



STANDARDS FOR ELECTRICAL SERVICE

2017 Edition



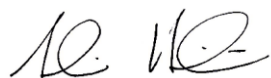
Seattle City Light

Standards for Electrical Service 2017 Edition

Welcome to the first 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 2017.

A handwritten signature in black ink, appearing to read "S. Hamilton", is positioned above the name of the signatory.

Sephir Hamilton, Engineering, Technology and Innovation Officer

Seattle City Light
Standards for Electrical Service 2017 Edition
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Prepared by Laura Vanderpool
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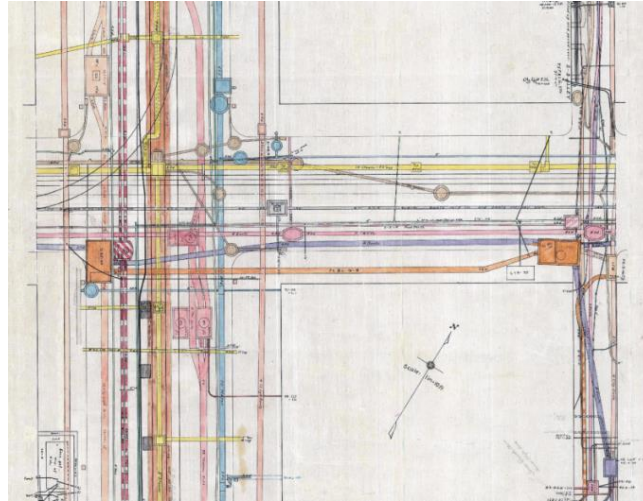
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	Secondary Underground	Multi-Lot Residential Development	Transformer Pad	Fenced Transformer Enclosure	Precast Below-Grade Vault	In-Building Vault	
0214.00	x	x	x	x	x	x	
0222.02	x	x	x	x	x	x	x
0224.01	x	x					
0224.05	x	x	x	x	x	x	x
0224.07	x	x					
0224.34	x	x	x	x	x	x	
0226.06		x	x	x	x	x	
0231.01	x	x	x				
0232.05	x	x	x	x	x	x	
0233.05	x	x	x				
0257.06						x	x
0461.10	x	x	x	x	x	x	
0468.90	x	x	x	x	x	x	
0474.08			x	x		x	x
0652.01			x				
0652.03			x				
0652.05			x				
0652.07			x				
0674.06						x	
0735.50			x	x			
0751.00						x	
0751.49						x	x
0751.60						x	
0751.77						x	x
1561.07	x	x					
1561.09	x						
DU13-4/NMT-30	x	x	x	x	x	x	
NCI-62						x	x
U2-1140/NDK-40	x	x	x	x	x	x	x
U2-14.2		x	x	x	x	x	
U2-15.1		x			x		
U10-1.2				x			
U10-7		x	x	x	x		
U12-1.3/NMT-10	x	x					
U12-5/NMT-20	x	x	x	x	x	x	
6103.90	x	x	x	x	x	x	
6762.25	x	x	x	x	x	x	
7015.05	x	x	x	x	x	x	x
7015.80		x	x	x	x	x	x
7050.05	x	x	x	x	x	x	x
7050.09	x	x					
7055.09	x	x	x	x	x	x	
7150.00		x	x	x	x	x	
7203.04	x	x	x				
7203.08	x	x	x				
7203.10	x	x					
7203.12	x	x					
7203.26	x	x	x				
7203.31		x	x				
7203.36		x	x				
7203.41		x	x	x	x	x	
7203.46		x			x		
7203.51		x			x		
7203.61		x	x	x	x	x	
7203.66		x			x		
7203.76			x				
7645.40	x	x	x	x	x	x	x
7651.25					x	x	

Clearances between SCL Underground Structures and Other Utility Structures in the Public Right-of-Way



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Standards Coordinator
Laura Vanderpool

Standards Supervisor
John Shippek

Unit Director
Darnell Cola

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

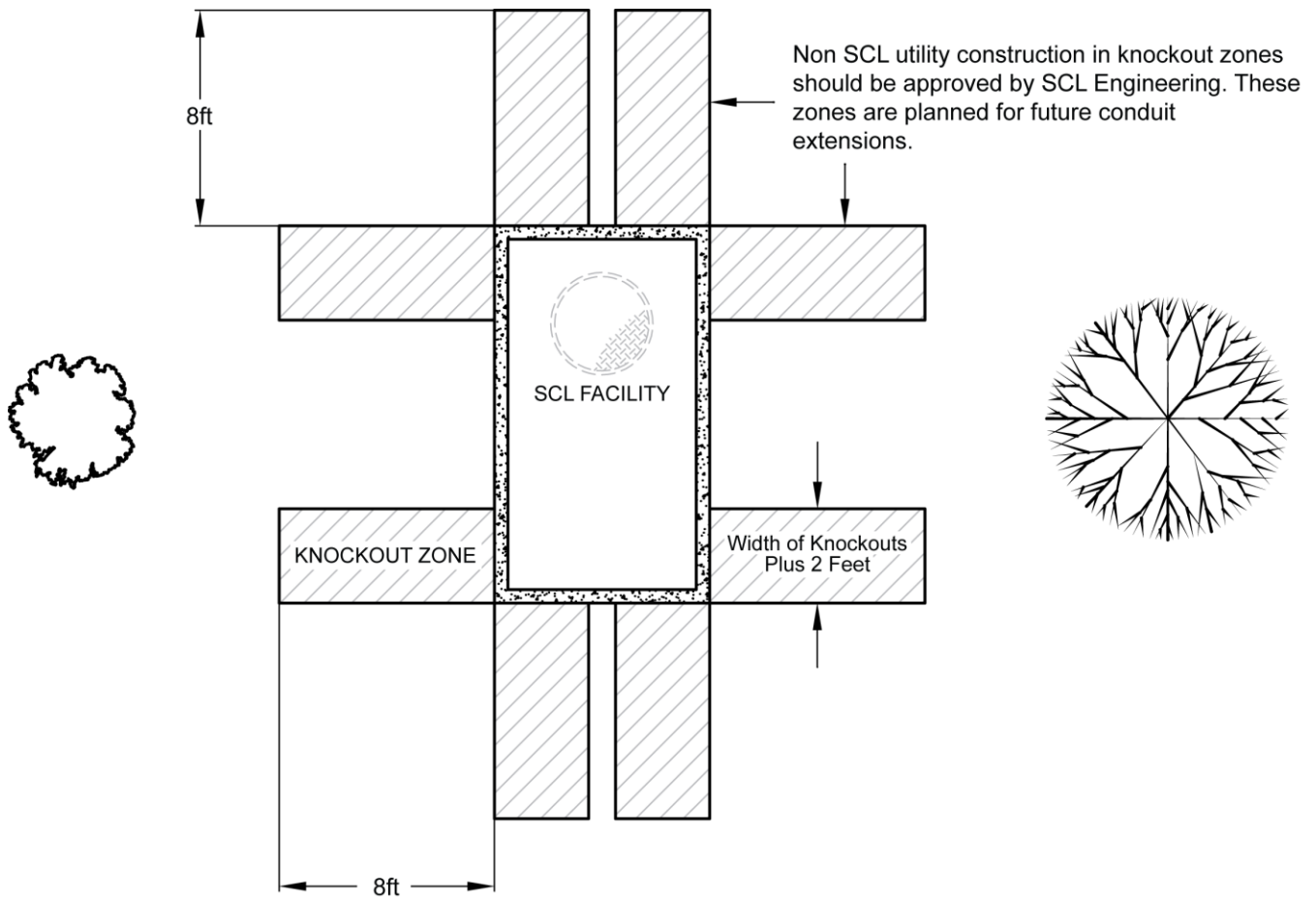
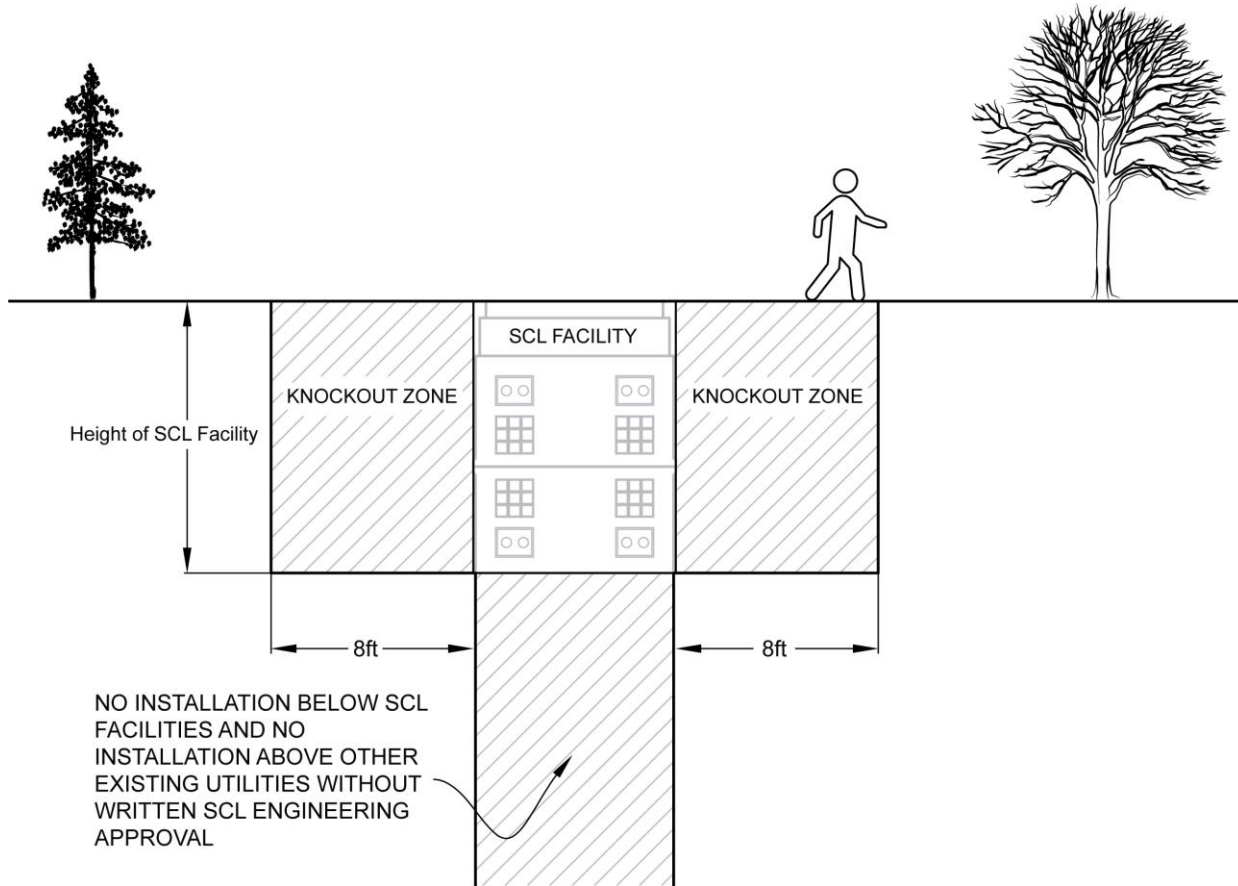


Figure 4.2b. Knockout Zone, Elevation View



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

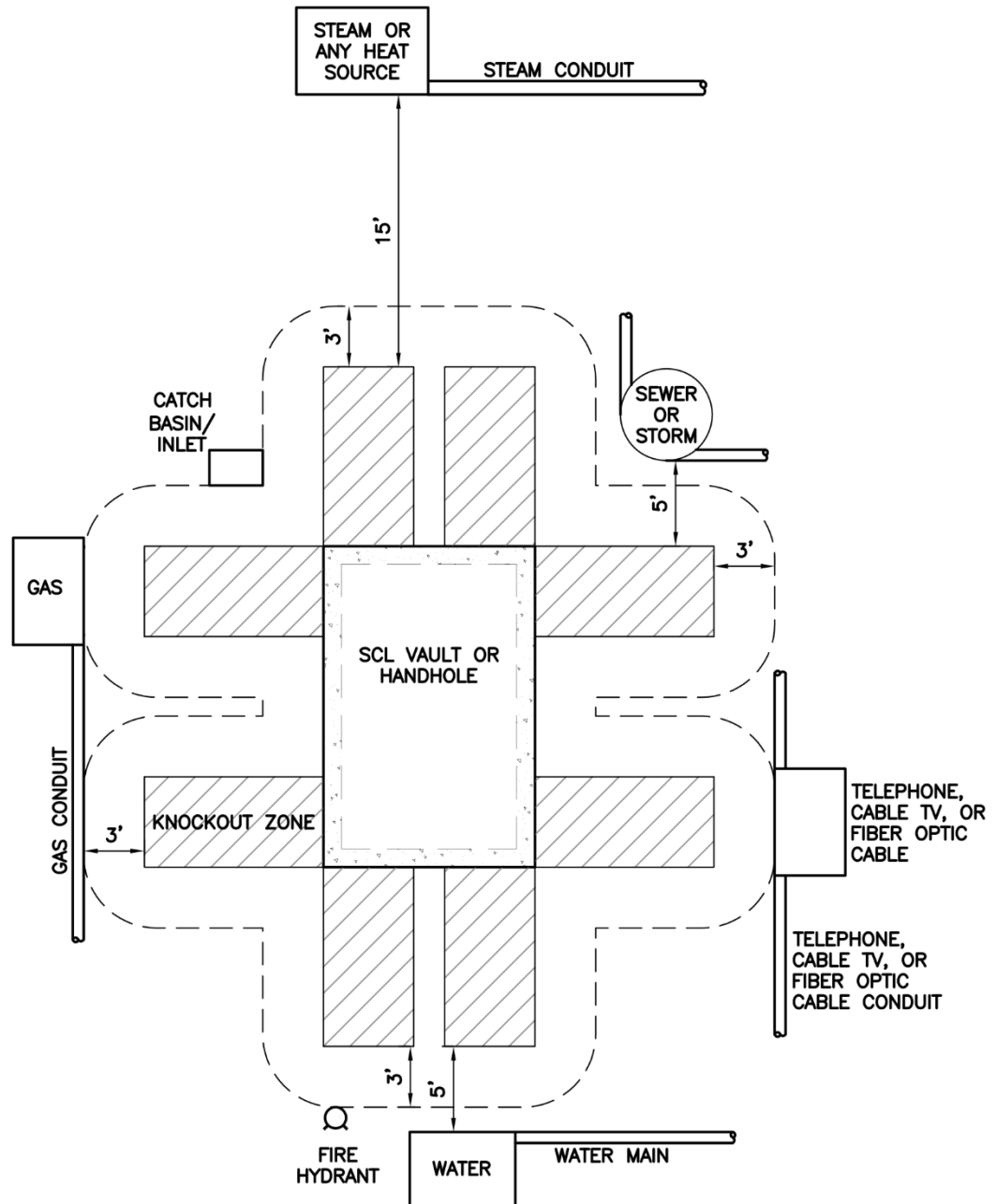
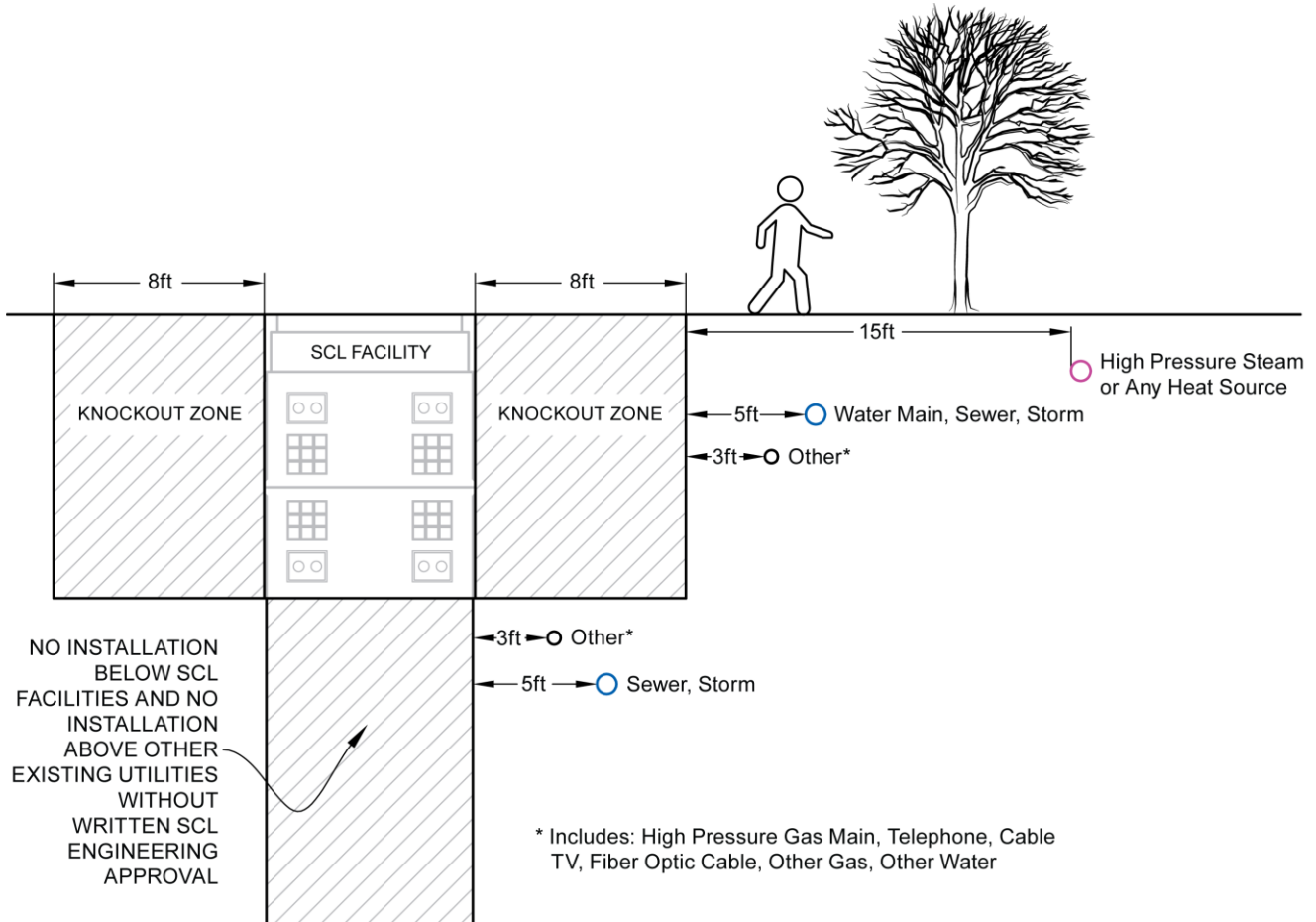


