hinged hatch side for bonding the frame.

The hatch shall have the following:

- Steel frame securely anchored in the concrete
- H20 rating
- Recessed lift handles
- One handle located on each of the short ends of the hatch
- 5/8-in bonding point hole on support bar for grounding hatch
- Hatch-locking mechanism with Penta-head bolt
- Label (Electric, SL, or SL/TC), according to Table 5.
Figure 5. Cover with Slip-Resistant Steel Hatch

Table 5. Hatch Label

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>013184</td>
<td>Electric</td>
</tr>
<tr>
<td>013185</td>
<td>SL</td>
</tr>
<tr>
<td>013484</td>
<td>SL/TC</td>
</tr>
</tbody>
</table>

6. Assemblies

Handhole assemblies consist of a handhole base and a cover with metal hatch. All handhole assemblies use the same size cover.
Table 6. Materials for 231 and 233 Handhole Assemblies

<table>
<thead>
<tr>
<th>Fig #</th>
<th>Stock No.</th>
<th>Assembly Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>013180</td>
<td>231 handhole base with cover, &quot;Electric&quot;</td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>013181</td>
<td>231 handhole base with cover, &quot;SL&quot;</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>720388</td>
<td>233 handhole base with cover, &quot;Electric&quot;</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>013179</td>
<td>233 handhole base with cover, &quot;SL&quot;</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>013485</td>
<td>233 handhole base with cover, &quot;SL/TC&quot;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013182</td>
<td>Base, 231 handhole</td>
</tr>
<tr>
<td>013183</td>
<td>Base 233 handhole</td>
</tr>
<tr>
<td>013184</td>
<td>Cover with hatch, &quot;Electric&quot;</td>
</tr>
<tr>
<td>013185</td>
<td>Cover with hatch &quot;SL&quot;</td>
</tr>
<tr>
<td>013484</td>
<td>Cover with hatch, &quot;SL/TC&quot;</td>
</tr>
</tbody>
</table>

7. Issuance

Unit: EA

8. Approved Manufacturers

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>013182</td>
<td>231 Handhole base</td>
<td>23R-12</td>
<td>VR233CL-12</td>
</tr>
<tr>
<td>013183</td>
<td>233 Handhole base</td>
<td>233 - LA Base</td>
<td>VR233CL</td>
</tr>
<tr>
<td>013184</td>
<td>Cover, with hatch, &quot;Electric&quot;</td>
<td>23-2436F Cover w/ ID Marker &quot;Electric&quot;</td>
<td>VR233-2436SN-ELECTRIC</td>
</tr>
<tr>
<td>013185</td>
<td>Cover with hatch, &quot;SL&quot;</td>
<td>23-2436F Cover w/ ID Marker &quot;SL&quot;</td>
<td>VR233-2436SN-SL</td>
</tr>
<tr>
<td>013484</td>
<td>Cover with hatch, &quot;SL/TC&quot;</td>
<td>23-2436F Cover w/ ID Marker &quot;SL/TC&quot;</td>
<td>VR233-2436SN-SL/TC</td>
</tr>
<tr>
<td>013180</td>
<td>231 handhole base with cover, &quot;Electric&quot;</td>
<td>Type 3 Handhole – SCL – &quot;Electric&quot;</td>
<td>TYPE 3 HAN DHOLE-SCL- &quot;ELECTRIC&quot;</td>
</tr>
<tr>
<td>013181</td>
<td>231 handhole base with cover, &quot;SL&quot;</td>
<td>Type 3 Handhole –SCL – &quot;SL&quot;</td>
<td>TYPE 3 HAN DHOLE-SCL-&quot;SL&quot;</td>
</tr>
<tr>
<td>720388</td>
<td>233 handhole base with cover, &quot;Electric&quot;</td>
<td>233 Handhole – SCL – &quot;Electric&quot;</td>
<td>233 HAN DHOLE-SCL-&quot;ELECTRIC&quot;</td>
</tr>
<tr>
<td>013179</td>
<td>233 handhole base with cover, &quot;SL&quot;</td>
<td>233 Handhole – SCL – &quot;SL&quot;</td>
<td>233 HAN DHOLE-SCL-&quot;SL&quot;</td>
</tr>
<tr>
<td>013485</td>
<td>233 handhole base with cover, &quot;SL/TC&quot;</td>
<td>233 Handhole – SCL – &quot;SL/TC&quot;</td>
<td>233 HAN DHOLE-SCL-&quot;SL/TC&quot;</td>
</tr>
</tbody>
</table>
9. References

**SCL Material Standard 7203.01; “Precast Reinforced Concrete Handholes - General”**

10. Sources

**Detter, Chris**; SCL Distribution Engineer and subject matter expert for 7203.08
(chris.detter@sattle.gov)

**Ng, Sharon**; SCL Civil Engineer and subject matter expert for 7203.08
(sharon.ng@seattle.gov)

**Wang, Quan**; SCL Standards Engineer and subject matter expert for 7203.08
(quan.wang@seattle.gov)
Type 1 and Type 2 Open Bottom Handhole, Precast, Secondary and Streetlight

1. Scope

This standard covers the requirements for precast secondary handholes, streetlight handholes, handhole stacking risers, and handhole covers.

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>012945</td>
<td>Type 1 handhole, with frame and cover labeled “S/L”</td>
</tr>
<tr>
<td>720391</td>
<td>Type 2 handhole, with frame and cover, “ELECTRIC”</td>
</tr>
<tr>
<td>013178</td>
<td>Type 2 handhole, with frame and cover, “S/L”</td>
</tr>
<tr>
<td>012978</td>
<td>Type 2 handhole, with frame and no cover</td>
</tr>
<tr>
<td>720402</td>
<td>Type 2 handhole stacking riser, without frame or cover</td>
</tr>
<tr>
<td>012660</td>
<td>Type 2 handhole cover, labeled “ELECTRIC”</td>
</tr>
<tr>
<td>012979</td>
<td>Type 2 handhole cover, labeled “S/L”</td>
</tr>
</tbody>
</table>

2. Application

Handhole assemblies are used to construct the means to allow connections to be made for secondary service and streetlight located on pedestrian sidewalks.

H-20 rated frames and covers are for use in pedestrian sidewalks where an occasional car or light truck may inadvertently traverse, or side streets that see only light truck traffic.
3. Industry Standards

All handholes shall meet the applicable requirements of the following industry standards:

City of Seattle Standard Plan 550a; “Handholes”; Public Utilities

WSDOT Standard Plan J-40.10-00; “Locking Lid Standard. Junction Box Types 1 & 2;” Washington State Department of Transportation


ASTM A185/A185 – 07; “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete”; ASTM

ASTM A615/A615M - 09b; “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”; ASTM


ASTM C478 – 11; “Standard Specification for Precast Reinforced Concrete Manhole Sections”; ASTM

ASTM C857 - 12a; “Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures”; ASTM

ASTM C858 - 10e1; “Standard Specification for Underground Precast Concrete Utility Structures”; ASTM

4. Conflict

Where conflict exists, the following order of precedence shall apply:

- Seattle City Light Purchase Order (PO)
- Seattle City Light General Terms and Conditions
- This material standard
- Other industry standards
5. Construction

The handhole shall meet Washington State Department of Transportation Standard Plan J-40.10 with the following clarifications.

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Item</th>
<th>Type</th>
<th>Inside Length</th>
<th>Inside Width</th>
<th>Outside Length</th>
<th>Outside Width</th>
<th>Height/Thickness</th>
<th>Cover Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>012945</td>
<td>Handhole with frame</td>
<td>1</td>
<td>19</td>
<td>14</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Cover</td>
<td></td>
<td>–</td>
<td>–</td>
<td>17</td>
<td>13</td>
<td>5/16</td>
<td>“SL”</td>
</tr>
<tr>
<td>720391</td>
<td>Handhole with frame</td>
<td>2</td>
<td>28</td>
<td>17</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Cover</td>
<td></td>
<td>–</td>
<td>–</td>
<td>26-5/8</td>
<td>16-1/2</td>
<td>5/16</td>
<td>“ELECTRIC”</td>
</tr>
<tr>
<td>013178</td>
<td>Handhole, with frame</td>
<td>2</td>
<td>28</td>
<td>17</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Cover</td>
<td></td>
<td>–</td>
<td>–</td>
<td>26-5/8</td>
<td>16-1/2</td>
<td>5/16</td>
<td>“SL”</td>
</tr>
<tr>
<td>720402</td>
<td>Stacking riser</td>
<td>2</td>
<td>–</td>
<td>–</td>
<td>28</td>
<td>17</td>
<td>12</td>
<td>–</td>
</tr>
<tr>
<td>012660</td>
<td>Cover only</td>
<td>2</td>
<td>–</td>
<td>–</td>
<td>26-5/8</td>
<td>16-1/2</td>
<td>5/16</td>
<td>“ELECTRIC”</td>
</tr>
<tr>
<td>012979</td>
<td>Cover only</td>
<td>2</td>
<td>–</td>
<td>–</td>
<td>26-5/8</td>
<td>16-1/2</td>
<td>5/16</td>
<td>“SL”</td>
</tr>
</tbody>
</table>

Figure 5. Handhole
5.1 Precast Handhole

Precast secondary and streetlight handholes shall be of the general configuration shown, in accordance with City of Seattle Standard Plan 550a.

Handhole shall be designed to nest, with an easy, snug fit to increase the depth of the handhole when necessary.

Handhole shall be sound and free of cracks.

5.2 Concrete

The handhole shall be cast of concrete meeting a minimum strength of 4000 psi after 28 days.

5.3 Cover Plate

The cover plate shall adhere to the following requirements:

- The cover shall comply with City of Seattle Standard Plan No. 550a.
- The cover shall be 5/16-in (nominal) in thickness or other design pre-approved by Seattle City Light.
- The cover shall be at least H-20 rated.
- The cover shall have 1/16-in to 1/8-in clearance on each edge within the frame after galvanizing.

5.4 Frame

The frame shall adhere to the following requirements:

- The frame shall comply with City of Seattle Standard Plan No. 550a.
- The steel frame shall be securely anchored in the concrete.
- The frame shall have a ground point, which the copper braid from the cover may be attached.

5.5 Non Slip Surface

The cover and frame shall have a non-slip surface with the following properties:

- Slip resistant surface shall be coated with SlipNOT® Grade 3-coarse by W.S. Molnar Company or have minimum coefficient of friction of 0.8.
- Bond strength shall be to the plate of 4000 psi or greater.
- Surface hardness shall be 55 minimum on the Rockwell "C" scale.
- The cover shall be identified on the underside with the type of surface (“S3” for SlipNOT® 3) and the year of manufacture. Example: “S3 2005.” The identification shall be bead-welded or clearly stamped into a metal surface on the underside of each lid, or labeled with an adhesive metallic foil-backed label.

5.6 Grounding

A 4-ft length of copper braid, equivalent to a #8 AWG THNW or THHW copper wire, shall be secured from the handhole cover.

All handholes shall have a 5/16-in ground insert or a ground pad on the interior wall.

5.7 Labeling

The word “ELECTRIC” or “SL” for streetlight shall be cast or otherwise permanently affixed to the cover and shall be easily readable. Lettering shall be affixed in such a manner as to avoid being a tripping hazard.

5.8 Lock

The cover shall have a Penta-head bolt locking device to prevent easy removal by unauthorized persons.
5.9 Galvanizing

The frame and cover shall be hot-dip galvanized after fabrication in accordance with ASTM A123M.

6. Documentation

6.1 General

Documentation shall be in English and use customary inch-pound units.

Documentation shall use common industry terminology and well-understood abbreviations.

6.2 Technical Information

Upon request, the supplier shall provide the following technical information:

- Manufacturer’s name
- Manufacturing plant locations
- Product shop drawing

Technical information shall be presented in a clear and consolidated manner for ease of review.

7. Issuance

EA

8. Approved Manufacturers

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Manufacturers</th>
<th>Catalog Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>012945</td>
<td>Fog-Tite</td>
<td>J-11 Type 1, with non-skid cover, &quot;SL&quot;</td>
</tr>
<tr>
<td></td>
<td>H2-Pre-Cast Inc</td>
<td>WDOT Type 1 Box with Cover – Galvanized, Non-Slip, &quot;SL&quot;</td>
</tr>
<tr>
<td>720391</td>
<td>Fog-Tite</td>
<td>J-11 Type 2, with non-skid cover, &quot;Electric&quot;</td>
</tr>
<tr>
<td></td>
<td>H2-Pre-Cast Inc</td>
<td>WDOT Type 2 Box with Cover – Galvanized, Non-Slip, &quot;Electric&quot;</td>
</tr>
<tr>
<td>013178</td>
<td>Fog-Tite</td>
<td>J-11 Type 2, with non-skid cover, &quot;S/L&quot;</td>
</tr>
<tr>
<td></td>
<td>H2-Pre-Cast Inc</td>
<td>WDOT Type 2 Box with Cover – Galvanized, Non-Slip, &quot;SL&quot;</td>
</tr>
<tr>
<td>012978</td>
<td>Fog-Tite</td>
<td>J-11 Type 2 bottom</td>
</tr>
<tr>
<td></td>
<td>H2-Pre-Cast Inc</td>
<td>WDOT Type 2 Box - Galvanized</td>
</tr>
<tr>
<td>720402</td>
<td>Fog-Tite</td>
<td>J-11 Type 2 ext.</td>
</tr>
<tr>
<td></td>
<td>H2-Pre-Cast Inc</td>
<td>WDOT Type 2 riser</td>
</tr>
<tr>
<td>012660</td>
<td>Fog-Tite</td>
<td>J-11 Type 2 with non-skid cover, &quot;Electric&quot;</td>
</tr>
<tr>
<td></td>
<td>H2-Pre-Cast Inc</td>
<td>WDOT Type 2 Cover - Galvanized, Non-Slip, &quot;Electric&quot;</td>
</tr>
<tr>
<td>012979</td>
<td>Fog-Tite</td>
<td>J-11 Type 2 non-skid cover, &quot;SL&quot;</td>
</tr>
<tr>
<td></td>
<td>H2-Pre-Cast Inc</td>
<td>WDOT Type 2 Cover - Galvanized, Non-Slip, &quot;SL&quot;</td>
</tr>
</tbody>
</table>

9. Sources

9-34.6; Standard Specifications for Road, Bridge and Municipal Construction; City of Seattle; Public Utilities

Smalley, Edward; SCL Engineer, Streetlights, and subject matter expert for 7203.10 (edward.smalley@seattle.gov)

Wang, Quan; SCL Standards Engineer, originator and subject matter expert for 7203.10 (quan.wang@seattle.gov)
HANDBOLE, SECONDARY
COMPOSITE FIBERGLASS, REINFORCED PLASTIC TYPE

1. Composite Fiberglass, Reinforced Plastic, or Fiberglass Reinforced Mortar Secondary Handholes shall be of the configuration shown and shall meet the applicable requirements of Western Underground Committee Guide 3.6, except as modified herein. The handholes are for use in light vehicular traffic areas. The handholes shall have good abrasion resistance, high dielectric strength, a low moisture-absorption rate and be impervious to rot and fungus growth. They shall also be inert to corrosive chemicals, including acids, alkalies, and organic solvents.