Figure 5b. Minimum Horizontal Clearance, Elevation, Side View



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

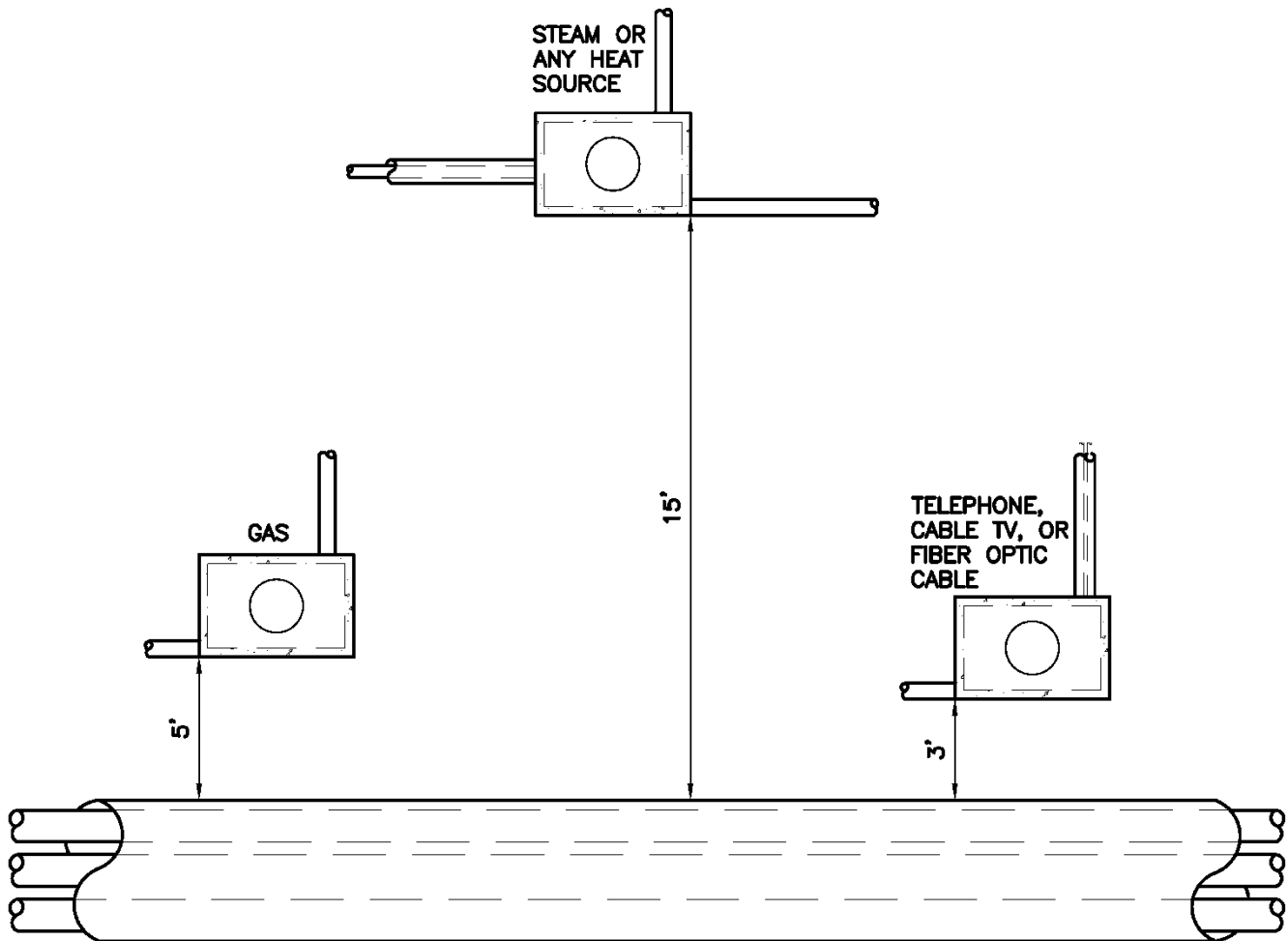


Figure 6b. Minimum Horizontal Clearance, Water Structures, Plan View

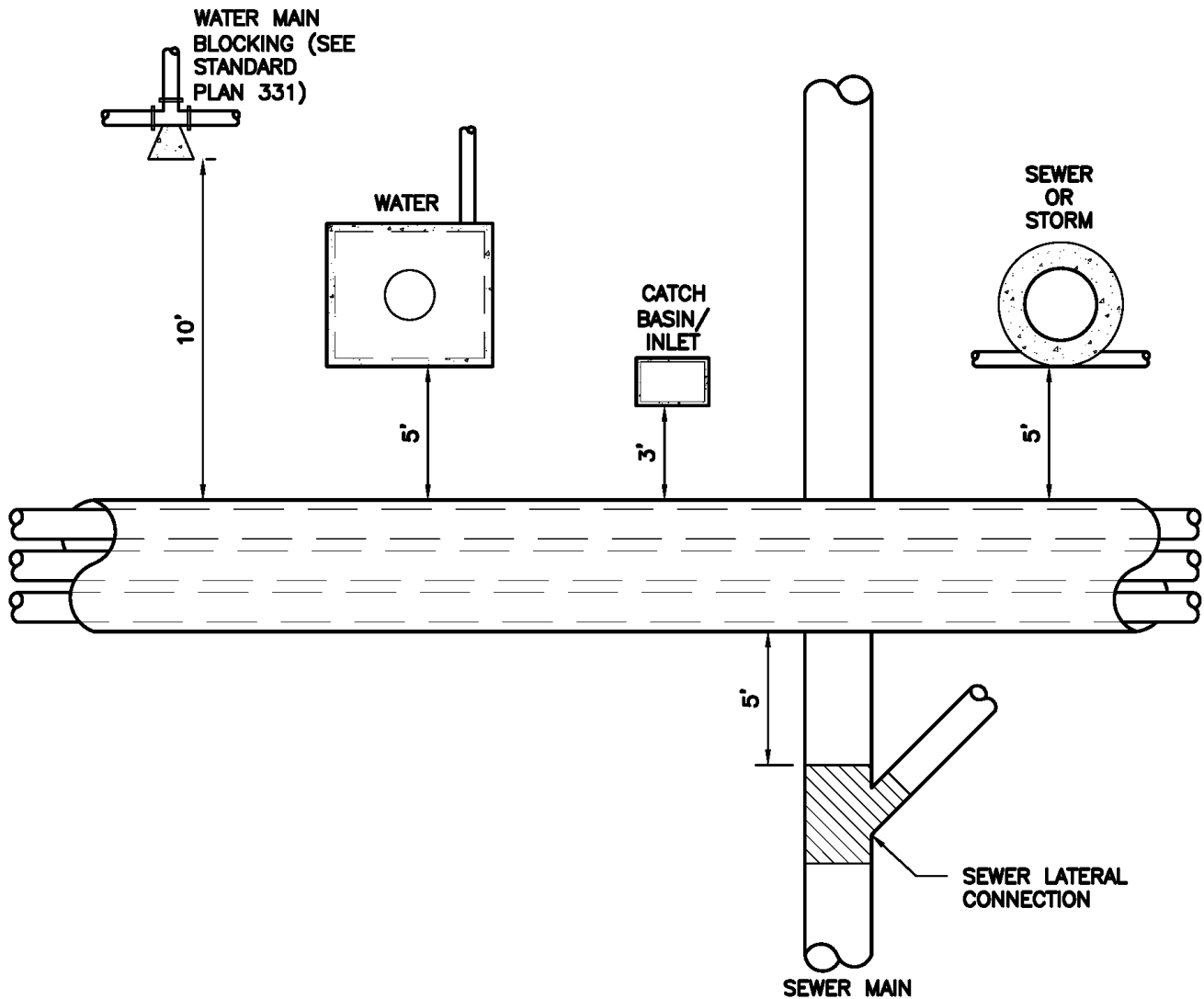
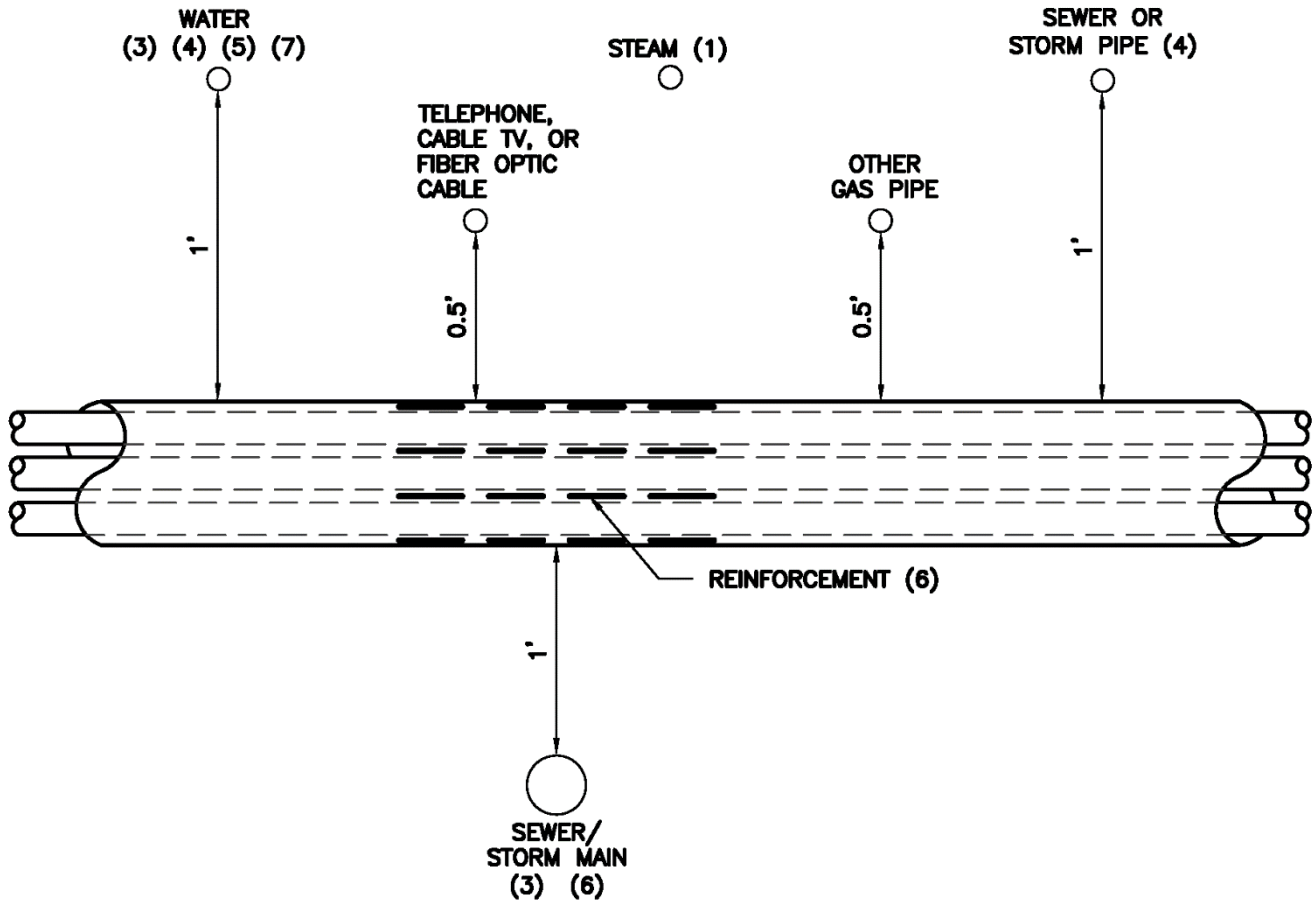


Figure 6c. Minimum Vertical Clearance, Elevation View



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

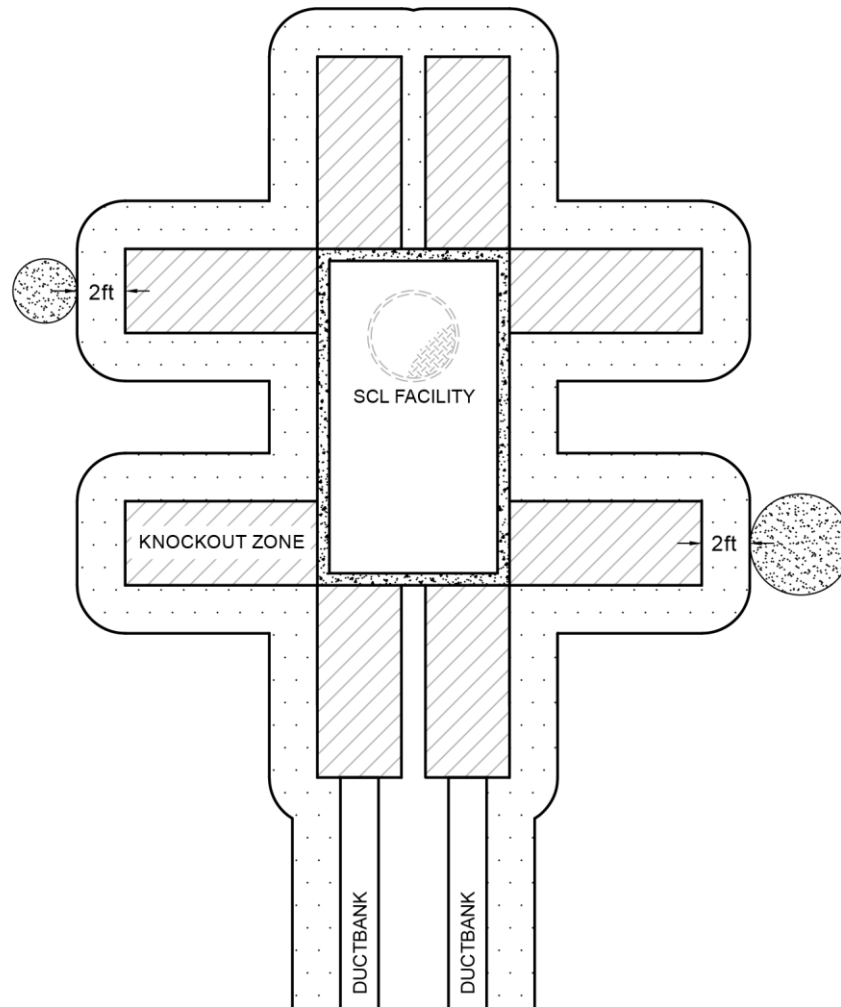
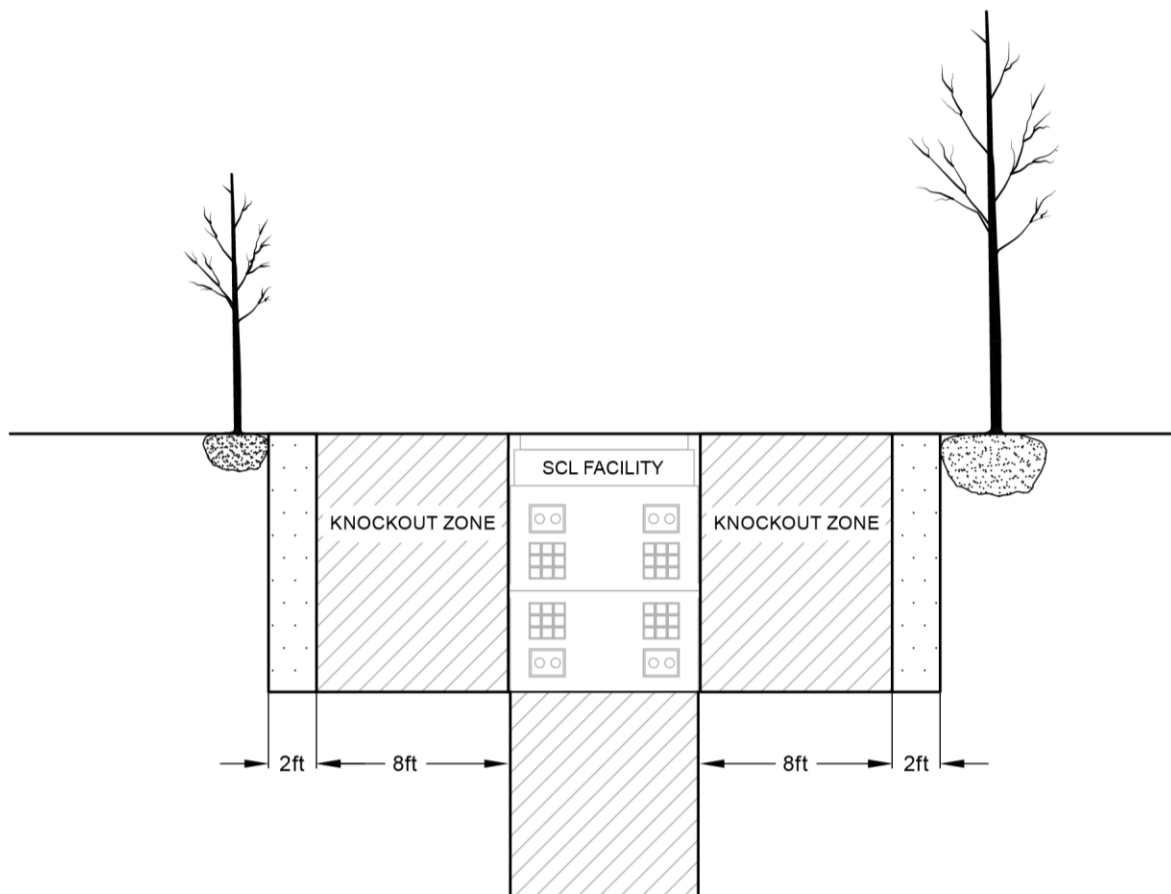


Figure 7b. Vegetation Clearance, Elevation View



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

Other Structures	Horizontal Clearance from SCL Structures (ft)			
	Conduits or Duct Banks Rated to 26 kV	Conduits or Duct Banks Rated 115 or 230 kV	Vaults, Manholes, or Handholes	Adjacent to Knockouts
Fire hydrants	3	5	3	8
Street curbing	1	5	2 ^a	–
Building footings	3	5	3	–
Metro buses and strain poles (overhead operations)	3	5	3	–
Concrete support columns	3	5	3	8
Concrete support column footings	3	5	3	8
Temporary construction shoring piles	1	1	1	1
SPU maintenance holes	5	5	5	8
CBs and inlets	3	3	3	8

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)

NESC C2-2012, Part 3; “Safety Rules for Underground Lines”

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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Standards Coordinator
Yaochiem Chao

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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

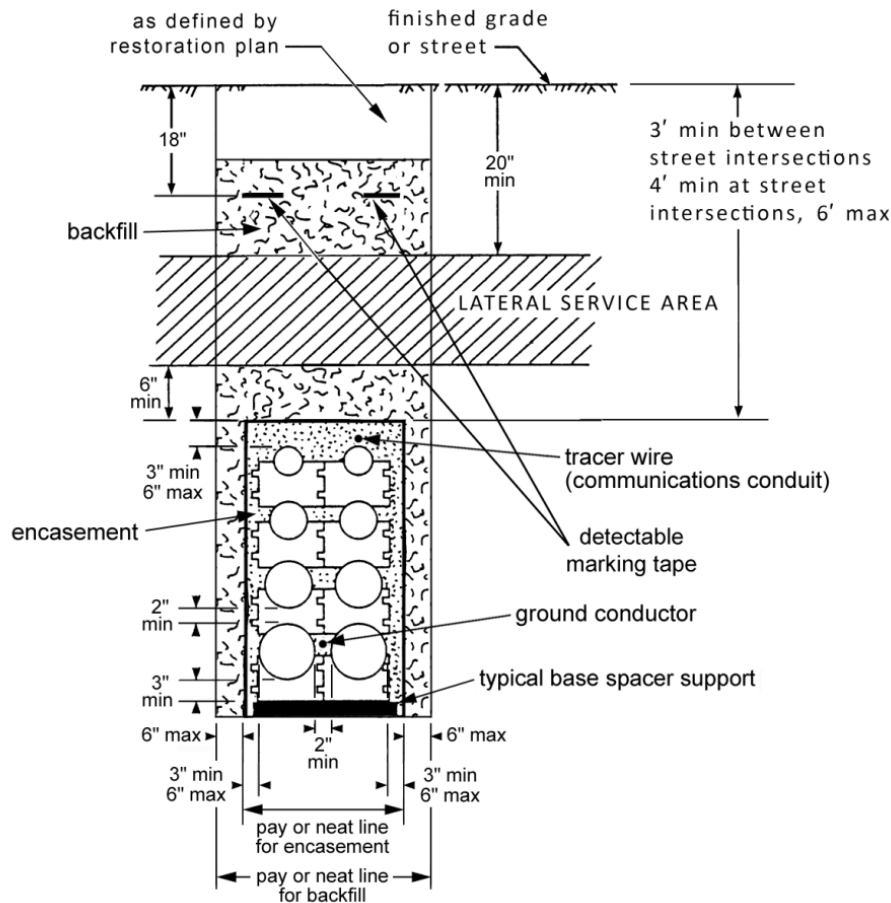
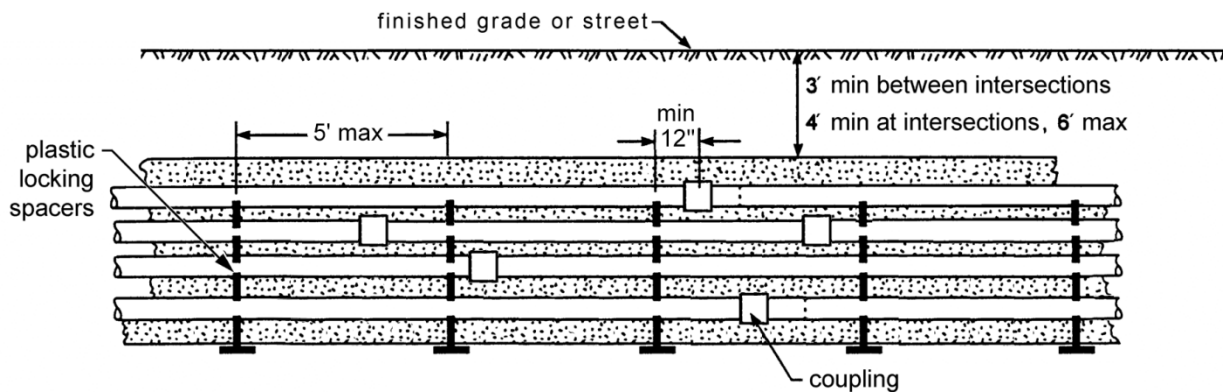


Figure 4.2. General Duct Bank, Side View



5. Duct Bank Construction

5.1 Arrangement

5.1.1 Transposition

Ducts shall NOT be transposed between vaults.

5.1.2 Numbering

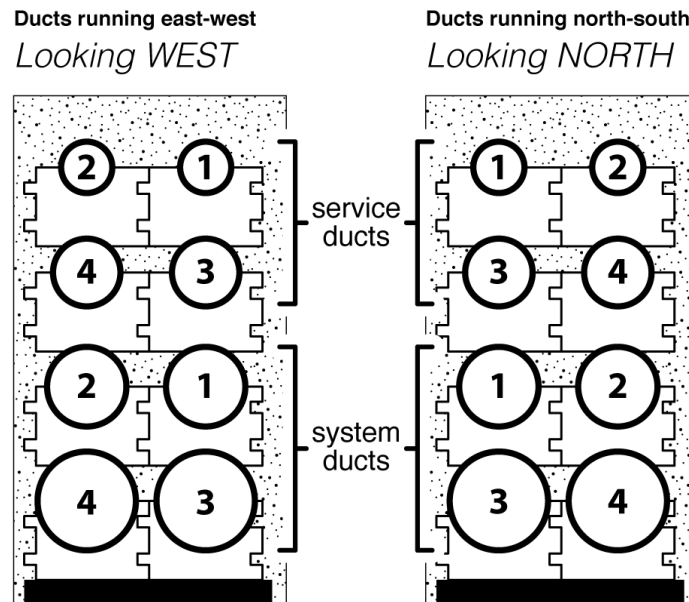
The ducts shall be numbered separately by type; service ducts together and system ducts together. The numbering method shall be as follows:

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

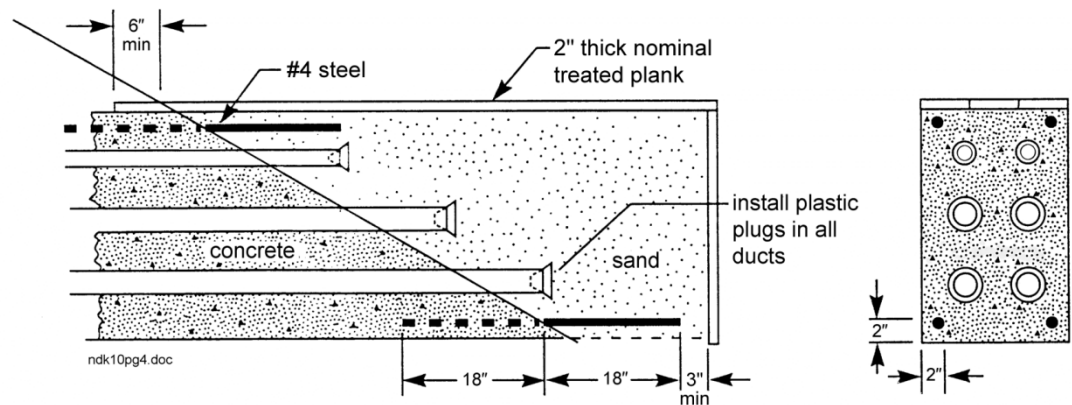
Install reinforcement steel dowels whenever placing of encasement is to be delayed beyond initial set.

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

Conduit (in)	System ^{1, 3} (in)	Service ^{2, 3} (in)
2.5	—	24
3	144	36
4	144	48
5	150	60
6	144	60

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

	Schedule 40 PVC (SCL 7015.05)	Rigid Steel (RGS) (SCL 7050.05)	Fiberglass (SCL 7025.05)
System – Straight	Yes	Yes	Yes
System – Bend	No	Yes	No ¹
Service – Straight	Yes	Yes	Yes
Primary Service – Bend	No	Yes	No ¹
Secondary Service – Bend	No ¹	Yes	Yes

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.

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.

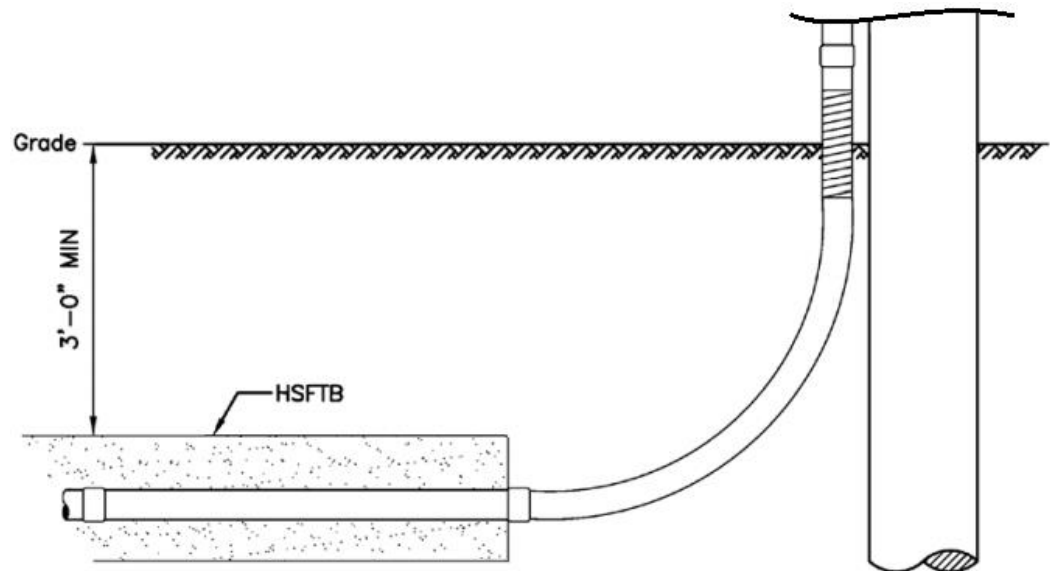
Forming is required for encasement:

- 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.

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

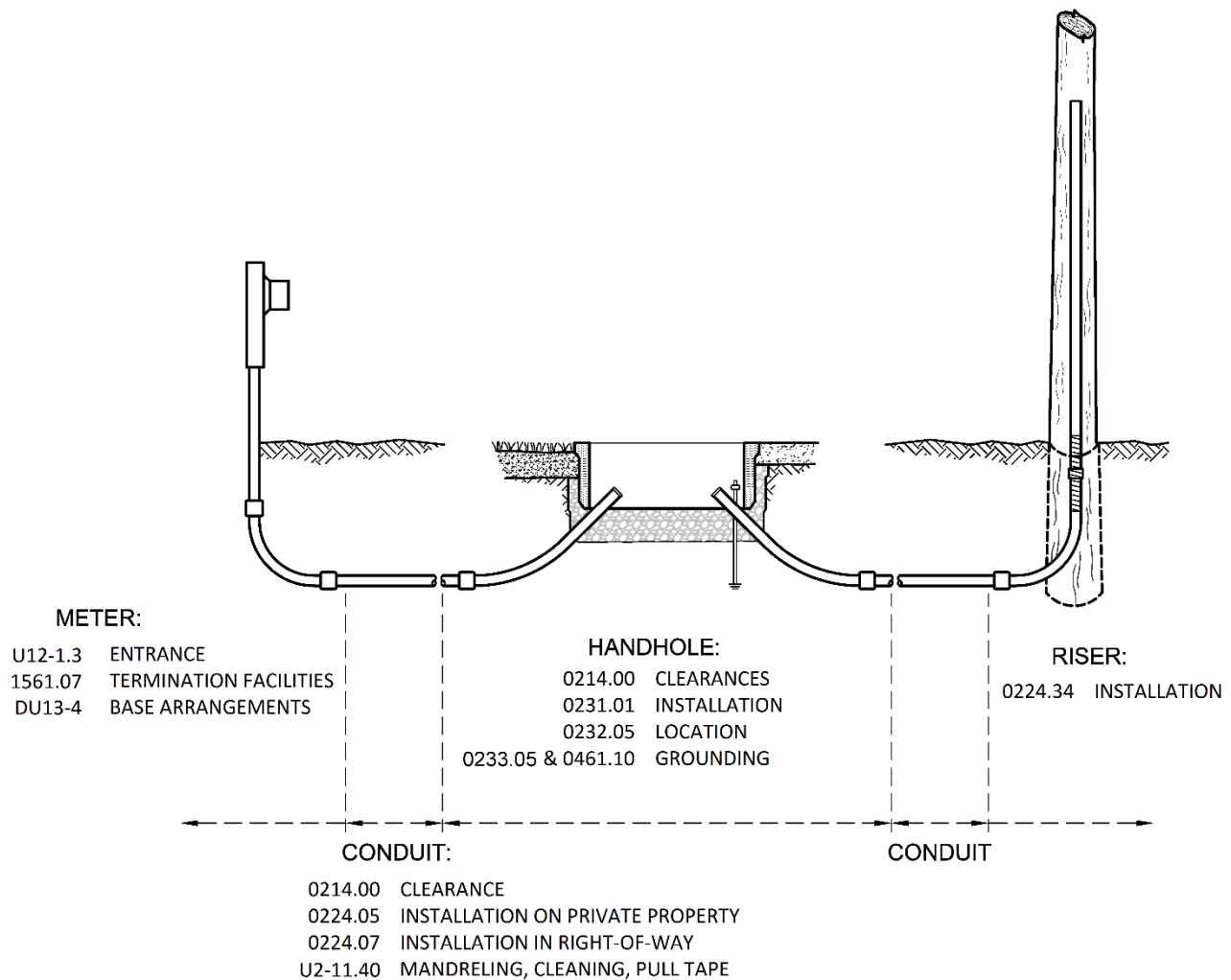
5. Requirements

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 Guideline U12-1.3/NMT-10; "Meter Location and Conduit Entrance Details for Secondary Underground Residential Service, Class 320 Maximum"

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

SCL Construction Standard U2-14.2; "Vault Installation"

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

7. Sources

Chao, Yaochiem; SCL Standards Engineer, originator, and subject matter expert for 0224.01 (yaochiem.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.

Standards Coordinator
Yaochiem Chao



Standards Supervisor
John Shipek



Unit Director
Darnell Cola



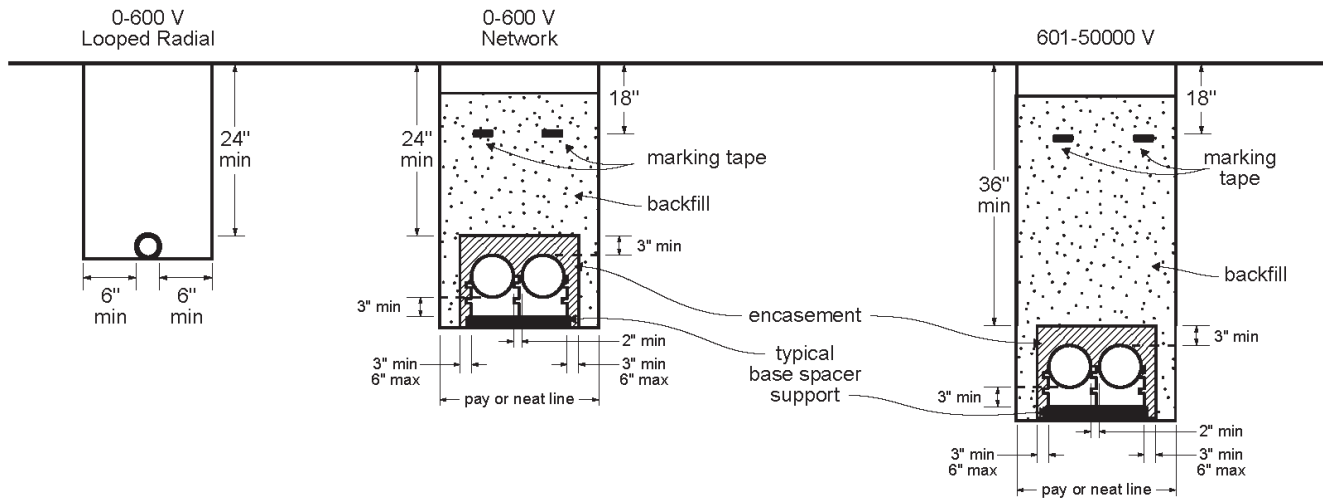
3. General Requirements

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

Table 3. General Requirements

Voltage	Looped Radial		Network	
	0 – 600 V	601 – 50000 V	0 – 600 V	601 – 50000 V
Cover (minimum)	24 in	36 in	24 in	36 in
No. of Conduits (minimum)	1	2	2	2
Encasement	No	Yes	Yes	Yes
Marking Tape	No	Yes	Yes	Yes

Figure 3. General Requirements



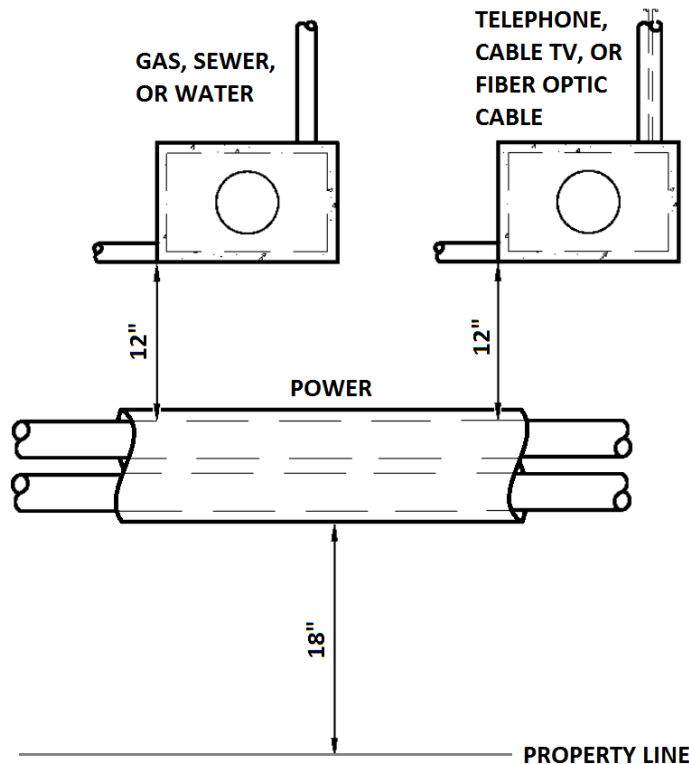
4. Location/Clearances

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.

Figure 4.1. Clearances to Property Line and Other Facilities



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 6.

Table 6. Allowed Conduit Materials

	Schedule 40 PVC (SCL 7015.05)	Rigid Steel (RGS) (SCL 7050.05)	Fiberglass (SCL 7025.05)
Service – Straight	Yes	Yes	Yes
Primary Service – Bend	No	Yes	No ^a
Secondary Service – Bend	No ^a	Yes	Yes

^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.