2. Covers. Handhole covers shall be made of the same material and have an embossed slip resistant surface to enhance pedestrian safety. The covers shall be provided with a locking device to prevent easy removal by unauthorized persons.

3. Extensions. Extensions, used to extend hole depth, shall be designed to nest with the handholes for a snug fit. Handholes may be 1 or 2 piece to equal a 24” to 26” depth.

4. Color. The color of the handholes and extensions shall be light to medium grey.

5. Marking. The words “Seattle City Light” shall be molded in the handhole cover.


7. Stock Unit: EA

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Item</th>
<th>Description</th>
<th>Carson Ind.</th>
<th>Electrimold</th>
<th>Quazite</th>
</tr>
</thead>
<tbody>
<tr>
<td>720393*</td>
<td>Handhole</td>
<td>17” x 30” x 12” or 24-26”</td>
<td>H1730-24</td>
<td>ECBA-173024 DO-EH</td>
<td>PC1730BA</td>
</tr>
<tr>
<td>720397</td>
<td>Cover</td>
<td>17” x 30” x 3/4” or 2”</td>
<td>H1730-P1</td>
<td>ECCA-173002 DO-EH</td>
<td>PC1730CA</td>
</tr>
<tr>
<td>720394</td>
<td>Handhole</td>
<td>24” x 36” x 18”</td>
<td>H2436-24</td>
<td>ECBA-243618 DO-EH</td>
<td>PG2436BA</td>
</tr>
<tr>
<td>720399</td>
<td>Cover</td>
<td>24” x 36” x 2” or 3”</td>
<td>H2436-P1</td>
<td>ECCA-243603 DO-EH</td>
<td>PG2436CA</td>
</tr>
</tbody>
</table>

* Quazite requires two PC1730BA sections for the 24-inch depth and for the City Light stock number.

formerly Material Standard 7203.10.1
1. **Table of Contents**

1. Table of Contents .................................. 1
2. Scope .................................................. 1
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2. **Scope**

This standard covers the detailed requirements for the 444 electrical vault components (vault base and cover slabs with cover hatch) and the assembled 444 electric vaults assembled from those components. The basic components can be ordered separately or they can be ordered as assembled vaults with cover slabs.

This standard applies to the following Seattle City Light Stock Numbers:

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>444 Vault Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>013093</td>
<td>vault base, standard 444</td>
</tr>
<tr>
<td>013094</td>
<td>cover slab, 4- by 4-foot slab with one 3-by 3-foot, non-slip, H-20, solid cover hatch</td>
</tr>
<tr>
<td>013095</td>
<td>cover slab, 4- by 4-foot slab with one 42-inch round, solid cover and frame, H-20</td>
</tr>
<tr>
<td>013157</td>
<td>cover slab, 4-foot, 4-inch by 4-foot, 7-inch slab with one 3- by 3-foot, non-slip, solid cover hatch, H-30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Assembled 444 Vaults with Cover Slabs</th>
</tr>
</thead>
<tbody>
<tr>
<td>013120</td>
<td>assembled 444 vault with 4- by 4-foot cover slab with one 3-foot by 3-foot, non-slip, H-20, solid cover hatch</td>
</tr>
<tr>
<td>013121</td>
<td>assembled 444 vault with 4- by 4-foot cover slab with one 42-inch round, solid cover and frame, H-20</td>
</tr>
<tr>
<td>013158</td>
<td>assembled 444 vault with 4-foot, 4-inch by 4-foot, 7-inch slab with one 3- by 3-foot, non-slip, solid cover hatch, H-30</td>
</tr>
</tbody>
</table>
3. Application

The 444 vaults are intended for use in the construction of underground electric systems. The precast concrete structure may be used to house load break junction boxes, and in making service connections and splices for the distribution system.

The H20-rated 444 vault assemblies are not intended to be used in high density traffic locations.

The standard 444 vault assembly typically consists of the 444 base (Stock Number 013093) and the 4-foot by 4-foot cover slab with one 3- by 3-foot non-slip, H-20 solid cover (Stock Number 013094).

Due to different applications, the vault may need to be customized with a different entry opening.

Depending on the application for the enclosure selected, it can be defined as a handhole or a vault.

When Seattle City Light uses the 444 enclosure for primary service, the 444 enclosure will be designated as a vault. For non-primary service the 444 enclosure can typically be referred to as a handhole (not covered in this Standard).

Steps for selecting the proper vault assembly for your application:

1. Select the appropriate vault base (one option for the 444 size)
2. Select slab cover (three options for the 444)

4. General Requirements

This detailed standard is to be used in conjunction with the latest revision of:

- City Light Material Standard 7203.21, “Precast Reinforced Concrete Structures – General”
- City Light Material Standard 7204.70, “Frames and Covers, 42-Inch Round, Iron”

5. Component Requirements

5.1 Grounding

Vault grounding shall comply with Material Standard 7203.21, Section 9, Grounding.

5.2 Vault Base

The SCL 444 vault base (Stock No. 013093) shall have an overall nominal dimension of 4-feet by 4-feet by 3-feet 6-inches high as shown in Table 5.2a and Figure 5.2.

Approximate base weight is 2,200 pounds.

Table 5.2a, Standard 444 Vault Base Dimensions

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Nominal Dimensions, ft-in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wall, Outside</td>
</tr>
<tr>
<td></td>
<td>Length</td>
</tr>
<tr>
<td>013093</td>
<td>4-0</td>
</tr>
</tbody>
</table>
5. Component Requirements, continued

5.2 Vault Base, continued

Table 5.2b, Vault Base Attributes

All Standard 444 Vault Bases Shall Have the Following Features:

<table>
<thead>
<tr>
<th>Knockouts</th>
<th>Size, Nominal, in</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>round</td>
<td>4-3/4 dia</td>
<td>all 4 walls, on bottom</td>
<td>8 ea side</td>
<td>32</td>
</tr>
<tr>
<td>ground rod</td>
<td>2 dia</td>
<td>2 corners of floor</td>
<td>1 ea</td>
<td>02</td>
</tr>
</tbody>
</table>

Channels

galvanized “C” channel, horizontal, embedded in walls

<table>
<thead>
<tr>
<th>Channels</th>
<th>Size, Nominal, in</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>galvanized “C” channel</td>
<td>24 long</td>
<td>all walls, above all knockouts</td>
<td>1 ea side</td>
<td>04</td>
</tr>
</tbody>
</table>

Pulling Irons

<table>
<thead>
<tr>
<th>Pulling Irons</th>
<th>Size, Nominal, in</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 dia</td>
<td>1 ea corner of floor (typical)</td>
<td>1 ea corner</td>
<td></td>
<td>04</td>
</tr>
</tbody>
</table>

Lift Holes

<table>
<thead>
<tr>
<th>Lift Holes</th>
<th>Size, Nominal, in</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2 dia</td>
<td>4 walls, center of wall, above channel</td>
<td>1 ea side</td>
<td></td>
<td>04</td>
</tr>
</tbody>
</table>

Ground Inserts, bronze

<table>
<thead>
<tr>
<th>Ground Inserts, bronze</th>
<th>Size, Nominal, in</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 dia</td>
<td>2 walls, opposite, internal and external</td>
<td>2 ea side</td>
<td></td>
<td>04</td>
</tr>
</tbody>
</table>

Ladder

<table>
<thead>
<tr>
<th>Ladder</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5.2, Standard 444 Vault Base (Stock Number 013093)

dimensions shown are nominal values
5. Component Requirements, continued

5.3 Cover Slab

Cover slabs shall have a nominal overall dimension of 4 feet by 4 feet. Thickness shall be 6 inches. Approximate slab weight is 650 pounds.

All cover slabs shall have overall dimension as shown in Table 5.3. Cover slabs shall have a keyed form to match the base for proper assembly.

All cover slabs shall have 3/4-inch diameter (nominal) lift insert at each corner on the top, as shown in Figure 5.3a.

Caps shall be provided to cover the lift inserts.

Cover slab with the 42-inch round cover shall include a 4-inch deep, round frame, as shown in Figure 5.3b. Note, the iron frame in the slab for round opening extends over the sides of the slab.

Figure 5.3a, 4-Foot Square Cover Slab with 3-Foot Square Cover
(Stock Number 013094) dimensions shown are nominal values

Table 5.3, Cover Slab

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Cover Slab Dimensions, Nominal, ft-in</th>
<th>Opening, in</th>
<th>Cover/Hatch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length x Width x Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013094</td>
<td>4-0 x 4-0 x 0-6</td>
<td>36 by 36, square</td>
<td>one 3- by 3-foot, non-slip, solid cover hatch, H-20</td>
</tr>
<tr>
<td>013095</td>
<td>4-0 x 4-0 x 0-6</td>
<td>38, dia, round</td>
<td>one 42-inch round, solid cover and frame, H-20</td>
</tr>
<tr>
<td>013157</td>
<td>4-4 x 4-7 x 0-6</td>
<td>36 by 36, square</td>
<td>one 36- by 36-inch, non-slip, solid cover hatch, H-30</td>
</tr>
</tbody>
</table>
5. **Component Requirements, continued**

5.3 **Cover Slab**, continued

*4-Foot, 8-inch Square Cover Slabs*, dimensions shown are nominal values

**Figure 5.3b, Slab with 42-Inch Round Cover**
(Stock Number 013095)

**Figure 5.3c, Slab with 36- by 36-Inch Hatch**
(Stock Number 013157)

6. **444 Vault Assemblies**

**Table 6, Assembled 444 Vault Components**

<table>
<thead>
<tr>
<th>Assembled Vault Stock Number</th>
<th>Vault Base Stock Number</th>
<th>Cover Slab Stock Number</th>
<th>Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>013120</td>
<td>013093</td>
<td>013094</td>
<td>H-20 solid square hatch, 3- by 3-foot</td>
</tr>
<tr>
<td>013121</td>
<td>013093</td>
<td>013095</td>
<td>H-20 solid round, 42-inch</td>
</tr>
<tr>
<td>013158</td>
<td>013093</td>
<td>013157</td>
<td>H-30 solid square hatch, 3- by 3-foot</td>
</tr>
</tbody>
</table>

Refer to Tables 5.2a, 5.2b, and 5.3 for the various components included in each vault assembly.

6.1 **Assembly Options**

All vault assemblies use the same vault base. Depending on the type of cover hatch desired, the vault base may be paired with a different cover slab size with appropriate cover hatch, as shown in Table 6.

6.2 **Assembly Requirements**

All solid cover hatches have non-slip surfaces. Each section of the vault components shall have keyways for proper assembly.
7. Issuance
   Unit: EA

8. Approved Manufacturers

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Description</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>013093</td>
<td>standard base</td>
<td>Oldcastle/Utility Vault</td>
</tr>
<tr>
<td>013094</td>
<td>cover slab, 4-foot by 4-foot cover slab with one 3- by 3-foot, non-slip solid cover</td>
<td>444-LA Base w/ Iron and GRD In &amp; Out</td>
</tr>
<tr>
<td>013095</td>
<td>cover slab, 4- by 4-foot slab with one 42-inch round, solid cover and frame, H-20</td>
<td>44-33F Cover w/ I.D. Marker</td>
</tr>
<tr>
<td>130157</td>
<td>cover slab, 4-foot, 4-inch by 4-foot, 7-inch slab with one 34-inch by 37-inch, non-slip, solid cover hatch, H-30</td>
<td>Oversized Special 44 Top w/3636 LW Hatch</td>
</tr>
<tr>
<td>013120</td>
<td>assembled vault with 4-foot by 4-foot cover slab with one 3-foot by 3-foot, non-slip, H-20, solid cover hatch</td>
<td>444-LA Base w/ Iron and GRD In &amp; Out w/332P Non-Slip-SCL</td>
</tr>
<tr>
<td>013121</td>
<td>assembled vault with 4-foot by 4-foot cover slab with one 42-inch round, solid cover and frame, H-20</td>
<td>444-LA Base w/ Iron and GRD In &amp; Out w/42&quot; Cover &amp; Frame-SCL</td>
</tr>
<tr>
<td>013158</td>
<td>assembled vault with 4-foot, 4-inch by 4-foot, 7-inch slab with one 36-inch by 36-inch, non-slip, solid cover hatch, H-30</td>
<td>444-LA Base w/ Iron and GRD In &amp; Out w/ Oversized Special 44 Top w/3636 LW Hatch</td>
</tr>
</tbody>
</table>

9. References

   Detter, Chris; SCL Distribution Engineer, subject matter expert for 7203.26 (chris.detter@sattle.gov)

   Ng, Sharon; SCL Civil Engineer, subject matter expert for 7203.26 (sharon.ng@seattle.gov)

   SCL 7203.21; "Precast Reinforced Concrete Structure, General"; Material Standard

   SCL 7204.70; "Frames and Covers, 42-Inch Round, Iron"; Material Standard

   SCL 9246.10; "Pulling Irons - Fundamentals and Detailed Requirements, Looped Radial and Network Systems"; Design Standard

   Wang, Quan; SCL Standards Engineer, originator and subject matter expert for 7203.26 (quan.wang@seattle.gov)
2. Scope

This standard covers the detailed requirements for 504 electrical vault components (base and cover with hatch) and assembled 504 electric vaults. Components can be ordered separately or as complete assemblies, which include covers.
This standard applies to the following Seattle City Light (SCL) stock numbers:

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013096</td>
<td>Base, standard 507</td>
</tr>
<tr>
<td>013097</td>
<td>Cover with hatch, H-20</td>
</tr>
<tr>
<td>013098</td>
<td>Cover with 42-in round solid hatch and frame, H-20</td>
</tr>
<tr>
<td>013159</td>
<td>Cover with solid hatch, H-30</td>
</tr>
<tr>
<td>013122</td>
<td>Assembly, base and cover with solid hatch, H-20</td>
</tr>
<tr>
<td>013123</td>
<td>Assembly, base and cover with 42-in round solid hatch and frame, H-20</td>
</tr>
<tr>
<td>013160</td>
<td>Assembly, base and cover with solid hatch, H-30</td>
</tr>
</tbody>
</table>

3. Application

504 vaults are used to construct underground electric systems. The precast concrete structure may be used to house load break junction boxes, and in making service connections and splices for the distribution system.

H20-rated 504 vault assemblies are not to be used in high density locations.

Depending on the selected application, a 504 vault can be defined as a handhole or a vault. When SCL uses a 504 for primary service, it is designated a vault. For non-primary service it is typically designated a handhole (not covered in this standard).

Also depending on the application selected, the vault may need to be customized with a different entry opening.

4. General Requirements

This detailed standard is to be used in conjunction with the latest revisions of:

SCL 7203.21; “Precast Reinforced Concrete Structures – General”

SCL 7204.70; “Frames and Covers, 42-Inch Round, Iron”

5. Component Requirements

5.1 Grounding and Bonding

Vault grounding shall comply with SCL 7203.21, Section 9, Grounding.

5.2 Base

Table 5.2a. Base Components

<table>
<thead>
<tr>
<th>Knockouts</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>4-3/4 dia</td>
<td>All 4 walls, on bottom</td>
<td>8 ea side</td>
<td>32</td>
</tr>
<tr>
<td>Ground rod</td>
<td>2 dia</td>
<td>2 corners of floor</td>
<td>1 ea</td>
<td>02</td>
</tr>
</tbody>
</table>

Channels

<table>
<thead>
<tr>
<th>Channels</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galvanized “C” channel, horizontal, embedded in walls</td>
<td>36 length</td>
<td>All walls, above all knockouts</td>
<td>1 ea side</td>
<td>04</td>
</tr>
</tbody>
</table>

Sump

<table>
<thead>
<tr>
<th>Sump</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor, center</td>
<td>12 dia</td>
<td>1, to one side</td>
<td>01</td>
<td></td>
</tr>
</tbody>
</table>

Pulling Irons

<table>
<thead>
<tr>
<th>Pulling Irons</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 dia</td>
<td>1 ea corner of floor (typical)</td>
<td>1 ea corner</td>
<td>04</td>
<td></td>
</tr>
</tbody>
</table>

Lift Holes

<table>
<thead>
<tr>
<th>Lift Holes</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 walls, center of wall, above channel, opposite</td>
<td>1-1/2 dia</td>
<td>1 ea side</td>
<td>02</td>
<td></td>
</tr>
</tbody>
</table>

Ground Inserts, bronze

<table>
<thead>
<tr>
<th>Ground Inserts, bronze</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 walls, opposite, internal and external</td>
<td>1/2 dia</td>
<td>2 ea side</td>
<td>04</td>
<td></td>
</tr>
</tbody>
</table>

Ladder

<table>
<thead>
<tr>
<th>Ladder</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>Not required</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
Base shall have dimensions as shown in Tables 5.2b and 5.2c, and Figure 5.2.

Table 5.2b. Base Dimensions, Inside, Nominal (ft-in)

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-2</td>
<td>4-2</td>
<td>3-2</td>
</tr>
</tbody>
</table>

Table 5.2c. Base Dimensions, Outside, Nominal (ft-in)

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-8</td>
<td>4-8</td>
<td>3-6</td>
</tr>
</tbody>
</table>

Figure 5.2. Base

5.3 Covers

Covers shall consist of a concrete collar with a slip-resistant hatch.

Covers shall have dimensions as shown in Table 5.3. Note: cover for square opening is tapered from top to bottom and is notched on the bottom to fit inside the sides of the vault.

Covers shall have 3/4-inch diameter (nominal) lift insert at each corner on the top, as shown in Figure 5.3a.

Caps shall be provided to cover the lift inserts.

The 42-inch round cover shall include a 4-in deep, round frame, as shown in Figure 5.3b.
Equipment hatches shall have:

- 3 ft x 3 ft dimension
- H20 rating
- Recessed lift handles
- Non-slip surfaces
- One handle located on each of the short ends of the hatch
- 5/8-in bonding point hole on support bar for grounding hatch
- Hatch-locking mechanism with Penta head bolt

**Table 5.3. Cover Dimensions, Nominal**

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Length</th>
<th>Width</th>
<th>Thickness</th>
<th>Opening (in)</th>
<th>Hatch</th>
</tr>
</thead>
<tbody>
<tr>
<td>013094</td>
<td>4-8</td>
<td>4-8</td>
<td>0-6</td>
<td>36 x 36</td>
<td>Solid, H-20</td>
</tr>
<tr>
<td>013095</td>
<td>4-8</td>
<td>4-8</td>
<td>0-6</td>
<td>42 dia, round</td>
<td>42-in round, solid, H-20</td>
</tr>
<tr>
<td>013159</td>
<td>4-8</td>
<td>4-8</td>
<td>0-6</td>
<td>36 x 36</td>
<td>Solid, H-30</td>
</tr>
</tbody>
</table>

**Figure 5.3a. Cover with Hatch**

**Figure 5.3b. Cover with 42-Inch Round Hatch**

**Figure 5.3c. Cover with H30 Hatch**
6. Issuance

Unit: EA

7. Approved Manufacturers

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Oldcastle/Utility Vault Catalog No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>013096</td>
<td><strong>Base</strong>, standard 504</td>
<td>504-LA Base w/ Iron and GRD In &amp; Out</td>
</tr>
<tr>
<td>013097</td>
<td><strong>Cover</strong> with hatch, H20</td>
<td>55-332p Cover w/ I.D. Marker</td>
</tr>
<tr>
<td>013098</td>
<td><strong>Cover</strong> with 42-in round solid hatch and frame, H-20</td>
<td>55-42C Cover w/ I.D. Marker and 42” Cover &amp; Frame</td>
</tr>
<tr>
<td>013159</td>
<td><strong>Cover</strong> with solid hatch, H-30</td>
<td>55-w/3437 LW Hatch Cover w/ I.D. Marker</td>
</tr>
<tr>
<td>013122</td>
<td><strong>Assembly</strong>, base and cover with solid hatch, H-20</td>
<td>504-LA Base w/ Iron and GRD In &amp; Out w/332P Non-Slip-SCL</td>
</tr>
<tr>
<td>013123</td>
<td><strong>Assembly</strong>, base and cover with 42-in round solid hatch and frame, H-20</td>
<td>504-LA Base w/ Iron and GRD In &amp; Out w/42” Cover &amp; Frame-SCL</td>
</tr>
<tr>
<td>013160</td>
<td><strong>Assembly</strong>, base and cover with solid hatch, H-30</td>
<td>504-LA Base w/ Iron and GRD In &amp; Out w/3437 LW Non-Slip-SCL</td>
</tr>
</tbody>
</table>

8. References

**SCL Material Standard 7203.21; “Precast Reinforced Concrete Structure, General”**

**SCL Material Standard 7204.70; “Frames and Covers, 42-Inch Round, Iron”**

9. Sources

**Detter, Chris;** SCL Distribution Engineer and subject matter expert for 7203.31
(chris.detter@seattle.gov)

**Ng, Sharon;** SCL Civil Engineer and subject matter expert for 7203.31
(sharon.ng@seattle.gov)

**SCL Design Standard 9246.10; “Pulling Irons - Fundamentals and Detailed Requirements, Looped Radial and Network Systems”**

**Wang, Quan;** SCL Standards Engineer, originator, and subject matter expert for 7203.31
(quan.wang@seattle.gov)
1. Scope

This standard covers the requirements for 507 (also known as 557) electrical vault components (vault base and cover with hatch) and assembled 507 units.

Components can be ordered separately or ordered as an assembly.

This standard applies to the following Seattle City Light (SCL) stock numbers:

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013101</td>
<td>Base, standard 507</td>
</tr>
<tr>
<td>013102</td>
<td>Cover with hatch</td>
</tr>
<tr>
<td>013124</td>
<td>Assembly (base and cover with hatch)</td>
</tr>
<tr>
<td>013688</td>
<td>Cover with 42-in blockout</td>
</tr>
<tr>
<td>013169</td>
<td>Assembly (base and cover with 42-in blockout)</td>
</tr>
</tbody>
</table>

2. Application

507 vaults are used to construct the underground electric system. This precast concrete vault may be used to house medium-size transformers, loadbreak junction boxes, and service connections and splices for the distribution system.

H20-rated 507 vault assemblies should not be used in high-density locations.

Depending on the selected application, the 507 vault can be defined as a handhole or a vault. When SCL uses the 507 vault for primary service, it is designated a vault. For non-primary service, it is typically designated a handhole (not covered in this standard).

A 42-in round iron frame and cover must be ordered separately. For detailed material specifications for the iron frame and cover, see SCL 7204.70, “Frame and Covers, 42-Inch Round, Iron.”
3. General Requirements

This standard is to be used in conjunction with the latest revision of SCL 7203.21, “Precast Reinforced Concrete Structures, General.”

4. Component Requirements

4.1 Grounding and Bonding

Vault grounding shall conform to SCL 7203.21.

4.2 Base

Table 4.2a. Vault Base Components

<table>
<thead>
<tr>
<th>Knockouts</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>4-3/4 dia</td>
<td>All 4 walls, on bottom</td>
<td>8 ea side</td>
<td>32</td>
</tr>
<tr>
<td>Round</td>
<td>4-3/4 dia</td>
<td>4 panels of 4 on middle of all walls</td>
<td>16 ea side</td>
<td>64</td>
</tr>
<tr>
<td>Ground rod</td>
<td>2 dia</td>
<td>2 corners of floor</td>
<td>1 ea</td>
<td>2</td>
</tr>
</tbody>
</table>

| Channels          | Galvanized "C" channel, horizontal, embedded in walls | 36 long | All walls, above all knockouts | 1 ea side | 4 |

| Sump              | 12 dia             | Floor, center                   | 1, to one side | 1 |
| Pulling irons     | 1/2 dia            | 1 ea corner of floor (typical)  | 1 ea corner    | 4 |
| Lift holes        | 1-1/2 dia          | 2 opposite walls, center wall horizontally | 1 ea side | 2 |
| Ground Inserts, bronze | 1/2 dia       | 2 walls, opposite, internal and external | 2 ea side | 4 |
| Ladder            | –                  | Not required                    | –             | – |

The base shall have dimensions as shown in Tables 4.2b and 4.2c, and Figure 4.2.

Table 4.2b. Base Dimensions, Inside, Nominal (ft-in)

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-2</td>
<td>4-2</td>
<td>6-0</td>
</tr>
</tbody>
</table>

Table 4.2c. Base Dimensions, Outside, Nominal (ft-in)

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-8</td>
<td>4-8</td>
<td>6-6</td>
</tr>
</tbody>
</table>
4.3 Cover

Covers shall consist of a concrete collar with a slip-resistant steel-grated vent hatch or a concrete collar with a 42-in round blockout.

Covers shall have dimensions as shown in Table 4.3. Note: The cover for a square opening is tapered from top to bottom and is notched on the bottom to fit inside the sides of the vault.

Covers shall have a 3/4-in diameter (nominal) lift insert at each corner on the top as shown in Figure 4.3a.

Caps shall be provided to cover the lift inserts.

Covers shall have a keyway to ensure a tight fit.

Covers with a 42-in round blockout are used in conjunction with a 42-in round hatch and frame as shown in Figure 4.3b.
The steel-grated vent hatch shall have:

- 3 ft x 3 ft dimension
- H20 rating
- Recessed lift handles
- Non-slip surfaces
- One handle located on each of the short ends of the hatch
- 5/8-in bonding point hole on support bar for grounding hatch
- Hatch-locking mechanism with Penta head bolt

**Figure 4.3a. Cover with Hatch**

![Diagram of cover with hatch]

**Figure 4.3b. Cover with 42-in Round Blockout**

![Diagram of cover with 42-in round blockout]

**Table 4.3. Cover Dimensions, Nominal**

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Length (ft-in)</th>
<th>Width (ft-in)</th>
<th>Thickness (in)</th>
<th>Opening (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>013102</td>
<td>4-8</td>
<td>4-8</td>
<td>6</td>
<td>36 x 36</td>
</tr>
<tr>
<td>013688</td>
<td>4-8</td>
<td>4-8</td>
<td>6</td>
<td>42 dia, round</td>
</tr>
</tbody>
</table>
5. Issuance

Unit: EA

6. Approved Manufacturer

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>130101</td>
<td>Base, standard 507</td>
<td>507-LA Base w/ Irons and GRD In &amp; Out</td>
</tr>
<tr>
<td>130102</td>
<td>Cover, with hatch</td>
<td>55-332 GV</td>
</tr>
<tr>
<td>013124</td>
<td>Assembly; base and cover with hatch</td>
<td>507-LA Base w/ Iron and GRD In &amp; Out w/Grate Vent, SCL</td>
</tr>
<tr>
<td>013688</td>
<td>Cover, with 42-in blockout</td>
<td>55-42C</td>
</tr>
<tr>
<td>013169</td>
<td>Assembly; base and cover with 42-in blockout</td>
<td>507-LA with 55-42C</td>
</tr>
</tbody>
</table>

7. References

- SCL Material Standard 7203.21; “Precast Reinforced Concrete Structure, General”
- SCL Material Standard 7204.70; “Frames and Covers, 42-Inch Round, Iron”

8. Sources

- Detter, Chris; SCL Distribution Engineer and subject matter expert for 7203.36 (chris.detter@seattle.gov)
- Ng, Sharon; SCL Civil Engineer and subject matter expert for 7203.36 (sharon.ng@seattle.gov)
- Wang, Quan; SCL Standards Engineer, originator, and subject matter expert for 7203.36 (quan.wang@seattle.gov)
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   5.2. Vault Base ............................................... 2
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   5.4. Cover Slab ............................................... 4
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7. Issuance ........................................................ 5
8. Approved Manufacturer ..................................... 5
9. References .................................................... 6

2. Scope

This standard covers the detailed requirements for the 577 electrical vault components (vault base, cover slabs with cover hatches, and divider walls) and the assembled 577 electric vaults assembled from those components. The basic components can be ordered separately or they can be ordered as assembled vaults with cover slabs.