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 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:

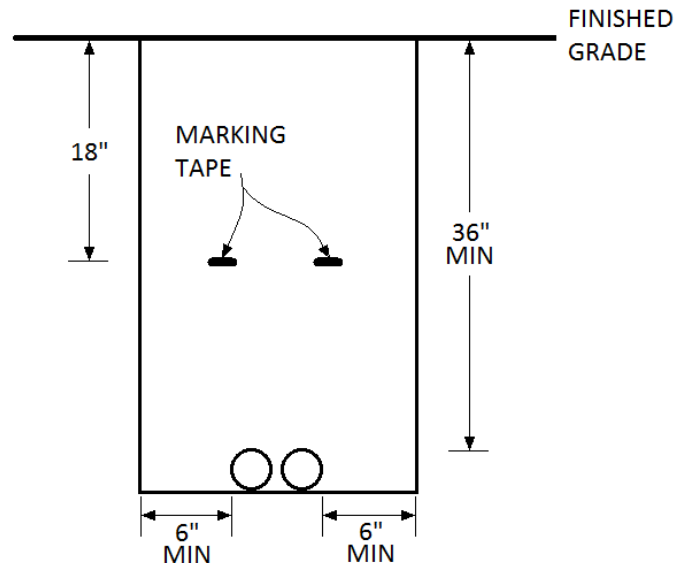
1. Project-specific Customer Requirements Package, including the Service Construction Drawing
2. SCL 0224.07
3. SCL Requirements for Electric Service Connection (RESC)
4. Other SCL standards

4. Requirements

4.1 General

General requirements are shown in Figure 4.

Figure 4. General Requirements



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 Engineer.

A minimum of 36 inches of cover from the top of the conduit 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 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.

Table 6a. Allowed Conduit Materials

	Schedule 40 PVC (SCL 7015.05)	Rigid Steel (RGS) (SCL 7050.05)
Straight	Yes	Yes
Bend	No ^a	Yes

^a Typical unless otherwise specified by SCL engineer.

Table 6b. Minimum Bend Radius

Conduit (in)	Minimum Bend Radius (in)
3	36
4	48

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.

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, secondary, and streetlight 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 0126.01.

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**

All risers and bends shall be rigid steel.

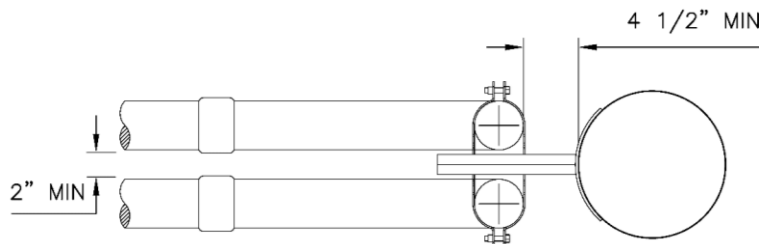
All conduit risers originating from the direction of the face of the pole shall be constructed as shown in Figure 3.1a and 3.1b.

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

Standards Coordinator
Yaochiem Chao

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

Figure 3.1b. Steel Conduit Riser, Side View

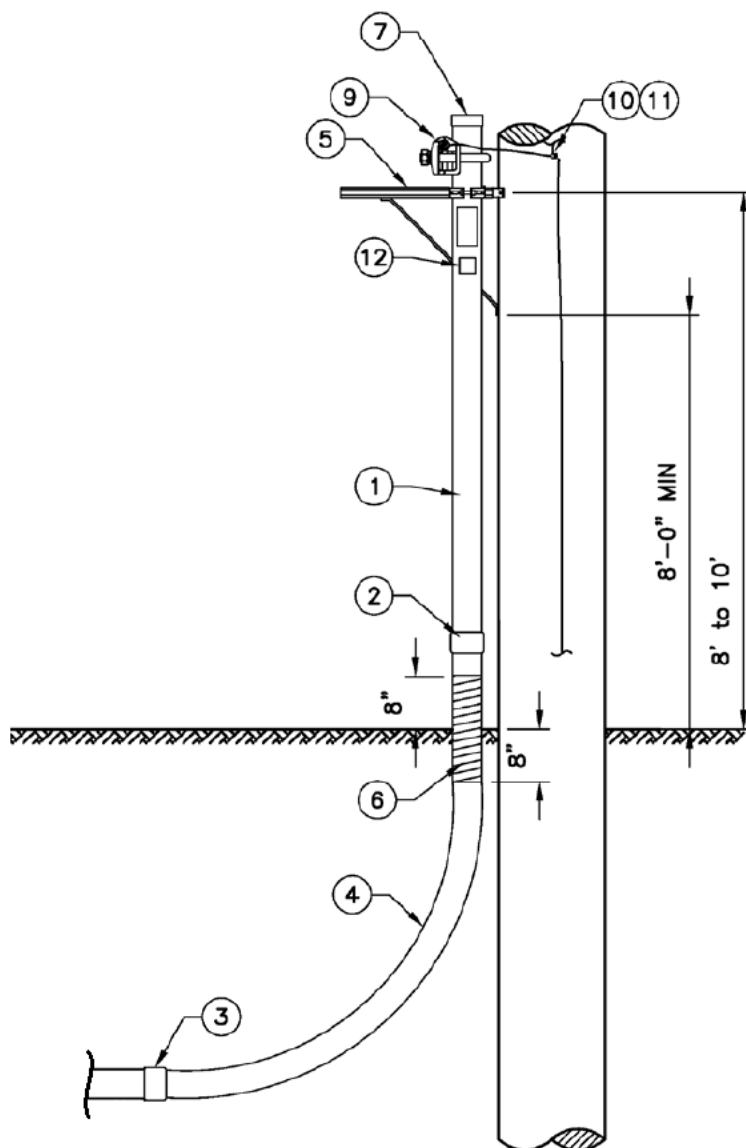


Figure 3.1c. Wraparound Steel Conduit Riser, Top View

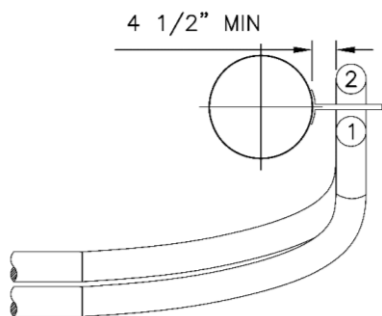
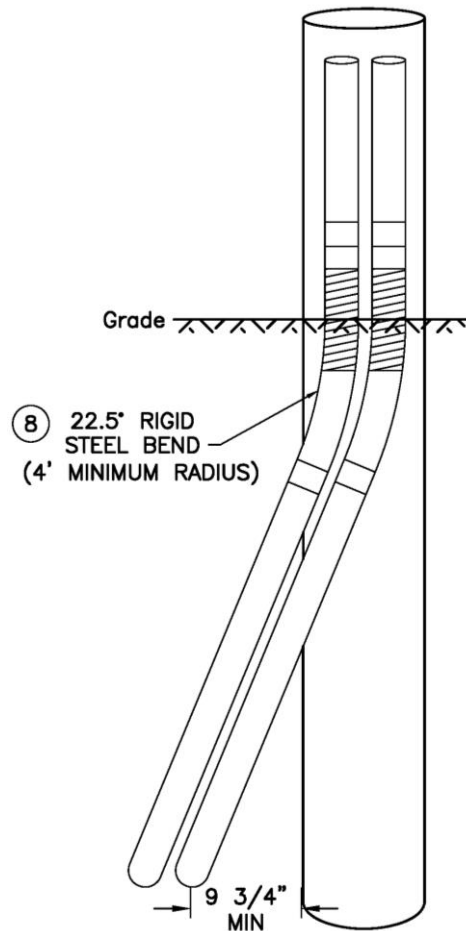


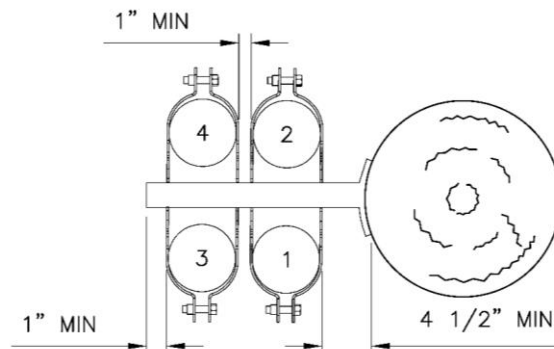
Figure 3.1d. Wraparound Steel Conduit Riser, Profile View



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 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-in conduit is being installed, a 26-in bracket shall be used. The lowest point of the first bracket on the pole shall be located a minimum of 8 feet above grade. 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. Grounding is installed by the SCL overhead crew.

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.

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

Fig	Compatible Unit	ID	Quantity			
3b	Riser, 2" assembly	RISER2				
3b	Riser, 3" assembly	RISER3				
3b	Riser, 4" assembly	RISER4				
3b	Riser, 5" assembly	RISER5				
#	Material Description	ID				
1	Conduit, rigid steel, 2"	734741	–	–	–	20
1	Conduit, rigid steel, 3"	734743	–	–	20	–
1	Conduit, rigid steel, 4"	734745	–	10	–	–
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	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	–	–
9	Clamp, conduit grounding, 2"	676283	–	–	–	1
9	Clamp, conduit grounding, 3"	676285	–	–	1	–
9	Clamp, conduit grounding, 4"	676286	–	1	–	–
9	Clamp, conduit grounding, 5"	676287	1	–	–	–
10	Connector, splitbolt, #4 AWG to #4 AWG	668864	1	1	1	1
11	Wire, #4 AWG, bare, Cu, soft-drawn	610208	3	3	3	3
12	"Call Before You Dig" label	765255	1	1	1	1

Table 5b. Materials for Riser Bracket

Fig	Compatible Unit	ID	Quantity			
3b	Bracket, 10" assembly	BRACKET10				
3b	Bracket, 12" assembly	BRACKET12				
3b	Bracket, 18" assembly	BRACKET18				
3b	Bracket, 26" assembly	BRACKET26				
#	Material Description	ID				
1	Bolt, lag, 1/2" x 4"	785261	3	2	2	2
2	Bracket, pole riser, 10-1/2"	686792	–	–	–	1
2	Bracket, pole riser, 12-1/2"	686794	–	–	1	–
2	Bracket, pole riser, 18"	686796	–	1	–	–
2	Bracket, pole riser, 26"	012330	1	–	–	–

6. References

City of Seattle Standard Plans and Specifications

SCL Construction Standard 0126.01; "Pole Terminations"

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"

7. Sources

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"

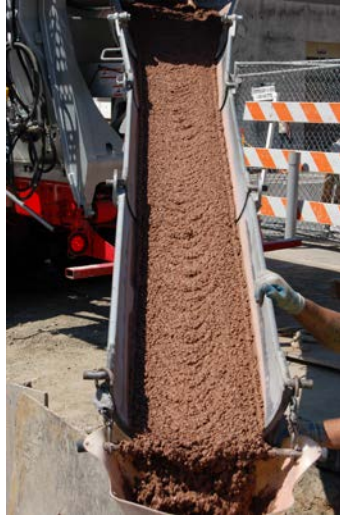
SCL Construction Standard U7-10.1/NDK-80 (canceled); Secondary Conduit Riser Pole Base Detail"

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"

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

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 C39; "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens," 2012

ASTM C94; "Standard Specification for Ready-Mixed Concrete," 2013

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")

IEEE Standard 442; "IEEE Guide for Soil Thermal Resistivity Measurements"

Standards Coordinator
Bob Kephart

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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"

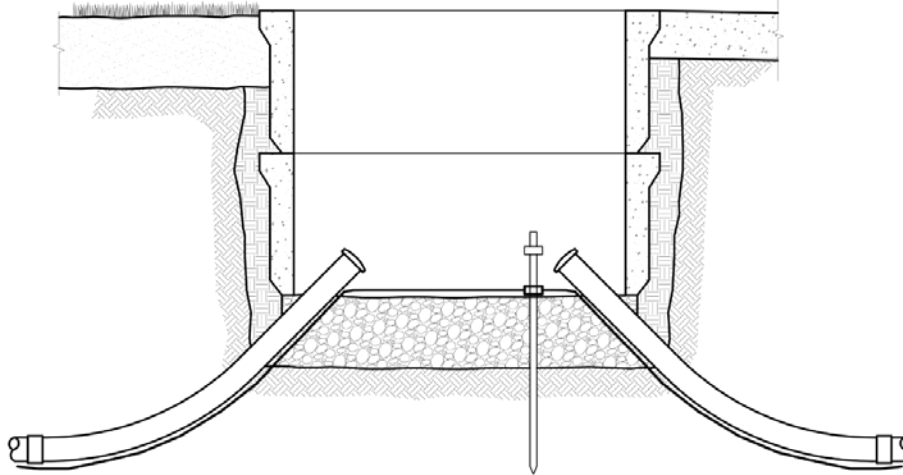
SCL Design Standard 9266.06, "Understanding Fluidized Thermal Backfill"

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.

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 1/4 in above 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.

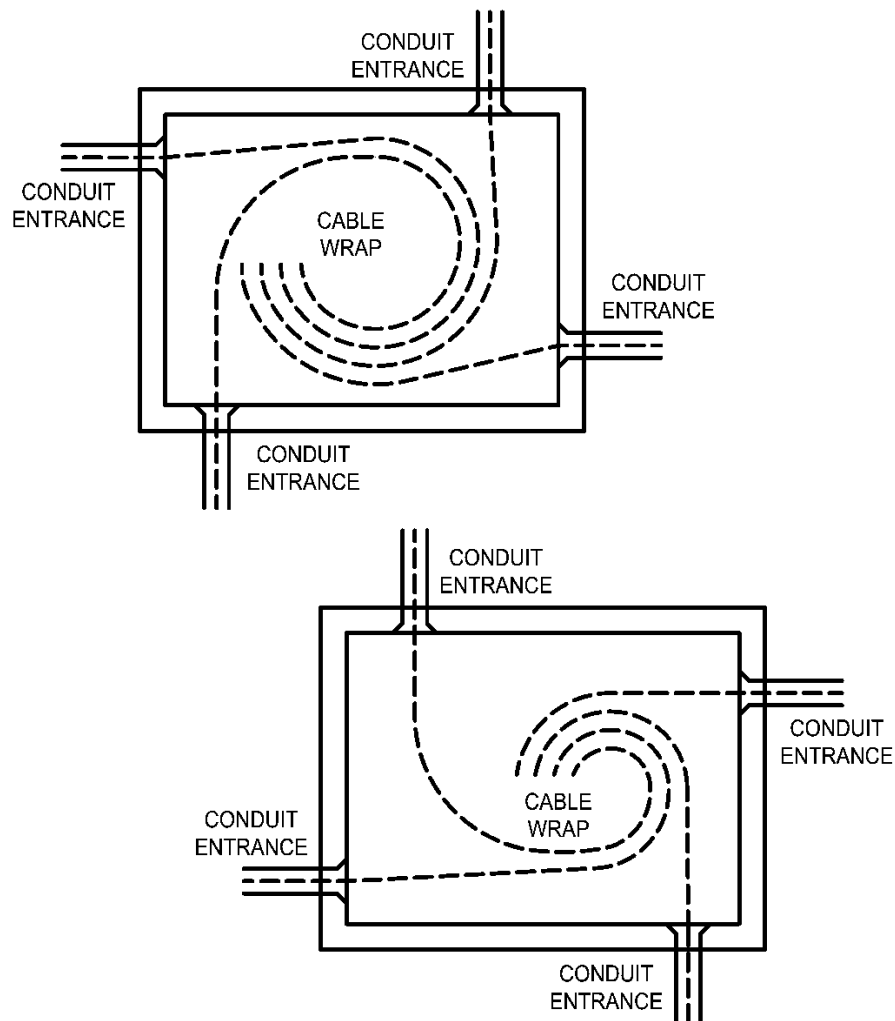
Handholes shall be bedded on a minimum of 6 inches of 3/8-in washed gravel, mineral aggregate Type 9.02.

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.

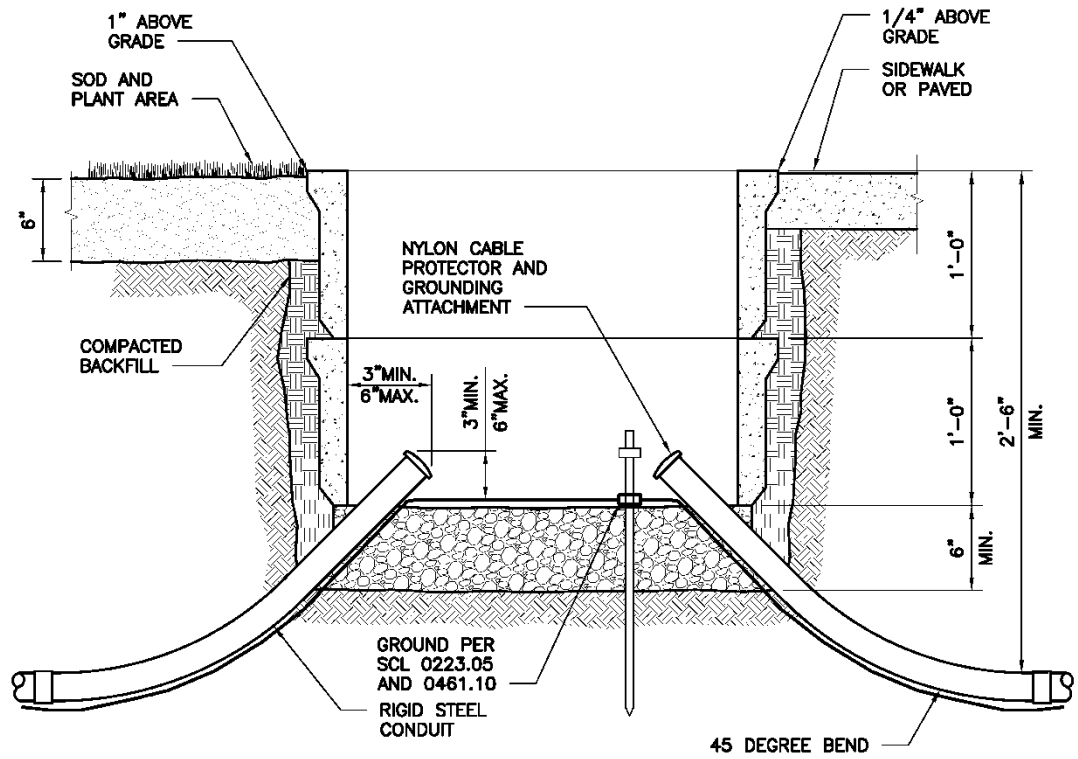
Figure 4. Offset Conduit, Plan View



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



5. Material List

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

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)

Underground Residential Equipment Location of 577 Vaults and Secondary Handholes



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.