This standard applies to the following Seattle City Light Stock Numbers:

Stock Number 577 Vault Components

013089 vault base, standard 577
013090 removable divider wall, standard 577
013091 cover top, 7-foot by 4-foot-8-inch by 12-inch slab with two 3- by 3-foot, non-slip, solid cover hatches, H-20
013092 cover top, 7-foot by 4-foot-8-inch by 12-inch slab with two 3- by 3-foot, H-20 cover hatches (one non-slip, solid hatch and one grated vent hatch)
013151 cover slab, 7-foot-6-inch by 5-foot-2-inch slab with two non-slip, H-30 cover hatches

Stock Number Assembled 577 Vaults with Cover Slabs

013125 assembled 577 vault with two 3- by 3-foot, non-slip, H-20 solid cover hatches
013126 assembled 577 vault with divider wall and with two 3- by 3-foot, H-20 cover hatches (one non-slip, solid hatch and one grated vent hatch)
013127 assembled 577 vault with divider wall and with two 3- by 3-foot, non-slip, H-20 solid cover hatches
013152 assembled 577 vault with two non-slip, H-30 cover hatches

standards coordinator  standards supervisor  unit director

Quan Wang  John Shipek  Darnell Cola
3. Application

577 vaults are intended for use in the construction of underground electric systems. This precast concrete structure may be used to house medium-size transformers, load break junction boxes, and in making service connections and splices for the distribution system.

The H20-rated 577 vault assemblies are not intended to be used in high density location.

The standard 577 vault assembly typically consists of the 577 base (Stock Number 013089) and the 7-foot by 4-foot-8-inch cover slab with two 3- by 3-foot non-slip, H-20 solid covers (Stock Number 013091).

Due to different applications, the vault may need to be customized with a divider wall and/or different entry openings and covers.

Depending on the application for the enclosure selected, it can be defined as a handhole or a vault. When Seattle City Light uses the 577 enclosure for primary service, the 577 enclosure will be designated as a vault. For non-primary service the 577 enclosure can typically be referred to as a handhole (not covered in this Standard).

Steps for selecting the proper vault assembly for your application:
1. Select vault base
2. Determine if divider wall is needed
3. Select removable divider wall (optional)
4. Select slab cover

4. General Requirements

This detailed standard is to be used in conjunction with the latest revision of Seattle City Light Material Standard 7203.21, “Precast Reinforced Concrete Structures – General”.

5. Component Requirements

5.1 Grounding Requirements

Vault grounding shall comply with Material Standard 7203.21, Section 9, Grounding.

5.2 Vault Base

The SCL 577 vault base (Stock No. 013089) shall have overall nominal dimensions of 7 feet by 4 feet 8 inches by 6 feet high as shown in Figure 6.2.

Approximate weight is 6,000 pounds.

Table 5.2, Vault Base Attributes

All standard 577 vault bases shall have the following features:

<table>
<thead>
<tr>
<th>Knockouts</th>
<th>Size, Nominal, in</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>round</td>
<td>4-3/4 dia</td>
<td>all 4 walls, on bottom</td>
<td>8 ea side</td>
<td>32</td>
</tr>
<tr>
<td>round</td>
<td>4-3/4 dia</td>
<td>3 rows of 2 in center of 2 long walls</td>
<td>6 ea side</td>
<td>12</td>
</tr>
<tr>
<td>waffle (12 - 6” squares)</td>
<td>18 x 24</td>
<td>all 4 walls</td>
<td>2 ea side</td>
<td>8 waffles</td>
</tr>
<tr>
<td>ground rod</td>
<td>2 dia</td>
<td>2 corners of floor</td>
<td>1 ea</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channels</th>
<th>Size, Nominal, in</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>galvanized “C” channel, horizontal, embedded in walls</td>
<td>42 long</td>
<td>short walls, above waffle</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>42 long</td>
<td>short walls, below waffle</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>72 long</td>
<td>long walls, above waffle</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>72 long</td>
<td>long walls, below waffle</td>
<td>1 ea side</td>
<td>2</td>
</tr>
</tbody>
</table>

| Sump, round     | 12 dia           | floor, off center (long axis)                 | 1, to one side | 1            |

| Pulling Irons   | 1/2 dia          | 1 ea corner of floor (typical)                | 1 ea corner   | 4            |

| Lift Holes      | 1-1/2 dia        | 2 center of wall, just below channel, long walls, opposite | 1 ea side   | 2            |

| Ground Inserts, bronze | 1/2 dia | on opposite long walls, on the internal and external of walls | 2 ea side | 4            |

| Ladder          | not required    |
5. Component Requirements, continued

5.2 Vault Base, continued

Figure 5.2, Standard 577 Vault Base (Stock Number 013089)
dimensions shown are nominal values

5.3 Removable 577 Divider Wall
(Stock Number 013090)

Divider wall shall be reinforced with #4 rebar.
Divider wall shall be 3 inches thick (nominal).
Approximate weight is 1,000 pounds.
The removable 577-divider wall shall include: (see Figure 5.3)

1/2-inch diameter lift ring, placed in the top edge
4-3/4-inch diameter knockouts, 6 locations in divider, 3 to a side laterally
1/2-inch diameter inserts, 3 on bottom face of wall only
3/4-inch diameter inserts, 4 on the top face of wall only
5. Component Requirements, continued

5.4 Cover Slabs

Cover slabs shall have a nominal overall dimension of 7 feet by 4 feet 8 inches. Thickness shall be 12 inches. Approximate weight is 2,200 pounds.

All cover slabs shall have 3/4-inch lift insert at each corner on the top, as shown in Figure 5.4.

Caps shall be provided to cover the lift inserts.

Hinges for the lids shall be along the length of the cover slab.

Cover slabs shall have shall have a keyway to match the base for proper assembly.

Figure 5.4, Cover Slab

(Stock Number 013091)
dimensions shown are nominal values

![Figure 5.4, Cover Slab](image)

Table 5.4, 577 Vault Cover Slab Options

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Inside Dimensions, Nominal, ft-in</th>
<th>Outside Dimensions, Nominal, ft-in</th>
<th>Cover Hatch Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>Width</td>
<td>Length</td>
</tr>
<tr>
<td>013091</td>
<td>6-6</td>
<td>4-2</td>
<td>7-0</td>
</tr>
<tr>
<td>013092</td>
<td>6-6</td>
<td>4-2</td>
<td>7-0</td>
</tr>
<tr>
<td>013151</td>
<td>6-6</td>
<td>4-2</td>
<td>7-6</td>
</tr>
</tbody>
</table>
4. 577 Vault Assemblies

Table 6, Assembled 577 Vault Components

<table>
<thead>
<tr>
<th>Assembled Vault Stock Number</th>
<th>Vault Base Stock Number</th>
<th>Divider Wall Stock Number</th>
<th>Cover Slab Number</th>
<th>Cover Hatches</th>
</tr>
</thead>
<tbody>
<tr>
<td>013125</td>
<td>013089</td>
<td>none</td>
<td>013091</td>
<td>H-20 solid</td>
</tr>
<tr>
<td>013126</td>
<td>013089</td>
<td>013090</td>
<td>013091</td>
<td>H-20 solid</td>
</tr>
<tr>
<td>013127</td>
<td>013089</td>
<td>013090</td>
<td>013092</td>
<td>H-20 solid</td>
</tr>
<tr>
<td>013152</td>
<td>013089</td>
<td>none</td>
<td>013151</td>
<td>H-30 solid</td>
</tr>
</tbody>
</table>

Refer to Table 6 for the various components included in each vault assembly.

6.1 Assembly Options

All vault assemblies use the same vault base. The assemblies differ on whether they are provided with a divided wall or not and on the type of cover hatch. Depending on the type of cover hatches desired, the vault base may be paired with a different cover slab size with appropriate hatches, as shown in Table 6.

6.2 Assembly Requirements

All solid cover hatches are and have non-slip surfaces. Each section of the vault components shall have keyways for proper assembly.

7. Issuance

Unit: EA

8. Approved Manufacturer

<table>
<thead>
<tr>
<th>Stock Number</th>
<th>Description</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>013089</td>
<td>vault base, standard 577</td>
<td>577-LA w/ GRD In &amp; Out</td>
</tr>
<tr>
<td>013090</td>
<td>removable divider wall, standard 577</td>
<td>577-Divider Wall</td>
</tr>
<tr>
<td>013091</td>
<td>cover slab, 7-foot by 4-foot-8-inch slab with two 3- by 3-foot, non-slip, H-20, solid cover hatches</td>
<td>57-2-332-NS-SA-80</td>
</tr>
<tr>
<td>013092</td>
<td>cover slab, 7-foot by 4-foot-8-inch slab with two 3- by 3-foot, H-20 cover hatches (one non-slip, solid hatch and one grated vent hatch)</td>
<td>57-2-332-NS-GV-SA-80</td>
</tr>
<tr>
<td>013151</td>
<td>cover slab, 7-foot-6-inch by 5-foot-2-inch slab with two non-slip, H-30 cover hatches</td>
<td>57 Top w/ LW Hatch 34&quot; x 74&quot;</td>
</tr>
<tr>
<td>013125</td>
<td>assembled 577 vault with two 3- by 3-foot, non-slip, H-20 solid cover hatches</td>
<td>577-LA w/ GRD In &amp; Out w/ 2-33 cover - SCL</td>
</tr>
<tr>
<td>013126</td>
<td>assembled 577 vault with divider wall and with two 3- by 3-foot, H-20 cover hatches (one non-slip, solid hatch and one grated vent hatch)</td>
<td>577-LA w/ Iron, GRD In &amp; Out w/ grate and 33 cover - SCL</td>
</tr>
<tr>
<td>013127</td>
<td>assembled 577 vault with divider wall and with two 3- by 3-foot, non-slip, H-20 solid cover hatches</td>
<td>577-LA w/ Iron, GRD In &amp; Out w/ 2-33 cover - SCL</td>
</tr>
<tr>
<td>013152</td>
<td>assembled 577 vault with two non-slip, H-30 cover hatches</td>
<td>577-LA w/ Iron, GRD In &amp; Out w/ LW Hatches</td>
</tr>
</tbody>
</table>
9. References

Detter, Chris; SCL Distribution Engineer, subject matter expert for 7203.41 (chris.detter@seattle.gov)

Ng, Sharon; SCL Civil Engineer, subject matter expert for 7203.41 (sharon.ng@seattle.gov)

SCL 7203.21: “Precast Reinforced Concrete Structure, General”; Material Standard

Wang, Quan; SCL Standards Engineer, originator and subject matter expert for 7203.41 (quan.wang@seattle.gov)
712 Electric Vault, Primary Service

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   3. Application .......................................................... 2
   4. General Requirements ............................................ 4
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  11. References ........................................................ 13

2. Scope

This standard covers the requirements for the 712 electrical vault components (vault base and top sections) and the assembled 712 electric vaults.

The 712 vault is considered a ring vault by Seattle City Light (SCL) crews.

Most of the basic components can be ordered separately or they can be ordered as assembled vaults with cover slabs.

This standard applies to the SCL stock numbers listed in Section 10.
3. Application

712 vaults are intended for use in the construction of underground electric systems. The precast concrete structure may be used to house medium-size transformers up to 501 kVA, three-phase load break junction boxes, and in making service connections and splices for the distribution system.

The standard 712-vault assembly consists of the 712 base [A], a 712 top with two 78-inch by 50-inch block-outs [B1], various risers to bring access opening to grade, a cover slab with two 3- by 3-foot non-slip, solid cover and a 42-inch entry access.

Due to different applications, the vault may need to be customized with different block-out configurations; various risers and access openings (see Figure 3).

Figure 3. Steps for selecting the proper vault assembly for your application:

Step 1. Select standard 712-vault base, [A] (Stock Number 013112, see section 5).

Step 2. Determine and select the type of blockout configuration needed for the vault top section [B#]. There are 4 possible options for the 712 top sections; each allowing a different set of access openings. (Stock Numbers 013113, 013114, 013395, or 013115, see section 6).

Step 3. Select appropriate risers [C#] to bring access opening up to grade. Each riser section for the 712 covers half of the top section. (Stock numbers 013105, 013106, 013162, 013107, 013108, and 013109)
Step 4. Determine the appropriate type of cover slabs and lids or hatches [D#]

- D2 = H20 Hatch
  Stock No. 013111

- D3 = H30 Hatch
  Stock No. 013153

- D1 = 42" Round Blockout; use with B1 only
  Stock No. 013110

- 42" Round Frame
  Stock No. 012753

- H20 – 42" Round Solid
  Stock No. 720466

- H20 – 42" Round Vented
  Stock No. 720226

Step 5. Check the assembled vault configurations in section 8 for vaults that can be ordered configured with base, top section, and cover slabs. Assembled option will still require choices for risers and hatches or lids.
4. General Requirements

This detailed standard is to be used in conjunction with SCL Material Standard 7203.21, “Precast Reinforced Concrete Structures – General”.

Vault grounding shall conform to SCL Material Standard 7203.21, Section 9, Grounding.

5. Vault Base Requirements [A]

All 712 vault bases shall conform to the dimensions cited in Table 5a and Figure 5.

Table 5a. Nominal Base Dimensions

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Outside (ft-in)</th>
<th>Inside (ft-in)</th>
<th>Height (ft-in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length Width</td>
<td>Length Width</td>
<td>Outside Inside</td>
</tr>
<tr>
<td>013112</td>
<td>12-11 7-10</td>
<td>12-3 7-2</td>
<td>4-2.5 3-9</td>
</tr>
</tbody>
</table>

Figure 5. Standard 712 vault base [A]
Table 5b. Vault Base Attributes

All standard 712 vault bases shall have the following features:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knockouts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round</td>
<td>4-3/4 dia</td>
<td>All 4 walls, on bottom corners of wall</td>
<td>4 ea side</td>
<td>16</td>
</tr>
<tr>
<td>Waffle, 9 - 6 in squares</td>
<td>18 x 18</td>
<td>All 4 walls, above round knockouts</td>
<td>2 ea side</td>
<td>8</td>
</tr>
<tr>
<td>Ground rod</td>
<td>2 dia</td>
<td>4 corners of floor</td>
<td>1 ea</td>
<td>4</td>
</tr>
<tr>
<td>Channels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galvanized “C” channel,</td>
<td>36 length</td>
<td>End walls, 9 inches above floor,</td>
<td>2 ea side</td>
<td>4</td>
</tr>
<tr>
<td>channel, horizontal, embedded</td>
<td></td>
<td>between knockouts, 22.5 inches on center</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in walls</td>
<td>96 length</td>
<td>Side walls, 9 inches above floor,</td>
<td>2 ea side</td>
<td>4</td>
</tr>
<tr>
<td>Sump with galvanized grate</td>
<td>12 x 60</td>
<td>Floor, about 1 foot from and parallel to</td>
<td>1 ea</td>
<td>1</td>
</tr>
<tr>
<td>Pulling irons</td>
<td>7/8 dia</td>
<td>2 each corner of floor (typical)</td>
<td>2 ea corner</td>
<td>8</td>
</tr>
<tr>
<td>Ground inserts, bronze</td>
<td>1/2 dia</td>
<td>Side walls, 4 inches below top channel,</td>
<td>2 ea side</td>
<td>4</td>
</tr>
<tr>
<td>Dowel Inserts</td>
<td>1/2 dia</td>
<td>12 inches on center; around the perimeter of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>duct knockout</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ladder</td>
<td></td>
<td>Not required</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Top Section Requirements [B1, B2, B3, B4]

All 712 top sections shall conform to the dimensions cited in Table 6.1 and Figure 6.