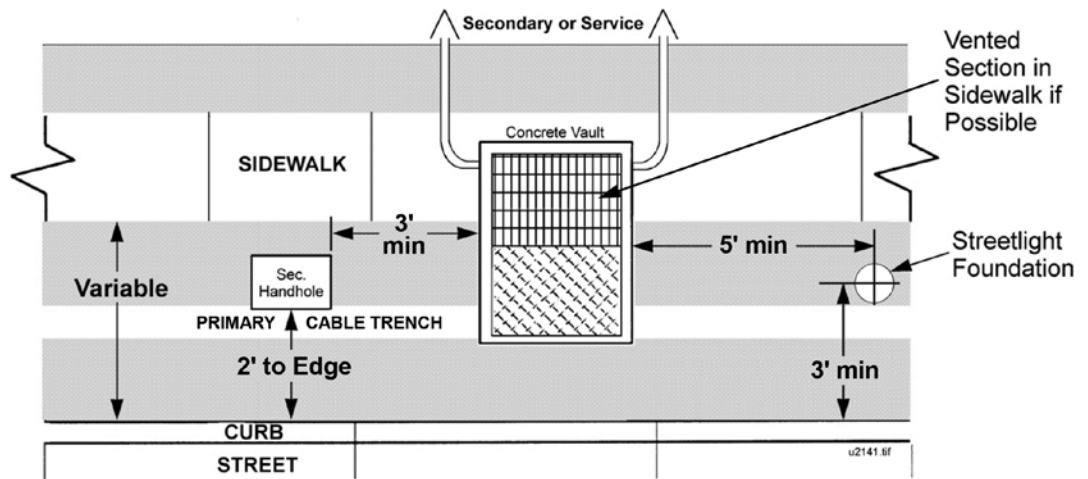
4. 577 Vaults

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.

Figure 4.1. Preferred Location and Orientation for 577 Vault



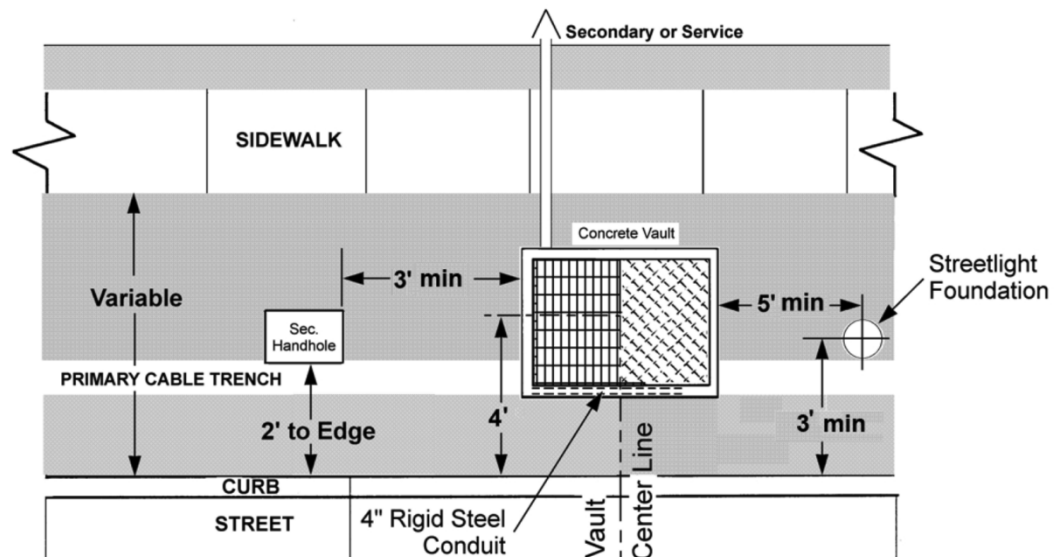
The vented section of the vault shall be located in the sidewalk.

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.

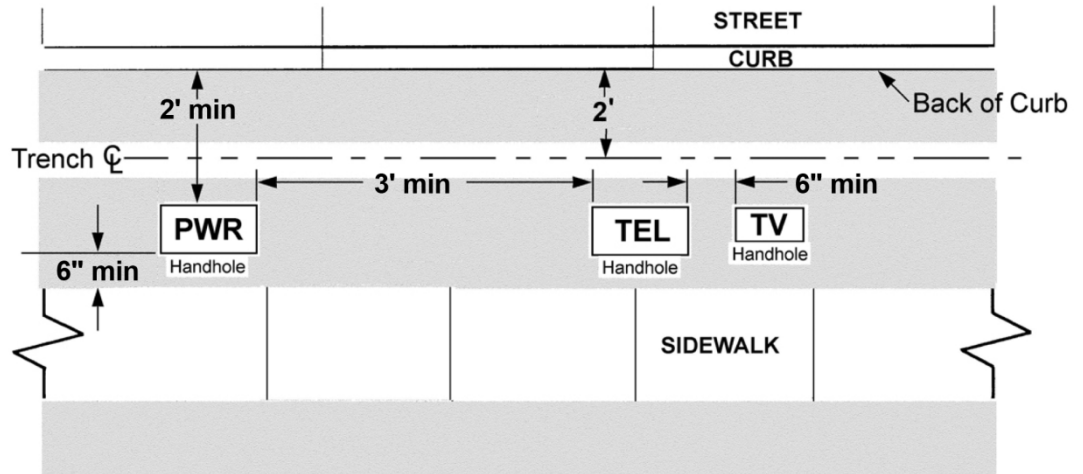
5. Secondary Handhole

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.

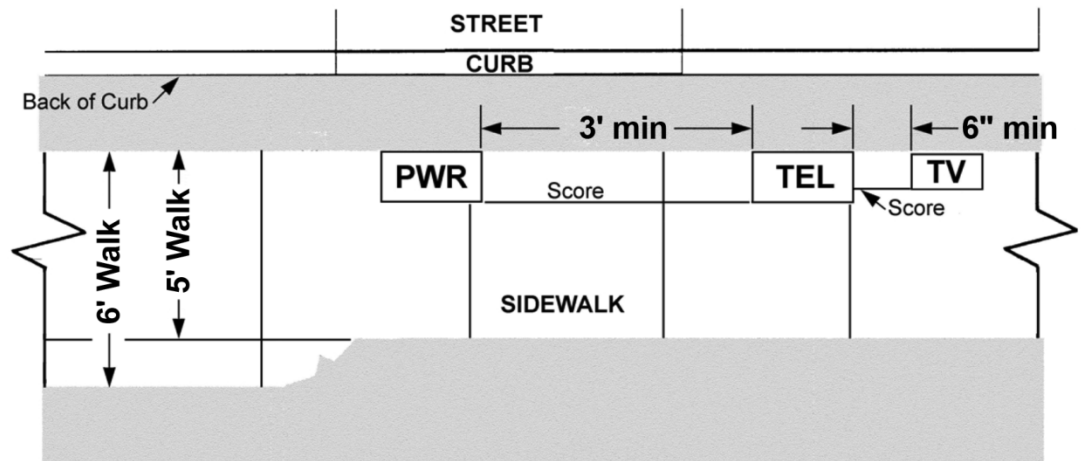
Figure 5.1. Preferred Location for Secondary Handhole



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



Restore sidewalk per requirements in city of Seattle Standard Plans for Municipal Construction, Standard Plan No. 420.

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)

Standard Plan No. 420; "Concrete Sidewalk Detail," City of Seattle Standard Plans for Municipal Construction, 2011 edition

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

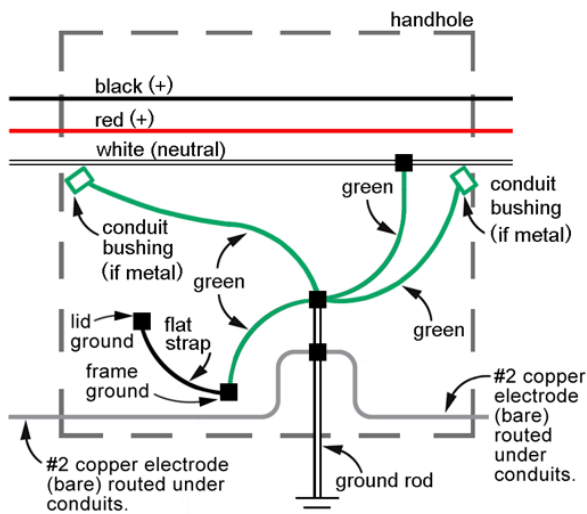
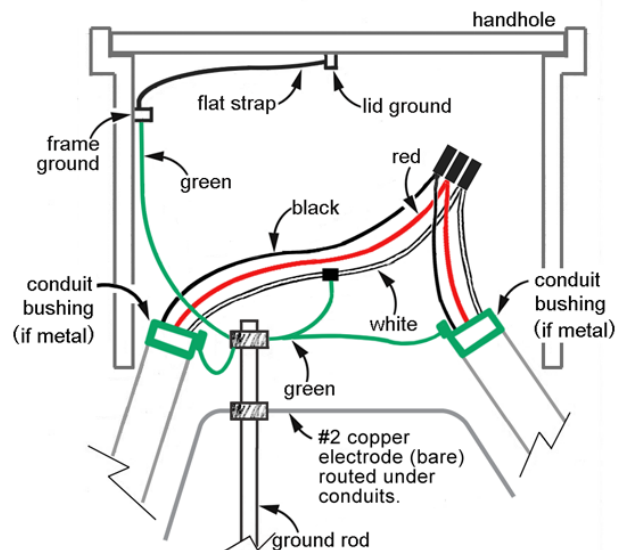


Figure 4b, Elevation, handhole wiring



5.1 Choose appropriate method based on traffic load:

Traffic Load	Method
heavy	A
medium	A
light	B

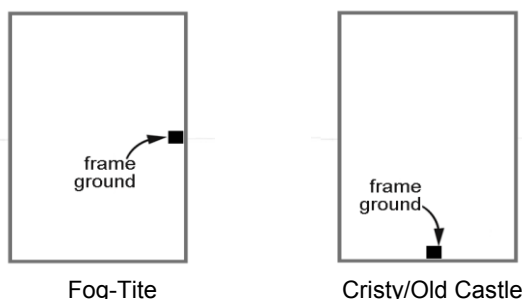
5.2 Method A, example, 17" x 28" handhole, heavy or medium traffic

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.

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.

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).

7. Material List

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

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)

NEC 2008 Handbook, Article 250; "Grounding and Bonding"; 11th Edition; NFPA; 2008

NESC 2007 Edition, Section 9; "Grounding Methods for Electric Supply and Communications Facilities"; IEEE, 2006

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 New 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.

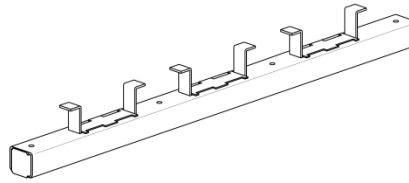
Concrete inserts shall be 12-gauge, galvanized Unistrut P3200 series (1-5/8 in x 1-3/8 in) or equal.

Standards Coordinator
Brett Hanson

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

Figure 3.2. Concrete Insert



3.3 Retrofit Option

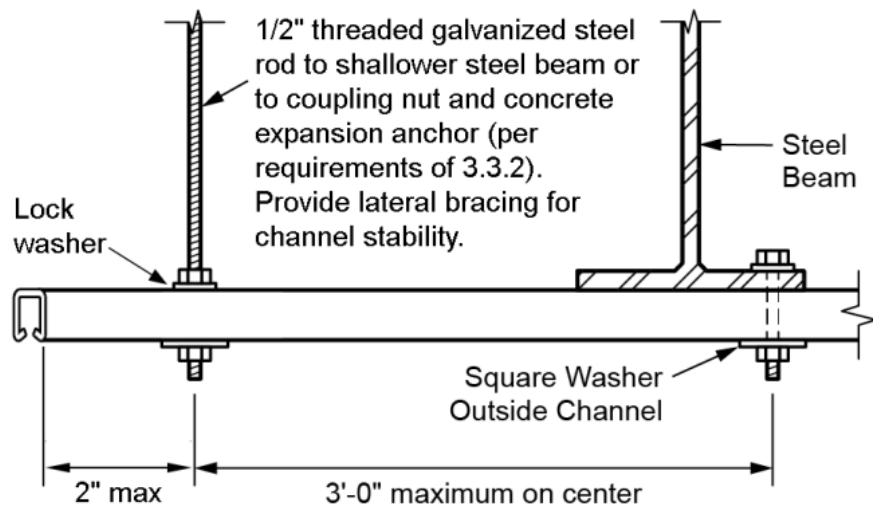
For the following conditions and with written approval from SCL Engineering prior to construction, channel may be surface mounted on the vault ceiling using one of the following methods:

3.3.1. Attachment to Steel Framing

Secure channel to building construction steel with 1/2-in galvanized steel bolts, square flat plate washers with tabs (Unistrut P2864 Stock No. 720658 or equal), nuts and lock washers. Place flat washers on the outside of the channel and place lock washers under the nut or bolt head on the opposite side of the connection assembly. The support near the end of the channel shall be within 2 inches of the end of the channel. Connect each channel to the wall on both ends. See Figure 3.3.1.

Channel shall be 12-gauge galvanized Unistrut P1000 series (1-5/8 in x 1-5/8 in) or P3000 series (1-5/8 in x 1-3/8 in) or equal.

Figure 3.3.1. Attachment of Channel to Steel Framing



Provide lateral bracing for channels to include the following:

- A minimum of 2 bracing locations per channel providing longitudinal restraint
- A minimum of 2 bracing locations per channel providing perpendicular restraint
- A sufficient number of bracing locations to result in a maximum distance of 9 feet between perpendicular restraints.

Lateral bracing can be accomplished by a combination of the following methods (Unistrut products may be substituted with equal):

1. Install a bolted connection to a steel beam flange as shown in Figure 3.3.1 (provides perpendicular and longitudinal restraint, as well as vertical support).
2. Extend channels to connect to concrete wall (provides perpendicular and longitudinal restraint, as well as vertical support). Use Unistrut P1025 or P1281 right angle fitting, ½-in bolt, P1010 channel nut if connecting to open face of channel, and ½-in expansion anchor into concrete.
3. Provide diagonal bracing up to structure (provides restraint in direction of brace). Use Unistrut P1000 or P3000 series at 45 degrees maximum from horizontal, P1843 adjustable hinges, ½-in bolts, P1010 channel nuts if connecting to open face of channels, and ½-in expansion anchor into concrete or ½-in bolt to top of steel beam.
4. Provide a perpendicular restraint location for up to 4 lines of ceiling channels, following these steps:
 - a. Install a perpendicular bracing channel immediately above the ceiling channels. Use ½-in bolts for the connection between perpendicular channels and ceiling channels.
 - b. Connect the bracing channel at each end to a wall or with diagonal bracing per items 2 and 3 above.

3.3.2. Attachment to Existing Concrete

Secure channel to existing concrete using stainless steel, 1/2-in x 5-1/2-in expansion anchors (Hilti Kwik Bolt 3, 316 stainless steel, Hilti Item No. 282571, SCL Stock No. 780143) at a maximum of every 3 feet along the length of the channel.

The anchor closest to the end of the channel shall be installed within 2 inches of the end of the channel.

Locate embedded conduit, reinforcing bars (rebar), and prestressing strands in concrete with non-destructive testing prior to drilling holes for anchors.

Do not drill through existing rebar or conduit or within 3 inches of prestressing strands.

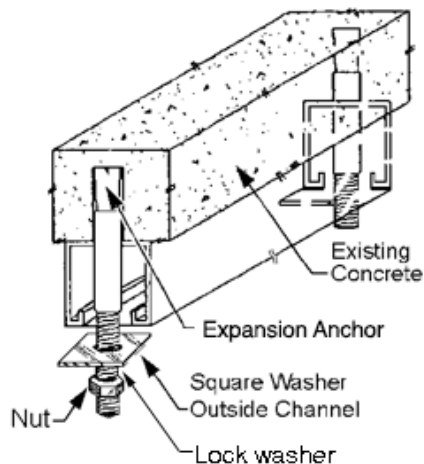
Expansion anchors shall be embedded in the ceiling to a minimum depth of 2-1/4 in.

Channel shall be 12-gauge galvanized Unistrut P1000HS (1-5/8 in x 1-5/8 in) or P3000 HS (1-5/8 in x 1-3/8 in) with 9/16-in holes on 1-7/8 in centers, or equal.

Washers shall be square flat plate style with tabs (Unistrut P2864 Stock No. 720658 or equal): 1-5/8-in square x 1/4-in thick with 9/16-in hole.

See Figure 3.3.2.

Figure 3.3.2. Attachment of Channel to Existing Concrete



Note: Each expansion anchor installed in concrete shall be proof tested for a load of 1,250 pounds. Tests shall be documented in writing and signed off by a registered Professional Engineer licensed in the State of Washington.

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.

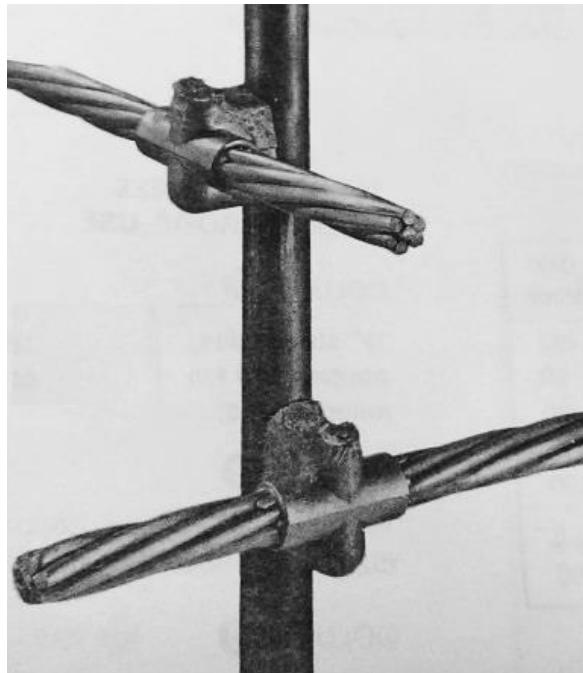
SCL has found installing multiple ground rods at the same location to provide only marginal improvement in reducing ground resistance.

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

Description	Stock No.	Material Standard
5/8-in x 8-ft ground rod	564238	5642.10
#2 AWG copper wire, bare, stranded	610434	6103.90
250 kcmil copper wire, bare, stranded	610412	6103.90

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.

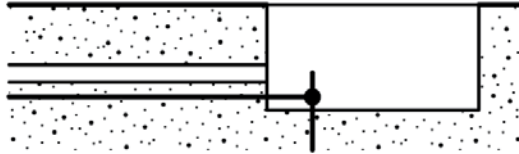
If the grounding electrode recommended below comes in contact with a metallic pole riser conduit, connect with a conduit grounding clamp. See U7-10.9/NDK-120.

Table 6. Grounding Electrode Methods

Condition	Single Vault or Handhole	Series of Vaults or Handholes
Conduits in Soil Trench	<p>Install a ground rod in vault or handhole.</p> <p>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.</p>	<p>Install a ground rod in each vault or handhole.</p> <p>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.</p>
Conduits in Encased Ductbank	<p>Install a ground rod outside the vault or handhole.</p> <p>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.</p>	<p>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.</p>

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

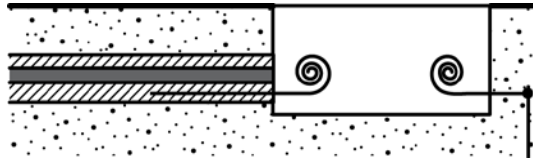
Figure 6.2. Direct buried conduits entering a series of vaults or handholes



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

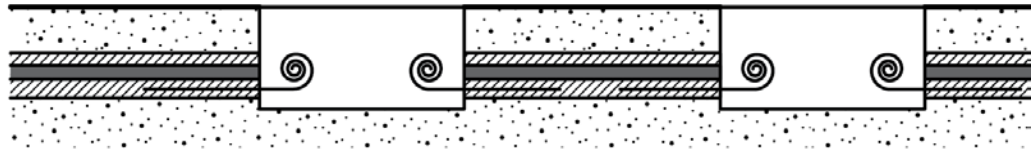
Figure 6.3. Concrete duct bank conduits entering a vault or handhole



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)

National Electric Safety Code (NESC), C2-2012 Edition; Institute of Electrical and Electronics Engineers (IEEE), Inc. New York, NY, 2011

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.