Table 6a. Nominal Top Section Dimensions

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Outside (ft-in)</th>
<th>Inside (ft-in)</th>
<th>Height (ft-in)</th>
<th>Blockout Configurations</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length Width</td>
<td>Length Width</td>
<td>Outside Inside</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013113</td>
<td>12-11 7-10</td>
<td>12-3 7-2</td>
<td>4-4.5 3-9</td>
<td>two 78-in by 50-in blockouts</td>
<td>6b, [B1]</td>
</tr>
<tr>
<td>013395</td>
<td>12-11 7-10</td>
<td>12-3 7-2</td>
<td>4-4.5 3-9</td>
<td>two 42-in round blockouts</td>
<td>6b, [B2]</td>
</tr>
<tr>
<td>013114</td>
<td>12-11 7-10</td>
<td>12-3 7-2</td>
<td>4-4.5 3-9</td>
<td>one 78-in by 50-in blockout and one 42-in round blockout,</td>
<td>6b, [B3]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>offset left (Type 1) [B3]</td>
<td></td>
</tr>
<tr>
<td>013115</td>
<td>12-11 7-10</td>
<td>12-3 7-2</td>
<td>4-4.5 3-9</td>
<td>one 78-in by 50-in blockout and one 42-in round blockout,</td>
<td>6b, [B4]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>offset right (Type 2) [B4]</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Type 1 refers to a left-offset rectangular blockout from point-of-view of round blockout end.
Type 2 refers to a right-offset rectangular blockout from point-of-view of round blockout end.
Figure 6a. Vault top section [B1]

Figure 6b. Vault top section blockout options (top view)

- Blockout
- Lift anchor
- Channel
- Round knockouts
- Dowel insert
- Waffle knockouts
- Lift insert loop
- 2 pulling irons

**Figure 6a. Vault top section [B1]**

**Figure 6b. Vault top section blockout options (top view)**

- **B1**
  - Stock No. 013113

- **B2**
  - Stock No. 013395
  - (not available on separate order)

- **B3**
  - Stock No. 013114

- **B4**
  - Stock No. 013115
### Table 6b. Top Section Attributes Required

<table>
<thead>
<tr>
<th>Knockouts</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>4-3/4 dia</td>
<td>all 4 walls, on top corners of wall</td>
<td>4 ea side</td>
<td>16</td>
</tr>
<tr>
<td>Waffle, 9 - 6 in squares</td>
<td>18 x 18</td>
<td>all 4 walls, below round knockouts</td>
<td>2 ea side</td>
<td>8 waffles</td>
</tr>
<tr>
<td>Channels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galvanized “C” channel, horizontal, embedded in walls</td>
<td>36 length</td>
<td>end walls, 11.25-inches from ceiling, between knockouts, 22.5-inches on center between channels</td>
<td>2 ea side</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>96 length</td>
<td>side walls, 11.25-inches from ceiling, between knockouts, 22.5-inches on center between channels</td>
<td>2 ea side</td>
<td>4</td>
</tr>
<tr>
<td>Access Port</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[B1]</td>
<td>3 dia</td>
<td>1 each side on top, centered along length of top</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td>[B2]</td>
<td>3 dia</td>
<td>1 each side on top, centered along length of top</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td>[B3]</td>
<td>3 dia</td>
<td>1, right of 42-inch blockout</td>
<td>1 side</td>
<td>1</td>
</tr>
<tr>
<td>[B4]</td>
<td>3 dia</td>
<td>1, left of 42-inch blockout</td>
<td>1 side</td>
<td>1</td>
</tr>
<tr>
<td>Pulling irons</td>
<td>7/8 dia</td>
<td>2 ea corner of ceiling (typical)</td>
<td>2 ea corner</td>
<td>8</td>
</tr>
<tr>
<td>Lift anchor</td>
<td>6-1/4</td>
<td>4-ton anchor, 1 each corner on top</td>
<td>1 ea corner</td>
<td>4</td>
</tr>
<tr>
<td>Lift insert loop</td>
<td>3/4 dia</td>
<td>2 each on outside of one end wall, above knockouts</td>
<td>2, one side</td>
<td>2</td>
</tr>
<tr>
<td>Ground inserts, bronze</td>
<td>1/2 dia</td>
<td>side walls, 4 inches below top channel, internal and external</td>
<td>2 ea side</td>
<td>4</td>
</tr>
<tr>
<td>Dowel Inserts</td>
<td>1/2 dia</td>
<td>12-Inch on center; around the perimeter of duct knockout</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7. Cover Slabs, Risers and Hatches or Covers

For detailed material standard of cover slabs and risers used with the 712 vault, refer to the latest version of SCL Material Standard 7204.15, “Risers and covers slab for Self-Grounding Electric Vault.”

For detailed material standard of 42-inch round cover and frames, refer to the latest version of SCL Material Standard 7204.70, “Frame and Covers, 42-Inch Round, Iron.”
Table 7. Cover slabs, risers and hatches or covers

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Mtl. Std.</th>
<th>References to Figure 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>013105</td>
<td>5- by 7-foot by 6-inch riser without galvanized “C” channel</td>
<td>7204.15</td>
<td>C1</td>
</tr>
<tr>
<td>013106</td>
<td>5- by 7-foot by 18-inch riser with galvanized “C” channels</td>
<td>7204.15</td>
<td>C2</td>
</tr>
<tr>
<td>013362</td>
<td>5- by 7-foot by 24-inch riser with galvanized “C” channels</td>
<td>7204.15</td>
<td>C3</td>
</tr>
<tr>
<td>013107</td>
<td>42-inch diameter by 4-inch high round riser</td>
<td>7204.15</td>
<td>C4</td>
</tr>
<tr>
<td>013108</td>
<td>42-inch diameter by 6-inch high round riser</td>
<td>7204.15</td>
<td>C5</td>
</tr>
<tr>
<td>013109</td>
<td>42-inch diameter by 12-inch high round riser</td>
<td>7204.15</td>
<td>C6</td>
</tr>
<tr>
<td>013110</td>
<td>5- by 7-foot cover slab with one 42-inch round access opening</td>
<td>7204.15</td>
<td>D1</td>
</tr>
<tr>
<td>013111</td>
<td>5- by 7-foot adjustable cover slab with two 3- by 3-foot non-slip solid covers</td>
<td>7204.15</td>
<td>D2</td>
</tr>
<tr>
<td>012753 and 720466</td>
<td>42-inch frame with 42-inch solid cover</td>
<td>7204.70</td>
<td></td>
</tr>
<tr>
<td>012753 and 720226</td>
<td>42-inch frame with 42-inch grated vent cover</td>
<td>7204.70</td>
<td></td>
</tr>
</tbody>
</table>

8. Vault Assembly and Packaging

The vault base and the vault top section shall have keyways for proper assembly.

Vault assemblies shall be delivered fully assembled, unless otherwise requested in purchase order.

Vaults shall be delivered to the job site, unless otherwise requested in purchase order.

Refer to Tables 8a, 8b, 8c and 8d for the various components included in each vault assemblies.
Table 8a. 712 Vault Assembly 013116: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) [A-B1]

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Label</th>
<th>Stock No.</th>
<th>Quantity</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td></td>
<td>A</td>
<td>013112</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Top Section</td>
<td>712 with 2 rectangular blockout</td>
<td>B1</td>
<td>013113</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rectangular Riser</td>
<td>18 in</td>
<td>C2</td>
<td>013106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>4 in</td>
<td>C4</td>
<td>013197</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>12 in</td>
<td>C6</td>
<td>013109</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Blockout</td>
<td></td>
<td>D1</td>
<td>013110</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cover Slab with H20 Hatch</td>
<td></td>
<td>D2</td>
<td>013111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42-in H20 Frame</td>
<td></td>
<td></td>
<td>012753</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td></td>
<td>720466</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
# Table 8b. 712 Vault Assembly 013117, With 2 Personnel (42-in Round Hatch) [A-B2]

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Label</th>
<th>Stock No.</th>
<th>Quantity</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td></td>
<td>A</td>
<td>013112</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Top Section</td>
<td>712 with 2 42-in round blockout</td>
<td>B2</td>
<td>013395</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>4 in</td>
<td>C4</td>
<td>013107</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>12 in</td>
<td>C6</td>
<td>013109</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>42-in H2O Frame</td>
<td></td>
<td></td>
<td>012753</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td></td>
<td>720466</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Table 8c. 712 Vault Assembly 013118, With 1 Equip. (72 in by 36 in) and 1 Personnel (42-in Round) Hatch, Offset Left (Type 1); [A-B3]

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Label</th>
<th>Stock No.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td></td>
<td>A</td>
<td>013112</td>
<td>1</td>
</tr>
<tr>
<td>Top section</td>
<td>712 with rectangular and 42-inch round blockout</td>
<td>B3</td>
<td>013114</td>
<td>1</td>
</tr>
<tr>
<td>Rectangular Riser</td>
<td>18 in</td>
<td>C2</td>
<td>013106</td>
<td>1</td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>4 in</td>
<td>C4</td>
<td>013107</td>
<td>1</td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>6 in</td>
<td>C5</td>
<td>013108</td>
<td>1</td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>12 in</td>
<td>C6</td>
<td>013109</td>
<td>1</td>
</tr>
<tr>
<td>Cover Slab with H20 Hatch</td>
<td></td>
<td>D2</td>
<td>013111</td>
<td>1</td>
</tr>
<tr>
<td>42-in H20 Frame</td>
<td></td>
<td></td>
<td>012753</td>
<td>2</td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td></td>
<td>720466</td>
<td>2</td>
</tr>
</tbody>
</table>
# Table 8d. 712 Vault Assembly with 1 Equip. (72 in by 36 in) and 1 Personnel (42-in Round) Hatch, Offset Right (Type 2); [A-B4]

<table>
<thead>
<tr>
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<th>Description</th>
<th>Label</th>
<th>Stock No.</th>
<th>Quantity</th>
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<td>1</td>
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<tr>
<td>Top Section</td>
<td>712 with rectangular and</td>
<td>B4</td>
<td>013115</td>
<td>1</td>
<td></td>
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<tr>
<td></td>
<td>42-in blockout</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectangular Risers</td>
<td>18 in</td>
<td>C2</td>
<td>013106</td>
<td>1</td>
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<tr>
<td>42-in Round Risers</td>
<td>4 in</td>
<td>C4</td>
<td>013107</td>
<td>1</td>
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</tr>
<tr>
<td>42-in Round Risers</td>
<td>6 in</td>
<td>C5</td>
<td>013108</td>
<td>1</td>
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</tr>
<tr>
<td>42-in Round Risers</td>
<td>12 in</td>
<td>C6</td>
<td>013109</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cover Slab with H20 Hatch</td>
<td></td>
<td>D2</td>
<td>013111</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in H20 Frame</td>
<td></td>
<td></td>
<td>012753</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td></td>
<td>720466</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

Re: Stock No. 013117, if having the flexibility to convert the access cover from equipment to personnel is desirable, use top section Stock No. 013113 with 2 each of Stock No. 013110 instead of top section Stock No. 013395.

Re: Stock No 720226, if vault contains more than 75 kVA of transformer capacity, a vented (grate) cover is required, per below:

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>720226</td>
<td>42-in H20 vented cover</td>
<td></td>
</tr>
</tbody>
</table>
9. Issuance

Stock Unit: EA

10. Approved Manufacturers

<table>
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<th>Components</th>
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<th>Catalog Number</th>
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<tr>
<td>013116</td>
<td>712 vault with one 72-inch by 36-inch and one 42-inch round entry access</td>
<td>[A-B1]</td>
<td>712 CLX Vault Assembly</td>
</tr>
<tr>
<td>013117</td>
<td>712 vault with two 42-inch round entry access</td>
<td>[A-B2]</td>
<td>712 TEE CLX Assembly w/ (2) 57-CLX-42C cover slabs</td>
</tr>
<tr>
<td>013118</td>
<td>712 vault with one 72-inch by 36-inch and one 42-inch round entry access,</td>
<td>[A-B3]</td>
<td>712-CLX Type 1 Vault Assembly</td>
</tr>
<tr>
<td></td>
<td>offset to left (Type 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013119</td>
<td>712 vault with one 72-inch by 36-inch and one 42-inch round entry access,</td>
<td>[A-B4]</td>
<td>712-CLX Type 2 Vault Assembly</td>
</tr>
<tr>
<td></td>
<td>offset to right (Type 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013112</td>
<td>712 vault base</td>
<td>[A]</td>
<td>712 Vault Base</td>
</tr>
<tr>
<td>013113</td>
<td>712 top with two 78-inch by 50-inch blockouts</td>
<td>[B1]</td>
<td>712-TEE-CLX</td>
</tr>
<tr>
<td>013395</td>
<td>712 top with two 42-inch blockouts</td>
<td>[B2]</td>
<td>712-TL-42EE</td>
</tr>
<tr>
<td>013114</td>
<td>712 top with one 78-inch by 50-inch blockout and one 42-inch round blockout</td>
<td>[B3]</td>
<td>712 TEE CLX Top – Type 1</td>
</tr>
<tr>
<td></td>
<td>offset to left (Type 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013115</td>
<td>712 top with one 78-inch by 50-inch blockout and one 42-inch round blockout</td>
<td>[B4]</td>
<td>712 TEE CLX Top – Type 2</td>
</tr>
<tr>
<td></td>
<td>offset to right (Type 2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. References

SCL Material Standard 7203.21; “Precast Reinforced Concrete Structure, General,” June 2012

SCL Material Standard 7204.15; “Risers and Cover Slabs for Self-Grounding Electric Vault” [date TBD]


Detter, Chris; SCL Distribution Engineer and subject matter expert for 7203.46 (chris.detter@sattle.gov)

Ng, Sharon; SCL Civil Engineer and subject matter expert for 7203.46 (sharon.ng@seattle.gov)

Wang, Quan; SCL Standards Engineer, subject matter expert and originator of 7203.46 (quan.wang@seattle.gov)
814 Electric Vault, Primary Service

1. Table of Contents
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2. Scope

This standard covers the requirements for 814 electrical ring vault components (vault base, center sections (risers) and top sections) and assembled 814 electric vaults.