Standards Coordinator
Kathy Tilley

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

Table 3. Exothermic Connection System Components

Mold		Clamp Handle		Weld Shot	
Stock No.	Description		Stock No.	Stock No.	Color Code
013557	4/0 stranded wire butt splice		013336	013560	 Gray
013339	250 kcmil wire butt splice		013336	013338	 Orange
013401	500 kcmil wire butt splice		013336	013339	 Yellow
013402	250 kcmil wire to 5/8-in ground rod		013336	013398	 Dk Blue
013403	500 kcmil wire to 5/8-in ground rod		013397	013400	 Brown
013441	250 kcmil wire to 3/4-in ground rod		013336	013399	 Yellow
013442	500 kcmil wire to 3/4-in ground rod		013397	013440	 Lt Brown
013558	4/0 stranded wire all way, horizontal Tee connection		013336	013398	 Dk Blue
013559	4/0 stranded wire all way, lapped, horizontal X connection		013336	013561	 Purple
013580	#2 AWG stranded wire to 5/8-in ground rod		013336	013560	 Gray
013581	#4 AWG solid wire to 5/8-in ground rod		013336	013560	 Gray
013585	2/0 stranded wire to 5/8-in ground rod		013336	013560	 Gray

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)

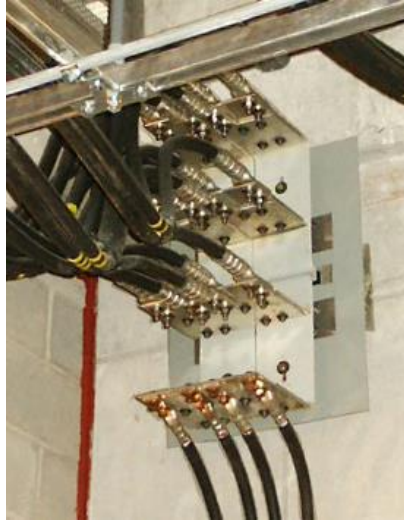
CADWELD® Welded Electrical Connections Facility Electrical Protection Catalog, A1C E1068CT08NAEN 00610M8 (Erico literature file name LT0039)

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 Dry Vault Service Entrance Bus Duct



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.

Standards Coordinator
Brett Hanson

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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.
- 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



- 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

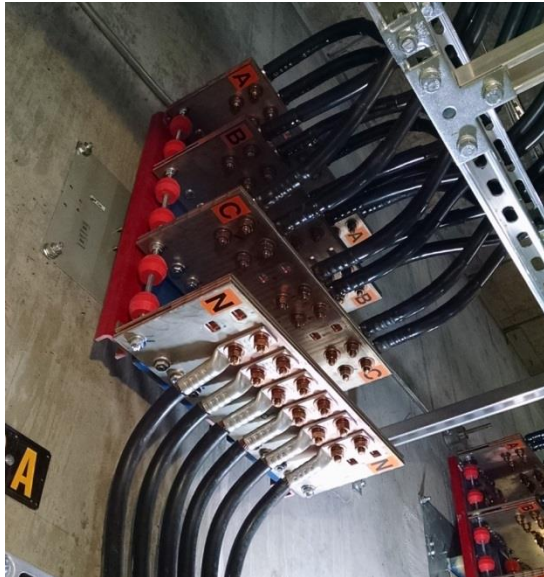


Figure 3.10b. Bus Bars Parallel to Floor, Plan View (Cables Parallel to Floor)

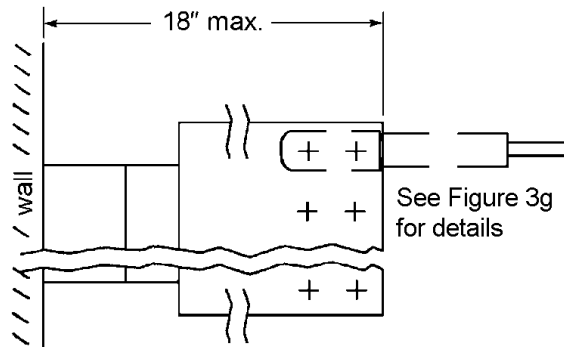


Figure 3.10c. Bus Bars Parallel to Floor, Elevation View (Cables Parallel to Floor)

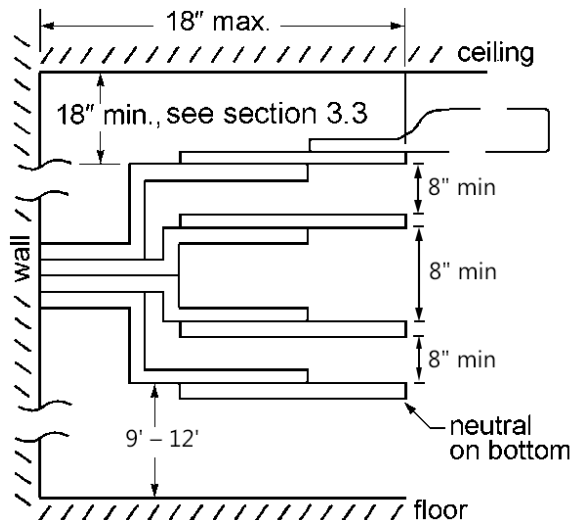


Figure 3.10d. Bus Bars Perpendicular to Floor



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

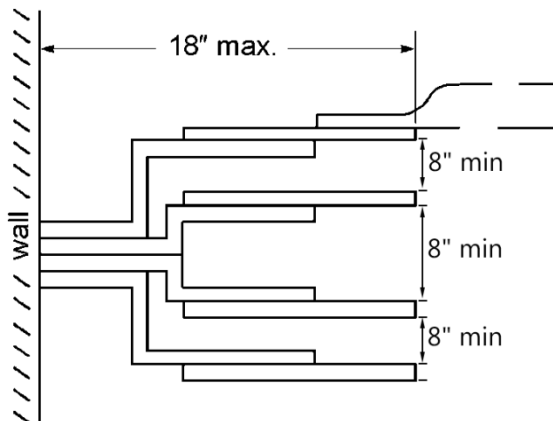


Figure 3.10f. Bus Bars Perpendicular to Floor, Elevation View (Cables Parallel to Floor)

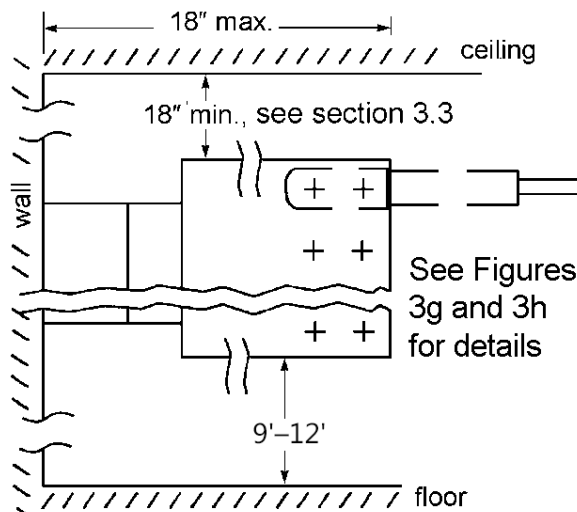


Figure 3.10g. Hole Spacing, Two-Hole Horizontal Connection

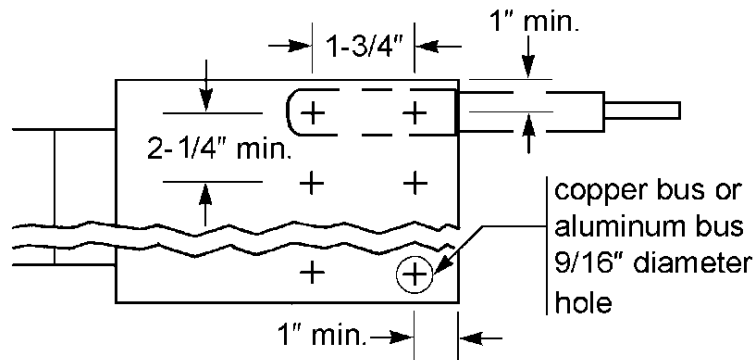


Figure 3.10h. Hole Spacing, Two-Hole Vertical Connection

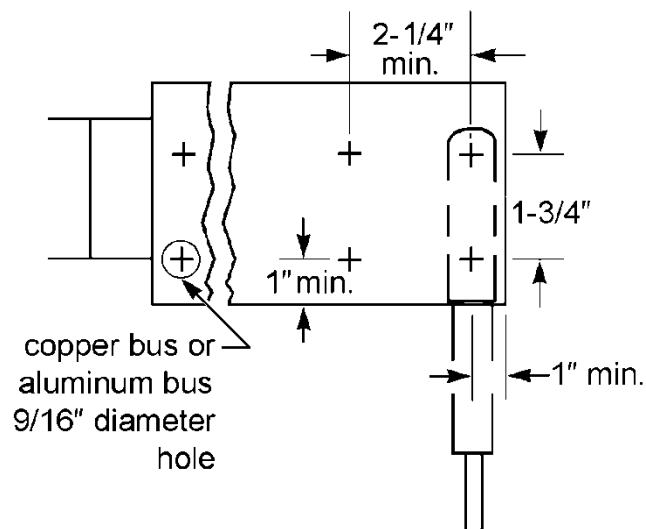
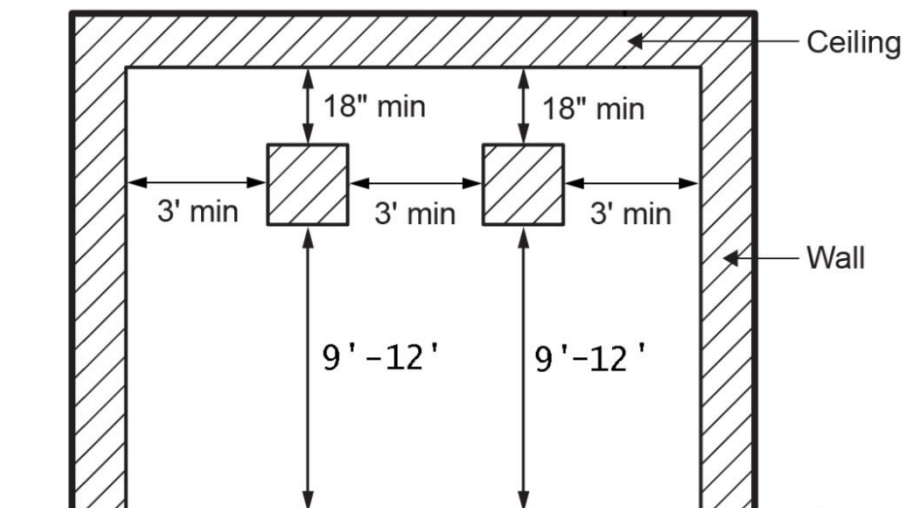


Figure 3.10i. Adjacent Service Entrance Bus Spacing



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

SCL Construction Standard NCB-160 (canceled), “Network Spot or System Dry Vault Service Entrance Bus”

SCL Construction Standard U11-9.1 (canceled), “Bus Extensions and Cable Tap Boxes”

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

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

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)

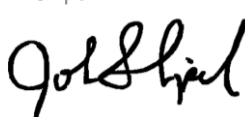
SCL Construction Guideline U10-1.4; "Padmount Transformer Installation, Grounding and Connections 240/120 V, 1Ø, 3 W, 25 Through 167 kVA"

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

Standards Coordinator
Brett Hanson



Standards Supervisor
John Shipek



Unit Director
Darnell Cola



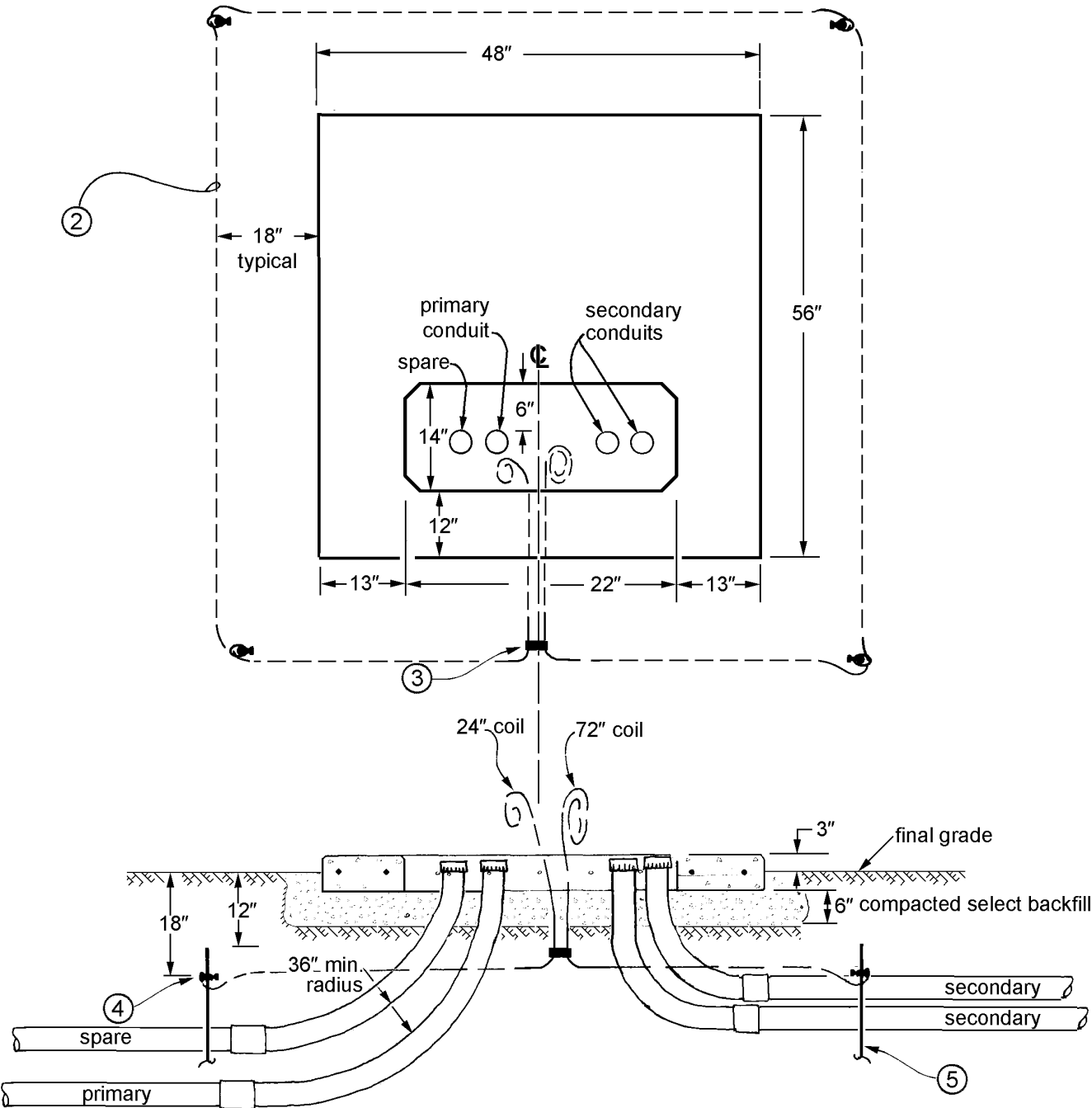
CONSTRUCTION STANDARD

Transformer Pad, Installation and Grounding, Single Phase,
25-167 kVA

Standard Number: **0652.01**

Superseding: October 26, 2015
Effective Date: December 22, 2016
Page: 2 of 2

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

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

5. References

Lu, Curtis; SCL Standards Engineer, subject matter expert and originator of 0652.03 (curtis.lu@seattle.gov)

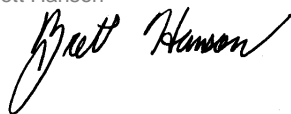
SCL Construction Standard 0224.05; "Requirements for Underground Services on Private Property"

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)

Standards Coordinator
Brett Hanson



Standards Supervisor
John Shipek



Unit Director
Darnell Cola



**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

Item	Quantity	Description	Stock No.	Material Standard
1	1	Three-phase transformer pad	013723	7203.76
2	60 ft	Wire, 2/0 bare, 7-strand, soft-drawn copper	610425	6103.90
3	1	Connector, 2-bolt parallel tap	669379 E	6693.70
4	4	Exothermic weld mold, #2 AWG–5/8 in ground rod	013580	6762.90
5	4	Ground Rod, 5/8 in by 8 ft	564238 E	6762.25

5. References

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

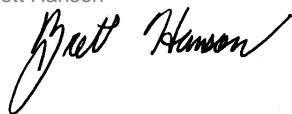
SCL Construction Standard 0224.05; "Requirements for Underground Services on Private Property"

SCL Construction Standard 0468.90; "Exothermic Connection System"

SCL Construction Guideline U10-1.6 "Transformer Pad Construction and Grounding, 150 through 300 kVA, 3Φ" (canceled)