Most of the basic components can be ordered separately or they can be ordered as assembled vaults with cover slabs.

This standard applies to the Seattle City Light (SCL) stock numbers listed in Section 12.

Due to their size, 814 vaults, components, and accessories will not be stocked in SCL inventory. Engineers and the Civil Crew Chief are required to order and specify delivery of these items.
3. Application

814 vaults are used to construct the underground electric system. This precast concrete vault may be used to house medium size transformers up to 501 kVA, three-phase load break junction boxes, and service connections and splices for the distribution system.

The standard 8-ft high 814-vault assembly consists of the 814 vault base, two 48-in center sections (risers), a 814 top section with two 78-in by 50-in blockouts, various additional risers to bring access opening to grade, a cover slab with two 3-ft by 3-ft non-slip, solid covers and a 42-inch entry access.

Due to different applications, the vault may need to be customized with tops with different block-out configurations, different combinations of center sections, various risers and access openings (see Figure 3).

**Figure 3. Steps for selecting the proper vault assembly for your application:**

**Step 1.** Select standard 814 vault base, [A] (Stock No. 013130, Section 5).

**Step 2.** Determine the height of vault needed, select any combination of 30-in [B1] or 48-in [B2] center sections (Stock Nos. 013131 and 013132, Section 6)

**Step 3.** Determine and select the type of blockout configuration needed for the vault top section, [C1, C2 and C3]. For the 814 top sections there are 4 possible options each allowing a different set of access openings. Note, the top section allowing for two 42-in round access openings is not an option to be ordered separately but can be ordered as part of an assembly. Three top sections can be ordered separately. (Stock Nos. 013133, 013134 or 013135, Section 7).
Step 4. Select appropriate risers [D#] to bring access opening up to grade. Each riser section for the 814 covers half of the top section. (Stock Nos. 013105, 013106, 013162, 013107, 013108, and 013109).

Step 5. Determine the appropriate type of cover slabs and lids or hatches [E#]
Step 6. Check the assembled vault configurations in Section 9 for vaults that can be ordered configured with base, top section, and cover slabs. Assembled option will still require choices for risers and hatches or lids.
4. General Requirements

This standard is to be used in conjunction with SCL 7203.21, “Precast Reinforced Concrete Structures – General”.

Vault grounding shall conform to SCL 7203.21, Section 9, Grounding.

Typical load rating for ring vaults is H-20; however, if heavy traffic is anticipated, engineer should request an H-25 load rating.

5. Base [A] Requirements

All 814 ring vault bases shall be constructed according to the dimensions shown in Table 5 and Figure 5.

The ring vault floor shall be sloped to drain toward the sump.

Table 5. Nominal Base Dimensions

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Outside (ft-in)</th>
<th>Inside (ft-in)</th>
<th>Height (ft-in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>013130</td>
<td>Length Width</td>
<td>Length Width</td>
<td>Outside Inside</td>
</tr>
<tr>
<td>15-0 9-0</td>
<td>14-0 8-0</td>
<td>1-3 -</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 5. Standard Vault Base [A]

All 814 ring vault base shall have the following attributes:

- Ground rod knockout (1 inch diameter) at each corner of floor
- Trench sump with removable galvanized grating (12 in x 60 in); 1 ft from, and parallel to, short wall
- Pulling iron (7/8 in diameter); two (2) shall be located at each corner of floor, recessed in floor
- 4-ton lift anchors, one on each corner of floor
- Ground inserts (1/2 in) on opposite end walls on the floor
- Ladder; as required if vault floor is 12 ft-6 in or more below finish grade; fixed ladders shall be per SCL drawing D-28304; ladder substitution shall be submitted for approval
6. Center Section (Riser) Requirements [B1, B2]

All 814 ring vault center sections shall be constructed according to the dimensions shown in Table 6.

Table 6. Vault Nominal Center Sections Dimensions

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Outside (ft-in)</th>
<th>Inside (ft-in)</th>
<th>Height (ft-in)</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length Width</td>
<td>Length Width</td>
<td>Outside Inside</td>
<td></td>
</tr>
<tr>
<td>013131</td>
<td>15-7 9-7</td>
<td>14-0 8-0</td>
<td>2-6 -</td>
<td>6 [B1]</td>
</tr>
<tr>
<td>013132</td>
<td>15-7 9-7</td>
<td>14-0 8-0</td>
<td>4-0 -</td>
<td>6 [B2]</td>
</tr>
</tbody>
</table>

Note: Center sections are considered to be risers by manufacturers but in this Standard we use the term 'center section' to make a distinction from risers used above the top section for the purpose of adjusting the heights of cover slabs to meet surface elevations (grade).

Figure 6. Vault Center Sections [B1 and B2]
6.1 Knockouts, Waffle

Knockouts shall be of the waffle type.

For a 30-in high vault section [B1] (Stock No. 013131), knockout shall measure 18 in by 18 in. Knockouts shall be located on all 4 walls on the outer edge of the wall, two (2) on each side, for a total of eight (8) knockouts.

For a 48-in high vault section [B2] (Stock No. 013132), knockout shall measure 15 in by 18 in. Knockouts shall be located on all 4 walls on the outer edge of the wall, four (4) on each side, for a total of 16 knockouts.

6.2 Dowel Inserts

Dowel inserts (duct bank knockout inserts) shall be embedded 12 inches on center, around the perimeter of the knockout. Dowel inserts shall accommodate a 1/2-in diameter threaded rebar or steel dowel.

6.3 Channels

Galvanized "C" channels shall be embedded in vault walls between knockouts, centered, with 22.5-in spacing between rows.

Channels shall measure 1-5/8 in by 7/8 in by 48 in on the end walls and 1-5/8 in by 7/8 in by 120 in on the side walls.

6.4 Lift Inserts

Lift inserts shall measure 1 inch in diameter. These shall be located on wall ends, along the bottom of the side walls, between knockouts.

6.5 Ground Inserts

Material shall be bronze. Ground inserts shall measure 1/2 inch in diameter. Four (4) total inserts shall be used, two (2) each located at the center of both internal and external side walls.

7. Top Section Requirements, [C1], [C2] and [C3]

All 814 top sections shall be constructed according to the dimensions shown in Table 7 and Figures 7a and 7b.

Table 7. Nominal Top Sections Dimensions and Weight

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Length</th>
<th>Width</th>
<th>Thickness (in)</th>
<th>Blockout Configurations</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>013133</td>
<td>15-2</td>
<td>9-2</td>
<td>9.5</td>
<td>Two 78-in x 50-in blockouts [C1]</td>
<td>7a &amp; 7b [C1]</td>
</tr>
<tr>
<td>013134</td>
<td>15-2</td>
<td>9-2</td>
<td>9.5</td>
<td>One 78-in x 50-in blockouts and one 42-in round blockouts, offset to left (Type 1) [C2]</td>
<td>7a &amp; 7b [C2]</td>
</tr>
<tr>
<td>013135</td>
<td>15-2</td>
<td>9-2</td>
<td>9.5</td>
<td>One 78-in x 50-in blockouts and one 42-in round blockouts, offset to right (Type 2) [C3]</td>
<td>7a &amp; 7b [C3]</td>
</tr>
</tbody>
</table>

Notes
1. Type 1 refers to a left-offset rectangular blockout from point-of-view of round blockout end.
2. Type 2 refers to a right-offset rectangular blockout from point-of-view of round blockout end.
Figure 7a. Vault Top Section [C1]
814 Electric Vault, Primary Service

Figure 7b. Vault Top Section Blockout Options

814 Standard Top, Stock No. 013133 [C1]

- 7/8" x 50" blockout
- 7/8" galvanized pulling iron, 2 each corner on ceiling
- 3" dia. hole for sump discharge
- 4-ton Burke-spread lift anchor, each corner on top

814 Type 1 Top, Stock No. 013134 [C2], blockout offset to left

- 78" x 50" blockout
- 42" round blockout

814 Type 2 Top, Stock No. 013135 [C3], blockout offset to right

- 78" x 50" blockout
- 42" round blockout

All 814 ring vault top covers shall have the following features:

- Pulling iron (7/8 in diameter); two (2) shall be located at each corner of ceiling
- 4-ton lift anchors, one on each corner of floor
- One access port (3 in diameter) shall be located at the center of each ends of top cover

8. Cover Slab, Risers, and Hatches or Covers

Risers described in this section are designed to be set on the vault top section or on the cover slab for the purpose of adjusting the height of the vault access entrance to meet surface elevations (grade).

For a detailed material standard for cover slabs and risers used with the 814 vault, refer to SCL 7204.15, "Cover Slabs and Risers for Electric Vaults."

For a detailed material standard for 42-inch round cover and frames, refer to SCL 7204.70, "Frame and Covers, 42-Inch Round, Iron."
Table 8. Cover Slabs, Risers, and Hatches or Covers

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Matl. Std.</th>
<th>References to Figure 3</th>
</tr>
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<tr>
<td>013105</td>
<td>5-ft x 7-ft x 6-in riser without galvanized “C” channel</td>
<td>7204.15</td>
<td>D1</td>
</tr>
<tr>
<td>013106</td>
<td>5-ft x 7-ft x 18-in riser with galvanized “C” channels</td>
<td>7204.15</td>
<td>D2</td>
</tr>
<tr>
<td>013362</td>
<td>5-ft x 7-ft x 24-in riser with galvanized “C” channels</td>
<td>7204.15</td>
<td>D3</td>
</tr>
<tr>
<td>013107</td>
<td>42-in diameter by 4-in high round riser</td>
<td>7204.15</td>
<td>D4</td>
</tr>
<tr>
<td>013108</td>
<td>42-in diameter by 6-in high round riser</td>
<td>7204.15</td>
<td>D5</td>
</tr>
<tr>
<td>013109</td>
<td>42-in diameter by 12-in high round riser</td>
<td>7204.15</td>
<td>D6</td>
</tr>
<tr>
<td>013110</td>
<td>5-ft x 7-ft cover slab with one 42-in round access opening</td>
<td>7204.15</td>
<td>E1</td>
</tr>
<tr>
<td>013111</td>
<td>5-ft x 7-ft adjustable cover slab with two 3-ft x 3-ft non-slip solid covers</td>
<td>7204.15</td>
<td>E2</td>
</tr>
<tr>
<td>013153</td>
<td>5-ft x 7-ft cover slab with two H-30 solid cover</td>
<td>7204.15</td>
<td>E3</td>
</tr>
<tr>
<td>012753 and 720466</td>
<td>42-in frame with 42-in solid cover</td>
<td>7204.70</td>
<td></td>
</tr>
<tr>
<td>012753 and 720226</td>
<td>42-in frame with 42-in grated vent cover</td>
<td>7204.70</td>
<td></td>
</tr>
</tbody>
</table>

**Rectangular blockout:** For all top sections with rectangular openings cover slabs are necessary, one for each top section rectangular blockout. Cover slabs may either be set directly on the top section or may be set on risers. Cover slabs shall be produced with a key shape on the bottom to fit into the 8-ft x 4-ft-6 in opening in the top section or in the riser openings. Risers are used to obtain the required elevation and then topped by the cover slabs. In that case the risers are set with the blockout hole in the top section matching the opening of the risers (the openings have the same dimension). No key system is required to mate the rectangular riser to the top section.

**Round blockout:** Cover slabs with 42-in round access holes may be set in grout directly on the top section surface. Keyed round risers may also be set directly into top sections that have 42-in round blockouts. Round risers shall have keys that are matched in the top slabs with round blockouts; the same type of matching keys is required in cover slabs with round blockouts.

9. **Vault Assemblies**

Seattle City Light has specified fourteen 814 vault assemblies that can be ordered by stock number. The predefined assemblies have three interior vault heights of 8, 9, or 10 feet with several options for overall height and type of access openings (see Table 9q).

The vault base and the vault top section shall have keyways for proper assembly.

Vaults shall be delivered to the job site, unless otherwise requested in purchase order.

Refer to Tables 9a – 9p for the various components included in each vault assemblies.

For all vault assemblies, if vault contains more than 75 kVA of transformer capacity, a vented (grate) cover (Stock No. 720226) is required in place of the solid cover (Stock No. 720466) per Table 9a.