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

Standards Coordinator
Brett Hanson



Standards Supervisor
John Shipek



Unit Director
Darnell Cola



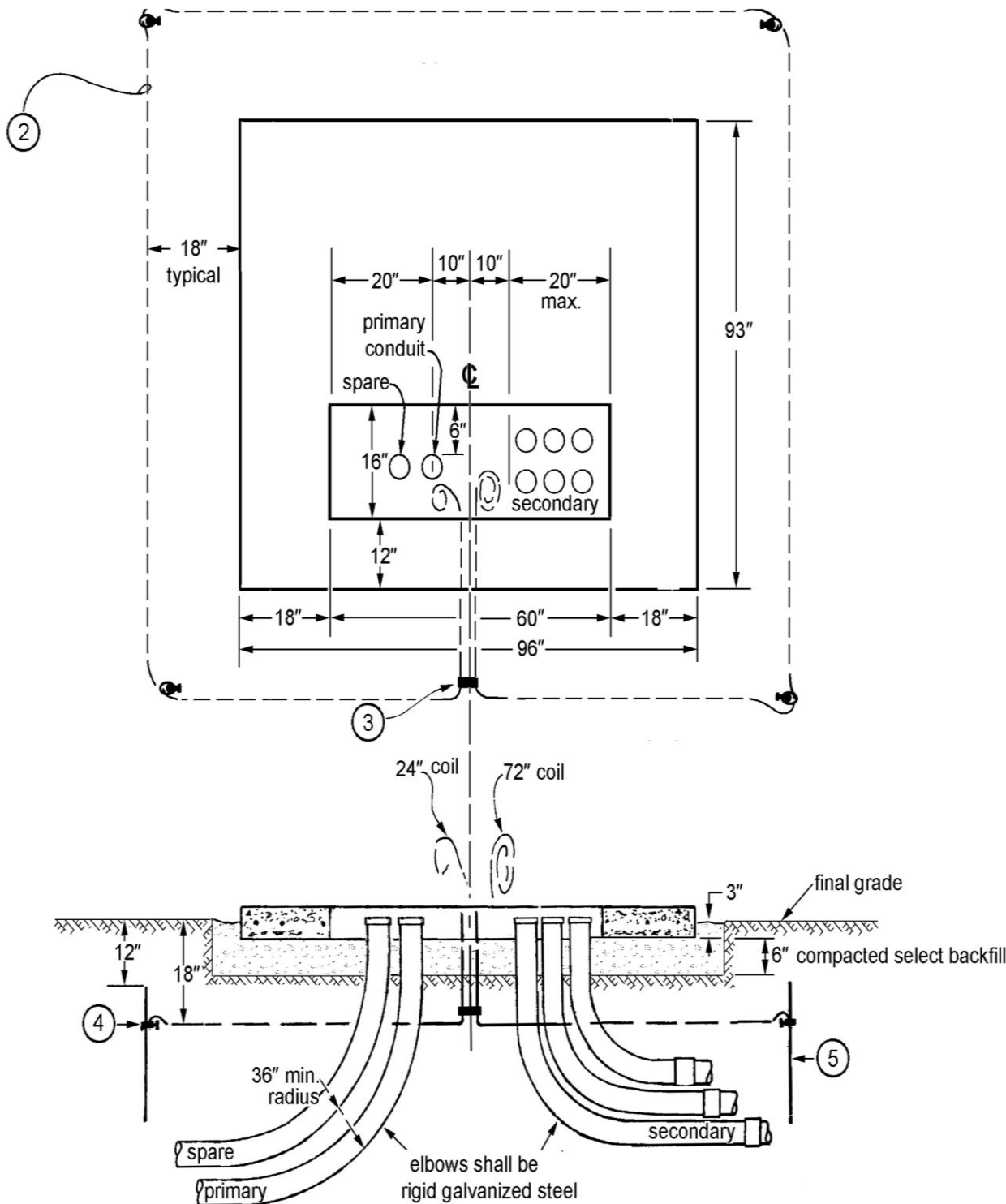
CONSTRUCTION STANDARD

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

Standard Number: **0652.05**

Superseding: October 27, 2015
Effective Date: December 22, 2016
Page: 2 of 2

Figure 1



**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.

4. Material List

Item	Quantity	Description	Stock No.	Material Standard
1	1	Three-phase transformer pad	013724	7203.76
2	65 ft	Wire, 2/0 bare, 7-strand, soft-drawn copper	610425	6103.90
3	1	Connector, 2-bolt parallel tap	669379 E	6693.70
4	4	Exothermic weld mold, #2 AWG-5/8 in ground rod	013580	6762.90
5	4	Ground rod, 5/8 in by 8 ft	564238 E	6762.25

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"

Standards Coordinator
Brett Hanson



Standards Supervisor
John Shipek



Unit Director
Darnell Cola



CONSTRUCTION STANDARD

Transformer Pad, Installation and Grounding, Three Phase,
2000-2500 kVA

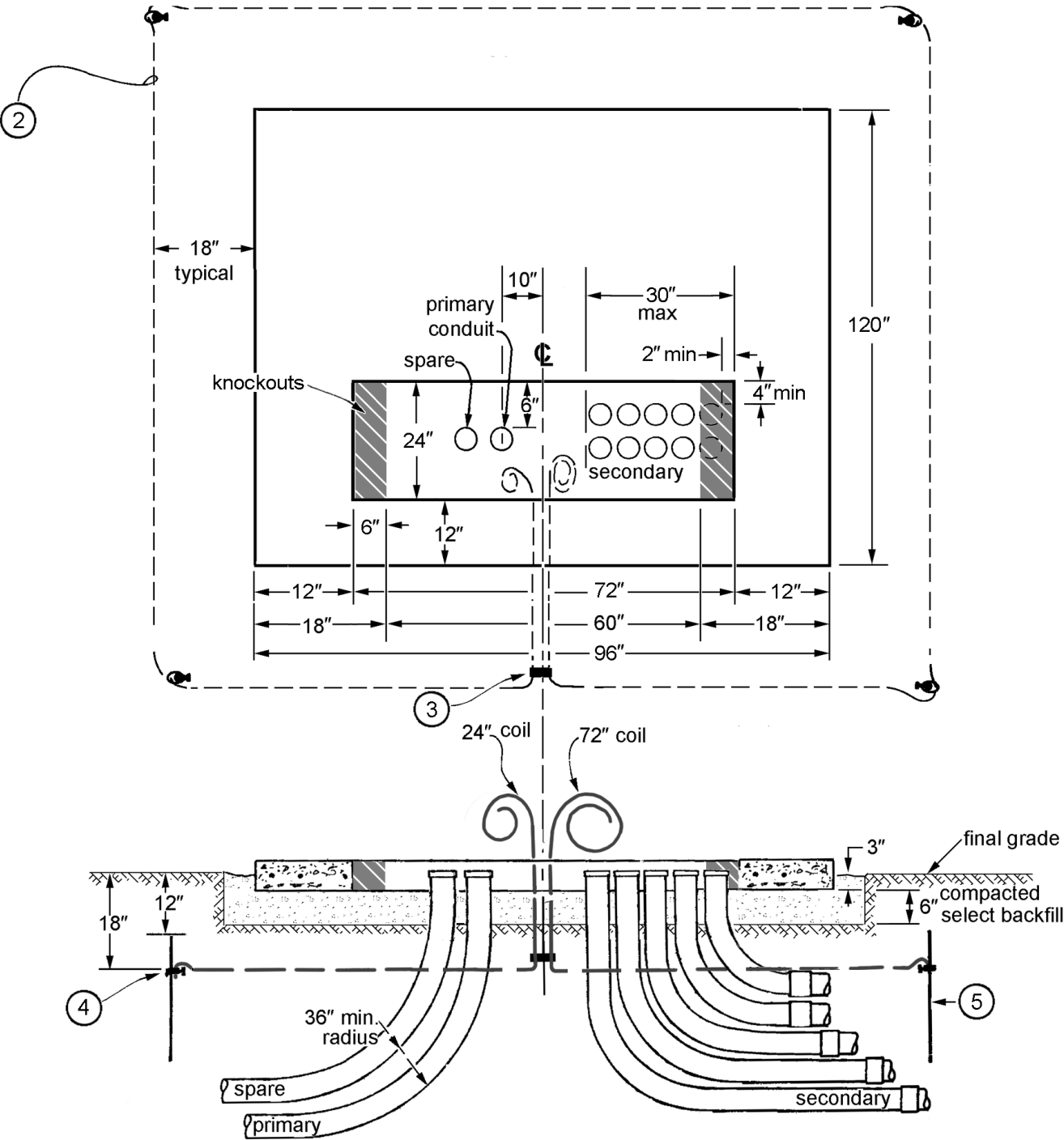
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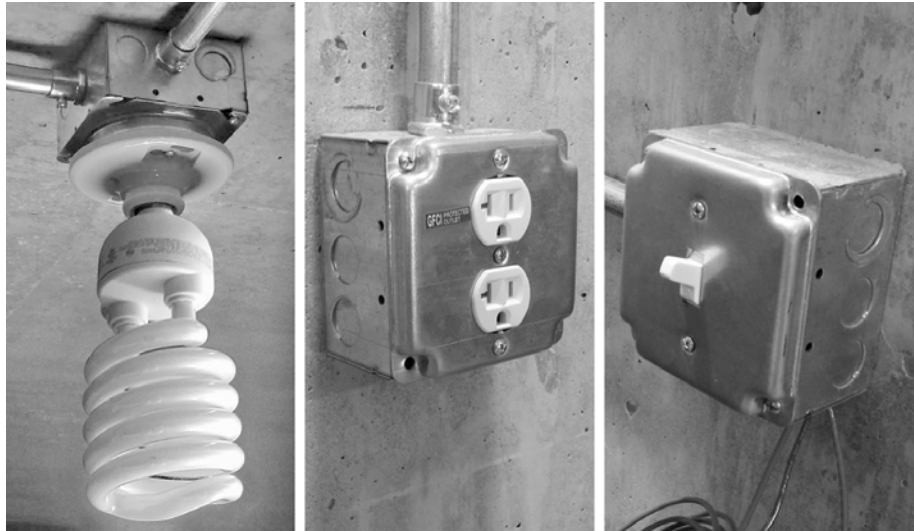
Effective Date: December 22, 2016

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Figure 1



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.

Standards Coordinator
Brett Hanson



Standards Supervisor
John Shipek



Unit Director
Darnell Cola



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

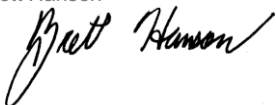
Oil containment systems shall meet the applicable requirements of the following industry standard:

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.

Standards Coordinator
Brett Hanson



Standards Supervisor
John Shipek



Unit Director
Darnell Cola



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

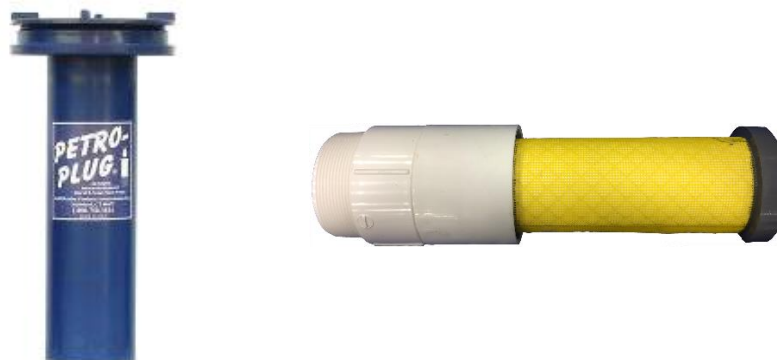


Figure 8b. C.I. Agent Polyvinyl or SorbWeb Plus Blankets



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 Looped Radial Systems



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Standards Coordinator
Brett Hanson

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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.
- 5.2 In-building vaults shall be located no more than one floor below the building's exterior finished grade.
- For a 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 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 Looped 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 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. SCL shall move in the transformer(s) to the in building vault room if the path floor slope is 3% or less. If the path floor exceeds 3%, the customer is responsible to move in the transformer(s).
- 5.12.4. The path floor shall be designed to support the weight of the electrical equipment and machinery to move the equipment.
- 5.13 Equipment transportation agreement: If required, an equipment transportation agreement makes the property owner responsible for moving equipment between the right-of-way and the in-building vault. An equipment transportation agreement shall be provided for all Network vaults.

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.

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.
- 7.7 Steel support channels shall be embedded in the ceiling for ceiling supported cable hangers per SCL 0257.06. Channel layout shall be determined for each specific project by SCL.
- 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.
- 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). Exact pulling iron location shall be determined for each specific project by SCL.
 - 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.

8. Doorways and Openings

8.1 Doorways

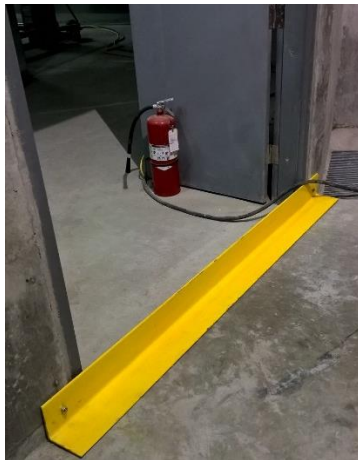
- 8.1.1. Looped Radial (URD): SCL requires an equipment access door. The number of personnel access doors shall be determined for each specific project by SCL.
- 8.1.2. Network: SCL requires two doors for personnel egress; one of which may also be the equipment access door.
- 8.1.3. Personnel access 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 not less than 10 ft 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 36582200 series 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

NFPA 80; Standard for Fire Doors and Other Opening Protectives; NFPA; 2007

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)

SCL 2007-2008 In-Building Vault Subcommittee: Shayan Arya, Ed Chu, Toni Gamble, Laurie Hammack, Bob Hansen, Gerard Legall, Eivind Perander, Uzma Siddiqi, Quang Ta, and Roger Tapp

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.

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:

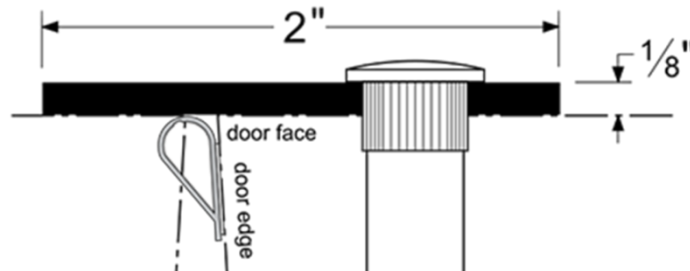
- Norton PR7500 689
- Sargent 351-P10 EN (25-year warranty)

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.

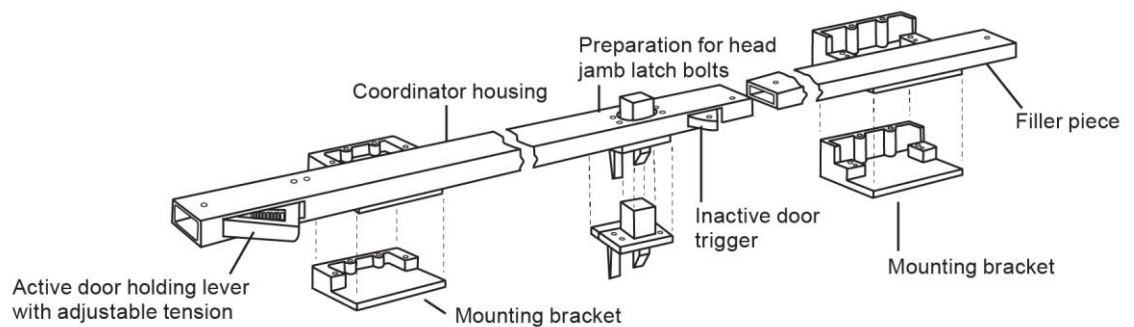
Figure 5.2.4. Astragal



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

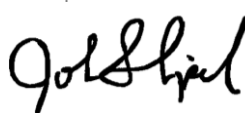
This standard lists the SCL requirements for in-building vaults. An in-building vault is required if (1) the customer's electrical load exceeds the limits listed in *Requirements for Electrical Service Connection*, Table 5-1, and (2) the customer cannot provide exterior space for the installation of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

Standards Coordinator
Brett Hanson



Standards Supervisor
John Shippek



Unit Director
Darnell Cola



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 Looped Radial In-Building Transformer Vault

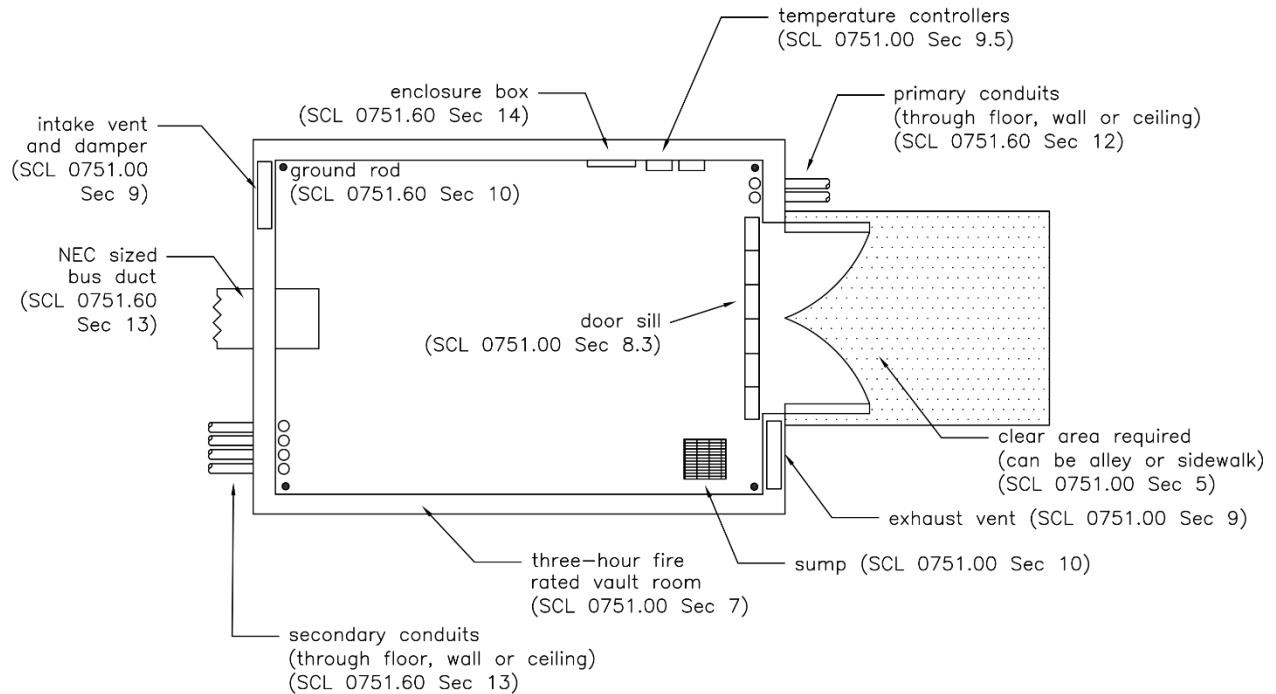
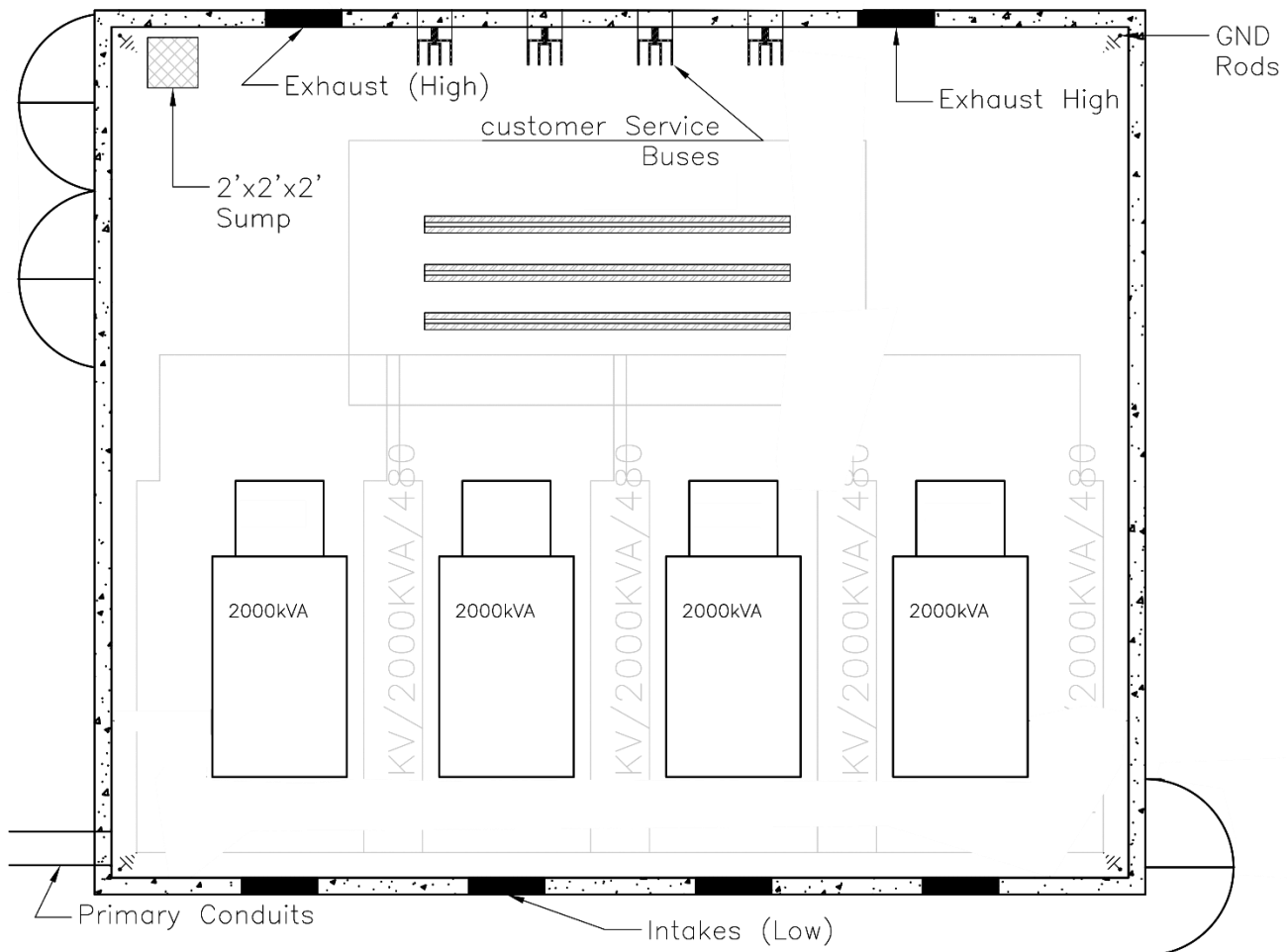