**Table 9a. 42-in Vented Cover**

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>720226</td>
<td>42-in H20 vented cover</td>
<td></td>
</tr>
</tbody>
</table>
Table 9b. 8-ft Vault Assembly 013136: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) [A-C1]

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Label</th>
<th>Stock No.</th>
<th>Quantity</th>
<th>Figure</th>
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<td>A</td>
<td>013130</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-Section Riser</td>
<td>48 in</td>
<td>B2</td>
<td>013132</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Top Section</td>
<td>814 with 2 rectangular blockout</td>
<td>C1</td>
<td>013133</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rectangular Riser</td>
<td>18 in</td>
<td>D2</td>
<td>013106</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>4 in</td>
<td>D4</td>
<td>013197</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>12 in</td>
<td>D6</td>
<td>013109</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Blockout</td>
<td></td>
<td>E1</td>
<td>013110</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cover Slab with H20 Hatch</td>
<td></td>
<td>E2</td>
<td>013111</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in H20 Frame</td>
<td></td>
<td></td>
<td>012753</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td></td>
<td>720466</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Table 9c. 8-ft Vault Assembly 013137: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 1); [A-C2]

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Label</th>
<th>Stock No.</th>
<th>Quantity</th>
<th>Figure</th>
</tr>
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<td>Base</td>
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<td>A</td>
<td>013130</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mid-Section Riser</td>
<td>48 in</td>
<td>B2</td>
<td>013132</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Top Section</td>
<td>814 with rectangular and 42-inch round blockout,</td>
<td>C2</td>
<td>013134</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type 1, offset to left</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rectangular Riser</td>
<td>18 in</td>
<td>D2</td>
<td>013106</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>4 in</td>
<td>D4</td>
<td>013197</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>12 in</td>
<td>D6</td>
<td>013109</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Blockout</td>
<td></td>
<td>E1</td>
<td>013110</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cover Slab with H20 Hatch</td>
<td></td>
<td>E2</td>
<td>013111</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in H20 Frame</td>
<td></td>
<td></td>
<td>012753</td>
<td>1</td>
<td></td>
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### Table 9d. 8-ft Vault Assembly 013138: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 2); [A-C3]

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**Table 9j. 10-ft Vault Assembly 013144: With 2 Personnel (42-in Round Hatch) [A-C1]**

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### Table 9k. 10-ft Vault Assembly 013145: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 1); [A-C2]

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Table 9m. 8-ft Vault Assembly 013161: With 1 H30 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) [A-C1]

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<td></td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td></td>
<td>720466</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Component</td>
<td>Description</td>
<td>Label</td>
<td>Stock No.</td>
<td>Quantity</td>
<td>Figure</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>Base</td>
<td></td>
<td>A</td>
<td>013130</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mid-Section Riser</td>
<td>48 in</td>
<td>B2</td>
<td>013132</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Top Section</td>
<td>814 with rectangular and 42-inch round blockout, Type 1, offset to left</td>
<td>C3</td>
<td>013134</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rectangular Riser</td>
<td>18 in</td>
<td>D2</td>
<td>013106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>4 in</td>
<td>D4</td>
<td>013197</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>12 in</td>
<td>D6</td>
<td>013109</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Blockout</td>
<td></td>
<td>E1</td>
<td>013110</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cover Slab with H30 Hatch</td>
<td></td>
<td>E2</td>
<td>013153</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in H20 Frame</td>
<td></td>
<td></td>
<td>012753</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td></td>
<td>720466</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Table 9p. 8-ft Vault Assembly 013163: With 1 H30 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 2); [A-C3]

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Label</th>
<th>Stock No.</th>
<th>Quantity</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>A</td>
<td>013130</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-Section Riser</td>
<td>48 in</td>
<td>B2</td>
<td>013132</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Top Section</td>
<td>814 with rectangular and 42-inch round blockout, Type 2, offset to right</td>
<td>C3</td>
<td>013135</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rectangular Riser</td>
<td>18 in</td>
<td>D2</td>
<td>013106</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>4 in</td>
<td>D4</td>
<td>013197</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Riser</td>
<td>12 in</td>
<td>D6</td>
<td>013109</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>42-in Round Blockout</td>
<td>E1</td>
<td>013110</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover Slab with H30 Hatch</td>
<td>E3</td>
<td>013153</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42-in H20 Frame</td>
<td></td>
<td>012753</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42-in Solid</td>
<td></td>
<td>720466</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 9q. Vault Assembly Components and Overall Heights and Weight

<table>
<thead>
<tr>
<th>Vault Assembly (ft)</th>
<th>Inside Height, Nominal</th>
<th>Outside Height(a), Nominal</th>
<th>814 – 30R Risers</th>
<th>814 – 48R Risers</th>
<th>Vault Weight(a), Nominal (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8 ft-0 in</td>
<td>10 ft-5 in</td>
<td>-</td>
<td>2</td>
<td>51,700 lb</td>
</tr>
<tr>
<td>9</td>
<td>9 ft-0 in</td>
<td>11 ft-5 in</td>
<td>2</td>
<td>1</td>
<td>55,400 lb</td>
</tr>
<tr>
<td>10</td>
<td>10 ft-0 in</td>
<td>12 ft-5 in</td>
<td>4</td>
<td>-</td>
<td>59,100 lb</td>
</tr>
</tbody>
</table>

Note
\(a\). Height and weight do not include cover slabs or additional risers to bring access to grade.

### 10. Shipping

All vaults larger than 444 shall be delivered to the job site. Contact SCL civil crew chief to arrange delivery details.

### 11. Issuance

Stock Unit: EA
12. Approved Manufacturers

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Components</th>
<th>Manufacturer and Catalog No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>013130</td>
<td>Standard vault base [A]</td>
<td>814 – SB</td>
</tr>
<tr>
<td>013131</td>
<td>30-in center section [B1]</td>
<td>814-30R w/ GRD</td>
</tr>
<tr>
<td>013133</td>
<td>Vault top section with two 76-in x 50-in blockouts [C1]</td>
<td>814-TEE-CLX</td>
</tr>
<tr>
<td>013134</td>
<td>Vault top section with one 76-in x 50-in and one 42-in round blockout, offset to left, Type 1 [C2]</td>
<td>814 Type 1 Top</td>
</tr>
<tr>
<td>013135</td>
<td>Vault top section with one 76-in x 50-in and one 42-in round blockout, offset to right, Type 2 [C3]</td>
<td>814 Type 2 Top</td>
</tr>
<tr>
<td>013136</td>
<td>8-ft high vault with one H-20 72-in x 36-in and one 42-in round entry access</td>
<td>814-8 CLX vault w/ GRD</td>
</tr>
<tr>
<td>013137</td>
<td>8-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to left (Type 1)</td>
<td>814-8 CLX Type 1 vault w/ GRD</td>
</tr>
<tr>
<td>013138</td>
<td>8-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to right (Type 2)</td>
<td>814-8 CLX Type 2 vault w/ GRD</td>
</tr>
<tr>
<td>013139</td>
<td>9-ft high vault with one 72-in x 36-in and one 42-in round entry access</td>
<td>814-9 CLX vault w/ GRD</td>
</tr>
<tr>
<td>013140</td>
<td>9-ft high vault with two 42-in round entry accesses</td>
<td>814-9 vault w/ 814-TEE-CLX Top w/ (2) 42-in access hole w/ GRD</td>
</tr>
<tr>
<td>013141</td>
<td>9-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to left (Type 1)</td>
<td>814-9 CLX Type 1 vault w/ GRD</td>
</tr>
<tr>
<td>013142</td>
<td>9-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to right (Type 2)</td>
<td>814-9 CLX Type 2 vault w/ GRD</td>
</tr>
<tr>
<td>013143</td>
<td>10-ft high vault with one 72-in x 36-in and one 42-in round entry access</td>
<td>814-10 CLX vault w/ GRD</td>
</tr>
<tr>
<td>013144</td>
<td>10-ft high vault with two 42-in round entry accesses</td>
<td>814-10 vault w/ 814-TEE-CLX Top w/ (2) 42&quot; access hole w/ GRD</td>
</tr>
<tr>
<td>013145</td>
<td>10-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to left (Type 1)</td>
<td>814-10 CLX Type 1 vault w/ GRD</td>
</tr>
<tr>
<td>013146</td>
<td>10-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to right (Type 2)</td>
<td>814-10 CLX Type 2 vault w/ GRD</td>
</tr>
<tr>
<td>013161</td>
<td>8-ft high vault with H-30 LW 2-door hatch and one 42-in round entry access</td>
<td>814-8 CLX vault w/ GRD w/ LW Hatch</td>
</tr>
<tr>
<td>013162</td>
<td>8-ft high vault with H-30 LW 2-door hatch and one 42-in round entry access, offset to left (Type 1)</td>
<td>814-8 CLX Type 1 vault w/ GRD w/ LW Hatch</td>
</tr>
<tr>
<td>013163</td>
<td>8-ft high vault with H-30 LW 2-door hatch and one 42-in round entry access, offset to right (Type 2)</td>
<td>814-8 CLX Type 2 vault w/ GRD w/ LW Hatch</td>
</tr>
</tbody>
</table>
13. References

SCL Material Standard 7203.21; “Precast Reinforced Concrete Structure, General”

SCL Material Standard 7204.15; “Cover Slabs and Risers for Electric Vaults”

SCL Material Standard 7204.70; “Frames and Covers, 42-Inch Round, Iron”

14. Sources

Ng, Sharon; SCL Civil Engineer and subject matter expert for 7203.51 (sharon.ng@seattle.gov)

Wang, Quan; SCL Standards Engineer, subject matter expert, and originator of 7203.51 (quan.wang@seattle.gov)

Youngs, Rob; SCL Electrical Reviewer and subject matter expert for 7203.51 (rob.youngs@seattle.gov)
1. **Scope**

This standard covers the detailed requirements for 644 electrical vault components (vault base and cover with hatch) and 644 vault assemblies. Components may be ordered separately or ordered as an assembly.

This standard applies to the following Seattle City Light (SCL) stock numbers:

<table>
<thead>
<tr>
<th>Stock No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013731</td>
<td>Base, standard 644</td>
</tr>
<tr>
<td>013732</td>
<td>Cover, with hatch</td>
</tr>
<tr>
<td>013733</td>
<td>Assembly; base and cover with hatch</td>
</tr>
</tbody>
</table>

2. **Application**

644 vaults are used in the construction of underground electric systems. The precast concrete structure may also house loadbreak junction boxes, and be used to make service connections and splices for the SCL system.

H20-rated 644 vault assemblies are not to be used in high traffic locations.
3. General Requirements

This standard is to be used in conjunction with the latest revision of SCL 7203.21.

4. Component Requirements

4.1 Grounding and Bonding

Vault grounding shall comply with SCL 7203.21.

4.2 Base

Table 4.2a. Vault Base Components

<table>
<thead>
<tr>
<th>Knockouts</th>
<th>Size, Nominal (in)</th>
<th>Location</th>
<th>Per Location</th>
<th>Total #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>4-3/4 dia</td>
<td>All 4 walls, on bottom</td>
<td>8 ea side</td>
<td>32</td>
</tr>
<tr>
<td>Ground rod</td>
<td>1 dia</td>
<td>2 corners of floor</td>
<td>1 ea corner</td>
<td>2</td>
</tr>
<tr>
<td>Channels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galvanized “C”</td>
<td>36 long</td>
<td>End walls, above all knockouts</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td>channel, horizontal, embedded in walls</td>
<td>60 long</td>
<td>Side walls, above all knockouts</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td>Sump</td>
<td>8 dia</td>
<td>Floor, center</td>
<td>1, to one side</td>
<td>1</td>
</tr>
<tr>
<td>Pulling irons</td>
<td>1/2 dia</td>
<td>As request per project; 2 corners of floor (typical)</td>
<td>1 ea corner</td>
<td>4</td>
</tr>
<tr>
<td>Lift holes</td>
<td>1-1/2 dia</td>
<td>2 opposite walls, center wall, horizontal</td>
<td>1 ea side</td>
<td>2</td>
</tr>
<tr>
<td>Ground inserts, bronze</td>
<td>1/2 dia</td>
<td>2 opposite walls, internal and external</td>
<td>2 ea side</td>
<td>4</td>
</tr>
<tr>
<td>Ladder</td>
<td>–</td>
<td>Not required</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

Base shall have dimensions as shown in Tables 4.2b and 4.2c, and Figure 4.2.

Table 4.2b. Base Dimensions, Inside, Nominal (ft-in)

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6</td>
<td>3-6</td>
<td>3-2</td>
</tr>
</tbody>
</table>

Table 4.2c. Base Dimensions, Outside, Nominal (ft-in)

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-0</td>
<td>4-0</td>
<td>3-6</td>
</tr>
</tbody>
</table>
4.3 Cover

Cover shall consist of a concrete collar with a slip-resistant solid hatch.

Cover shall have overall dimensions as shown in Table 4.3.

Cover shall have a 3/4-in diameter (nominal) lift insert at each corner on the top, as shown in Figure 4.3.

Caps shall be provided to cover the lift inserts.

Cover shall have a keyway to ensure a tight fit.

Table 4.3. Cover Dimensions, Nominal

<table>
<thead>
<tr>
<th>Concrete Collar</th>
<th>Length (ft-in)</th>
<th>Width (ft-in)</th>
<th>Thickness (in)</th>
<th>Opening (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6-0</td>
<td>4-0</td>
<td>6</td>
<td>3 x 3</td>
</tr>
</tbody>
</table>
The solid hatch shall have the following:

- 3 ft x 3 ft dimension
- H20 rating
- Recessed lift handles
- Non-slip surfaces
- One handle located on each of the short ends of the hatch
- 5/8-in bonding point hole on support bar for grounding hatch
- Hatch-locking mechanism with Penta head bolt

Figure 4.3. Cover with Hatch

5. Issuance

Unit: EA

6. Approved Manufacturer

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Oldcastle/Utility Vault Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>013731</td>
<td>Base, standard 644</td>
<td>644-BL</td>
</tr>
<tr>
<td>013732</td>
<td>Cover, with hatch</td>
<td>64-332P</td>
</tr>
<tr>
<td>013733</td>
<td>Assembly, base and cover with hatch</td>
<td>644-LA</td>
</tr>
</tbody>
</table>

7. References

SCL Material Standard 7203.21; “Precast Reinforced Concrete Structure, General”

8. Sources

Wang, Quan; SCL Standards Engineer, originator, and subject matter expert for 7203.61 (quan.wang@seattle.gov)
687 Electric Vault, Primary Service

1. Scope

This standard covers the requirements for 687 electrical vault components (vault base, mid-section, and cover with round access) and assembled 687 electric vaults.

Either separate components or an assembled unit can be ordered.

This standard applies to the following Seattle City Light (SCL) stock numbers:

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013734</td>
<td>Base, standard 687</td>
</tr>
<tr>
<td>013735</td>
<td>Mid-section</td>
</tr>
<tr>
<td>013736</td>
<td>Cover with round access</td>
</tr>
<tr>
<td>013737</td>
<td>Assembly (base, mid-section, and cover with round access)</td>
</tr>
</tbody>
</table>

2. Application

687 precast concrete vaults are used to construct the underground electric system. The vault may be used to house medium-size transformers, and service connections and splices for the distribution system.

The standard assembly consists of a base, a mid-section, and a cover with one 42-in round access.

A 42-in round iron frame and cover must be ordered separately. For detailed material specifications for the iron frame and cover, see SCL 7204.70, "Frame and Covers, 42-Inch Round, Iron."

H20-rated vault assemblies with rectangular or square hatches should not be used in locations with high-density traffic.
3. General Requirements

This standard is to be used in conjunction with SCL 7203.21, “Precast Reinforced Concrete Structures, General.”

Vault grounding shall conform to SCL 7203.21, Section 9, “Grounding.”

4. Base Requirements

The vault base shall be constructed according to the dimensions and details shown in Table 4 and Figure 4.

Table 4. Base Dimensions (Nominal)

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Outside</th>
<th>Inside</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8' 8&quot;</td>
<td>6' 8&quot;</td>
</tr>
<tr>
<td>013734</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4. Base

Vault bases shall have:

- Round rod knockout (1 in diameter) at each corner of the floor.
- Trench sump with removable galvanized grating (12 in x 64 in x 8 in) 1 ft from, and parallel to, the end wall.
- Two pulling irons that are 7/8 in diameter at each end of the floor. 1/2-inch diameter pulling irons shall not be used for 687 vaults.
5. Mid-Section Requirements

The vault mid-section shall be constructed according to the dimensions and details shown in Table 5 and Figure 5.

Table 5. Mid-Section Dimensions (Nominal)

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Outside Length</th>
<th>Outside Width</th>
<th>Outside Height</th>
<th>Inside Length</th>
<th>Inside Width</th>
<th>Inside Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>013735</td>
<td>8’ 8”</td>
<td>6’ 8”</td>
<td>4’ 10”</td>
<td>8’ 0”</td>
<td>6’ 0”</td>
<td>4’ 9”</td>
</tr>
</tbody>
</table>

Figure 5. Mid-Section

5.1 Knockouts, Waffle

Knockouts shall be of the waffle type.

Knockouts shall measure 18 in by 18 in.

Four knockouts shall be located on the outer edge of each wall for a total of 16 knockouts.
5.2 Channels

Galvanized "C" channels shall be embedded and centered in the side walls between knockouts. There shall be 22-1/2 inches of space between channel rows as measured from the center of each row.

Channels shall measure 1-5/8 in by 13/16 in by 48 in. See Figure 5.2

**Figure 5.2. Channel Placement, Side Wall**

![Diagram of channel placement in a side wall with dimensions and notes:]

- **Cover**
- **Mid-section**
- **Base**

*GALVINIZED "C" CHANNEL, 48" LONG, 3 EACH SIDE, 2 SIDES*
5.3 Racking Inserts

Racking inserts shall accommodate 1/2-in diameter threaded bolts.

Racking inserts shall be embedded in the center of end walls between knockouts. There shall be 20 inches of space (horizontal) and 22-1/2 inches of space (vertical) between racking inserts as measured from the center of each insert.

Figure 5.3. Racking Insert Placement, End Wall

5.4 Lift Anchor

A lift anchor with a 2-ton ultimate strength rating shall be located on each corner of the wall.
6. Cover Requirements

Covers shall be constructed according to the dimensions shown in Table 6 and Figure 6.

**Table 6. Cover Dimensions (Nominal)**

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Outside</th>
<th>Inside</th>
<th>Access Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>Width</td>
<td>Height</td>
</tr>
<tr>
<td>013736</td>
<td>8' 8&quot;</td>
<td>6' 8&quot;</td>
<td>1' 10&quot;</td>
</tr>
</tbody>
</table>

**Figure 6. Cover with Round Access**

The cover shall have:

- 2-ton lift anchors, two on each end of the top.
- A keyway on the cover to ensure a tight fit with the mid-section.

7. Issuance

Unit: EA

8. Approved Manufacturer

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>013734</td>
<td>Base, standard 687</td>
<td>687-BL</td>
</tr>
<tr>
<td>013735</td>
<td>Mid-section with cable supports</td>
<td>687-ML</td>
</tr>
<tr>
<td>013736</td>
<td>Cover, with round access</td>
<td>687-TL-42C</td>
</tr>
<tr>
<td>013737</td>
<td>Assembly (base and cover with round access)</td>
<td>687-LA</td>
</tr>
</tbody>
</table>

9. References

**SCL Material Standard 7203.21; “Precast Reinforced Concrete Structure, General”**

**SCL Material Standard 7204.70; “Frames and Covers, 42-Inch Round, Iron”**
10. Sources

Ng, Sharon; SCL Civil Engineer and subject matter expert for 7203.66 (sharon.ng@seattle.gov)

Wang, Quan; SCL Standards Engineer, and originator and subject matter expert for 7203.66 (quan.wang@seattle.gov)
1. Scope

This standard covers the detailed requirements for precast reinforced concrete transformer pads.

This standard applies to the following Seattle City Light (SCL) stock numbers:

<table>
<thead>
<tr>
<th>Stock No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013721</td>
<td>Single phase transformer pad</td>
</tr>
<tr>
<td>013722</td>
<td>Three phase transformer pad (75–300 kVA)</td>
</tr>
<tr>
<td>013723</td>
<td>Three phase transformer pad (500–1500 kVA)</td>
</tr>
<tr>
<td>013724</td>
<td>Three phase transformer pad (2000–2500 kVA)</td>
</tr>
</tbody>
</table>

2. Application

Precast reinforced concrete transformer pads are used as a platform for transformers or switchgear.

Due to their size, transformer pads will not be stocked in SCL inventory. Engineers and the Civil Crew Chief are required to order and specify delivery of these items.

3. General Requirements

This standard is to be used in conjunction with the latest revision of SCL 7203.21.
4. Requirements, General

Pad grounding shall comply with SCL 7203.21.

Transformer pads shall be constructed according to the dimensions and details shown in Table 4.2 and figures 4.2a and 4.2b.

Table 4.2. Pad Dimensions

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Width</th>
<th>Length</th>
<th>Height</th>
<th>Blockout Dimensions, nominal (in)</th>
<th>Blockout placement from edge of pad (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>013721</td>
<td>4-0</td>
<td>4-8</td>
<td>0-6</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td>013722</td>
<td>7-0</td>
<td>7-0</td>
<td>0-6</td>
<td>60</td>
<td>16</td>
</tr>
<tr>
<td>013723</td>
<td>8-0</td>
<td>7-9</td>
<td>0-6</td>
<td>60</td>
<td>16</td>
</tr>
<tr>
<td>013724</td>
<td>8-0</td>
<td>10-0</td>
<td>0-8</td>
<td>60</td>
<td>24</td>
</tr>
</tbody>
</table>

Figure 4.2a. Transformer Pad
Figure 4.2b. Knockout Panel Detail

Lift inserts measuring 3/4-inch in diameter (nominal) shall be located at each corner on the top side of the pad.

Caps shall cover each lift insert.

For all transformer pads except for Stock No. 013274, the letters “SCL,” measuring 3-in high, shall be cast into the top side of the pad.

For Stock No. 013724, knockout panels measuring 6 in x 24 in shall be installed on each side of the blockout.

5. Issuance

Unit: EA

6. Approved Manufacturer

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Description</th>
<th>Catalog No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>013721</td>
<td>Single phase transformer pad</td>
<td>54-1422</td>
</tr>
<tr>
<td>013722</td>
<td>Three phase transformer pad (75–300 kVA)</td>
<td>77-1660</td>
</tr>
<tr>
<td>013723</td>
<td>Three phase transformer pad (500–1500 kVA)</td>
<td>88-1660</td>
</tr>
<tr>
<td>013724</td>
<td>Three phase transformer pad (2000–2500 kVA)</td>
<td>77-810-2460</td>
</tr>
</tbody>
</table>

7. References

SCL Material Standard 7203.21; “Precast Reinforced Concrete Structure, General”

8. Sources

Ng, Sharon; SCL Civil Engineer, subject matter expert for 7203.76 (sharon.ng@seattle.gov)

Wang, Quan; SCL Standards Engineer, originator and subject matter expert for 7203.76 (quan.wang@seattle.gov)
Mandrels, Proofing

1. Scope

This standard covers the requirements for rigid proofing mandrels. This standard applies to the following Seattle City Light (SCL) stock numbers.

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Conduit Trade Size (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>013294</td>
<td>3/4</td>
</tr>
<tr>
<td>013295</td>
<td>1</td>
</tr>
<tr>
<td>013296</td>
<td>1-1/4</td>
</tr>
<tr>
<td>013297</td>
<td>1-1/2</td>
</tr>
<tr>
<td>013298</td>
<td>2</td>
</tr>
<tr>
<td>013299</td>
<td>2-1/2</td>
</tr>
<tr>
<td>013300</td>
<td>3</td>
</tr>
<tr>
<td>013301</td>
<td>3-1/2</td>
</tr>
<tr>
<td>013302</td>
<td>4</td>
</tr>
<tr>
<td>013303</td>
<td>5</td>
</tr>
<tr>
<td>013304</td>
<td>6</td>
</tr>
</tbody>
</table>

2. Application

Rigid proofing mandrels are used to test for obstructions in an underground conduit run after trench backfill and/or conduit pour is complete.

The mandrel size should be at least as large as the largest cable pulling head (or grip) that could be used within that conduit to ensure cable can be pulled in successfully.
3. Construction

Proofing mandrels corresponding to conduit sizes up to and including 3-1/2 inches shall be constructed per Figure 3.1. A stainless steel 1/8-in aircraft cable shall be run through the center of the mandrel, looped at the ends, and secured with red Loctite compound and a flat washer.

Proofing mandrels corresponding to conduit sizes 4 inches and larger will be constructed per Figure 3.2. At each end of the mandrel, 1/2-in galvanized steel oval eye nuts shall be installed and secured with red Loctite compound to the 1/2-in galvanized rod via a lock washer and flat washer.

Acceptable dimensional mandrel length and diameter tolerance is +0% to -3%

Each mandrel shall be marked in a permanent legible fashion with the stock number and date of manufacture. Marking shall appear on the mandrel end face to prevent damage.

Figure 3.1. Mandrel with Stainless Steel Cable

![Figure 3.1. Mandrel with Stainless Steel Cable]

Figure 3.2. Mandrel

![Figure 3.2. Mandrel]

Table 3.1. Mandrel Dimensions

<table>
<thead>
<tr>
<th>Stock No.</th>
<th>Conduit Trade Size (in)</th>
<th>Mandrel Diameter (in)</th>
<th>Mandrel Length (in)</th>
<th>Taper Length (in)</th>
<th>Taper Depth (in)</th>
<th>Material</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>013294</td>
<td>3/4</td>
<td>0.62</td>
<td>1.0</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013295</td>
<td>1</td>
<td>0.78</td>
<td>1.25</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013296</td>
<td>1-1/4</td>
<td>1.00</td>
<td>1.5</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013297</td>
<td>1-1/2</td>
<td>1.25</td>
<td>1.75</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013298</td>
<td>2</td>
<td>1.62</td>
<td>2.25</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013299</td>
<td>2-1/2</td>
<td>2.00</td>
<td>2.75</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013300</td>
<td>3</td>
<td>2.50</td>
<td>3.25</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013301</td>
<td>3-1/2</td>
<td>3.00</td>
<td>3.75</td>
<td>–</td>
<td>–</td>
<td>Delrin or nylon</td>
<td>3.1</td>
</tr>
<tr>
<td>013302</td>
<td>4</td>
<td>3.50</td>
<td>8.0</td>
<td>1.0</td>
<td>0.5</td>
<td>Delrin or nylon</td>
<td>3.2</td>
</tr>
<tr>
<td>013303</td>
<td>5</td>
<td>4.75</td>
<td>12.0</td>
<td>1.5</td>
<td>0.5</td>
<td>Delrin or nylon</td>
<td>3.2</td>
</tr>
<tr>
<td>013304</td>
<td>6</td>
<td>5.50</td>
<td>14.0</td>
<td>2.0</td>
<td>0.7</td>
<td>Delrin or nylon</td>
<td>3.2</td>
</tr>
</tbody>
</table>
4. Pre-Production Approval

The successful bidder shall submit a first prototype to SCL Standards for approval prior to the fabrication of the first production piece. The successful bidder shall submit a first production piece to SCL Standards for approval prior to the fabrication of the balance of the order.

5. Issuance

Stock Unit: EA

6. Approved Manufacturers

Bids may be solicited from any fabricator identified by Civil/Mechanical Engineering or Material Control as being capable.

7. References

SCL Construction Standard U2-11 / NDK-40; "Mandreling and Cleaning of Ducts and Conduits"

Hanson, Brett; SCL Standards Engineer, and subject matter expert and originator of 7645.40 (brett.hanson@seattle.gov)

Jerochim, Pete; SCL Electrical Inspector and subject matter expert of 7645.40 (pete.jerochim@seattle.gov)

Youngs, Rob; SCL Electrical Inspector and subject matter expert of 7645.40 (rob.youngs@seattle.gov)
Sign, Equipment Transportation Agreement

1. **Scope**

This standard covers the material requirements for Equipment Transportation Agreement (ETA) signage.

2. **Application**

Specific signage is required when an ETA contract exists between a customer and Seattle City Light (SCL) for transformers or related equipment installed in a vault.

An ETA is a binding agreement typically established between SCL and a property owner as part of the electrical service initiation process. It dictates that in the event SCL equipment needs to be replaced or installed on site, it is the owner's responsibility to move such equipment in and out of the building.

ETA signage is not part of SCL stock. The customer is responsible for procuring signage per this standard.
3. General Requirements

<table>
<thead>
<tr>
<th>Material</th>
<th>Phenolic resin sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>12 in x 12 in square, ± 1/16 in</td>
</tr>
<tr>
<td>Color</td>
<td></td>
</tr>
<tr>
<td>Sign</td>
<td>Red</td>
</tr>
<tr>
<td>Lettering</td>
<td>White</td>
</tr>
<tr>
<td>Lettering style and size</td>
<td></td>
</tr>
<tr>
<td>Style</td>
<td>All caps, sans serif font, engraved</td>
</tr>
<tr>
<td>Size</td>
<td>Title text: 1-in high, nominal</td>
</tr>
<tr>
<td></td>
<td>Body text: 1/2-in high, nominal</td>
</tr>
<tr>
<td>Thickness (in)</td>
<td>6 mils, nominal</td>
</tr>
<tr>
<td>Mounting</td>
<td>4 holes, 5/16-in diameter, ± 1/16-in, on corners</td>
</tr>
</tbody>
</table>

Figure 3. Text Sign Example

TRANSPORTATION AGREEMENT

AN EQUIPMENT TRANSPORTATION AGREEMENT

EXISTS FOR THIS VAULT. IF TRANSFORMER(S)

OR RELATED EQUIPMENT NEEDS TO BE MOVED

INTO OR OUT OF BUILDING, THE BUILDING

OWNER IS RESPONSIBLE FOR MOVING IT.

4. Suggested Manufacturer

Scott Machine Development Corporation, Walton, NY

5. Sources


Scott Machine Development Corporation; www.scottmachinecorp.com

Tilley, Kathy; SCL Electrical Engineering Support Specialist, originator of 7651.25 (kathy.tilley@seattle.gov)