Figure 9b. Preferred Layout for a Network In-Building Transformer Vault



- 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 25 ohms or less, inform SCL engineer. SCL shall advise additional grounding measures required.

- 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. Conduit shall be rigid galvanized steel throughout the depth of the wall. No more than 12 cables per phase or neutral are allowed. Grounding and bonding of conduits shall be external to the vault and is subject to inspection by the Authority Having Jurisdiction.
 - 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. Vault Document Enclosure

- 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 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

Hall, Alan; SCL Engineer and subject matter expert for 0751.60 (alan.hall@seattle.gov)

NFPA-70, National Electric Code (NEC); 2008 Edition, National Fire Protection Association, Quincy, MA, 2010

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)"

SCL 2007-2008 In-Building Vault Subcommittee: Shayan Arya, Ed Chu, Toni Gamble, Laurie Hammack, Bob Hansen, Gerard Legall, Eivind Perander, Uzma Siddiqi, Quang Ta, and Roger Tapp

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 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

Standards Coordinator
Brett Hanson

A handwritten signature in black ink, appearing to read "Brett Hanson".

Standards Supervisor
John Shipek

A handwritten signature in black ink, appearing to read "John Shipek".

Unit Director
Darnell Cola

A handwritten signature in black ink, appearing to read "Darnell Cola".

Acronyms used in this section include:

Acronym	Definition
CSB	Customer Service Bus (or bus duct)
WMB	Wall Mounted Bus
BTS	Bus Tie Switch
XFMR	Transformer (acronym used in tables but not in text)
IWCB	Integral Web Channel (or Collector) Bus
NP	Network Protector
HVAC	Heating Ventilation and Air Conditioning

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 3.1. Working Space Width (ft)

	See Figure	CSB	WMB	Adjacent Wall	Column	HVAC Grille	Door	BTS	IWCB	Cables in Conduit	XFMR
CSB	3.3b, 3.3c	3	6	3	3	3	3	6	N/A	3	6
WMB	3.4b	6	N/A	6	6	3	6	6	N/A	4	6

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 3.2. Working Space Depth (ft)

	See Figure	CSB	WMB	Opposite Wall	Column	HVAC Grille	Door	BTS	IWCB	Cables in Conduit	XFMR
CSB	3.3b	6	6	6	6	3	1.5	6	6	6	6
IWCB	3.5b	6	6	6	6	6	6	6	N/A	6	6
XFMR	3.6b, 3.7b	6	6	4	4	4	4	6	6	4	3

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

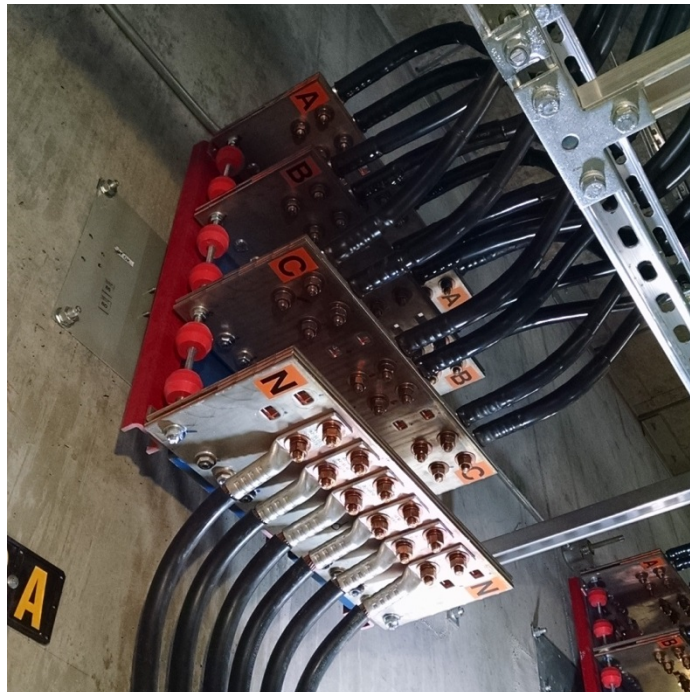


Figure 3.3b. CSB Working Space, Plan View

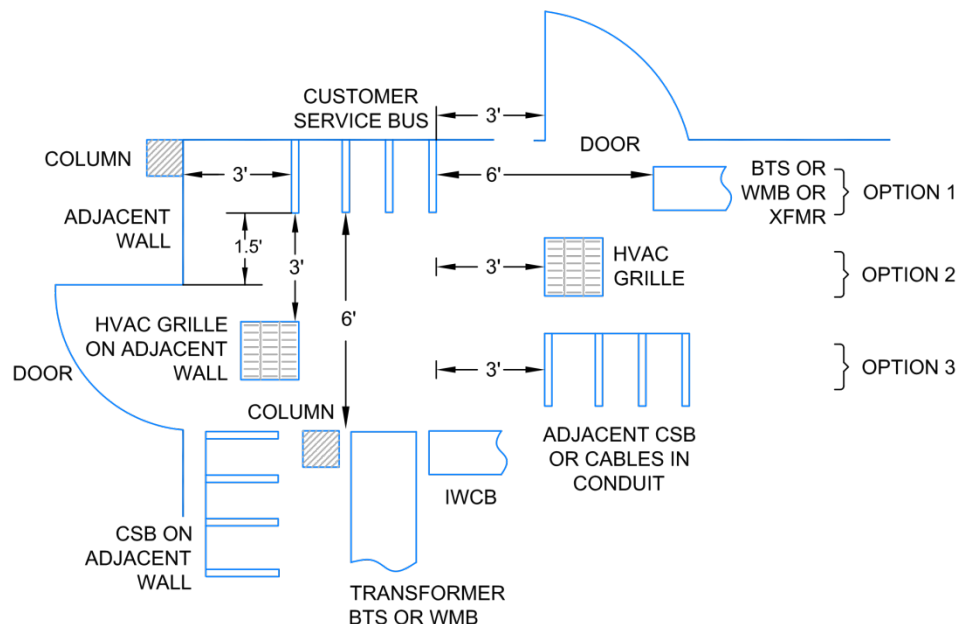
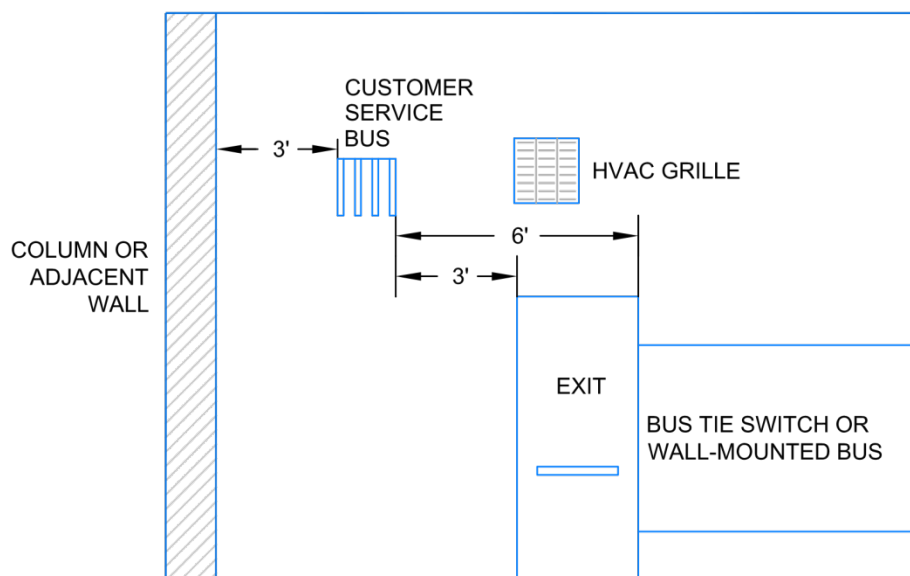


Figure 3.3c. CSB Working Space, Elevation



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

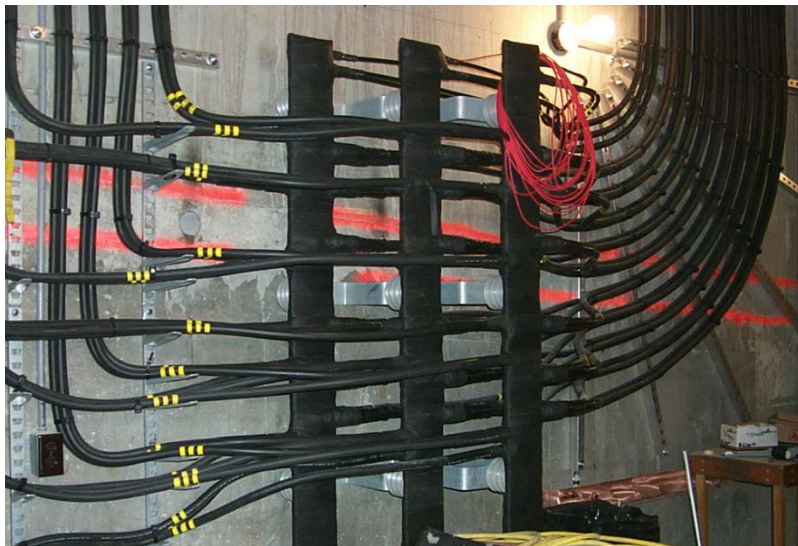
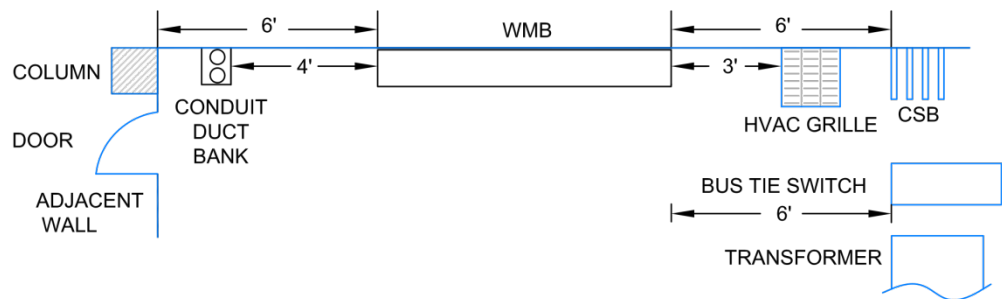


Figure 3.4b. WMB Working Space, Plan View



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.

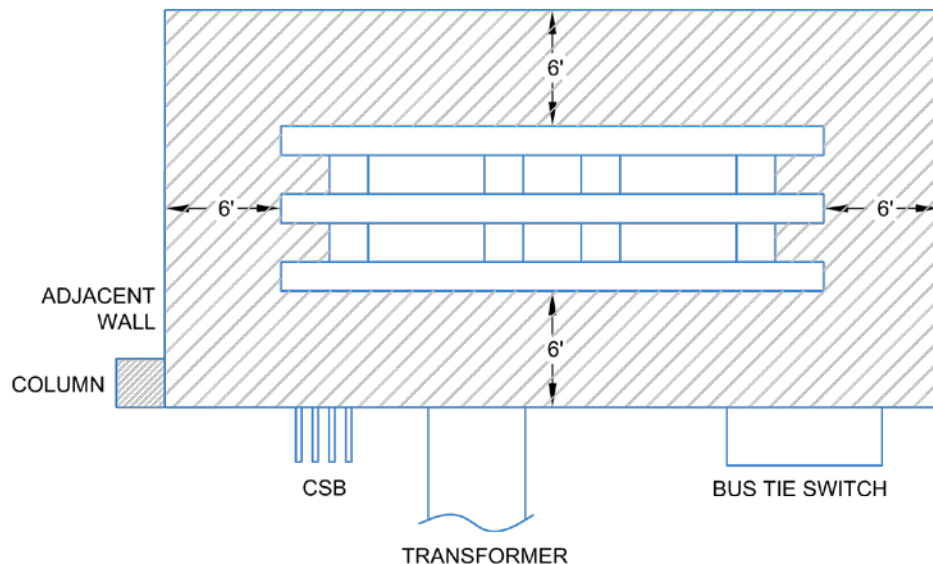
The IWCB connects to the transformers and CSB using heavy cables overhead and requires a lift to train and connect the cables.

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



Figure 3.5b. IWCB Working Space, Plan View



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.

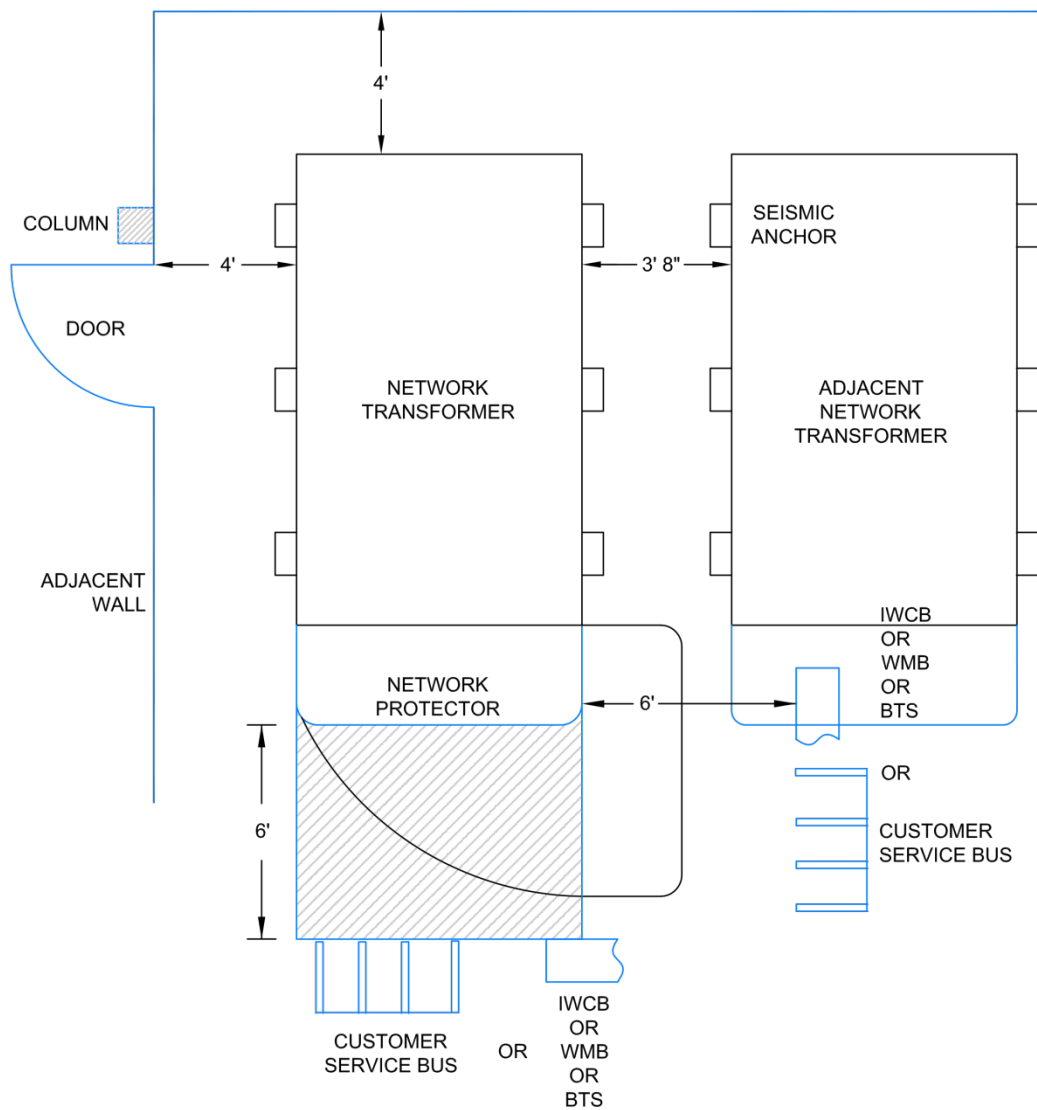
The secondary side of a Network transformer has a Network Protector (NP) mounted to it. The NP is a three-phase breaker intended to disconnect power when a fault is detected. The NP has a door that swings out 90 degrees and components that rack out for periodic maintenance. Therefore, working space is 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

The transformer connects SCL's in-building vault primary service to the customer 480 V or 208 V service bus using cables. See Figure 3.7a.

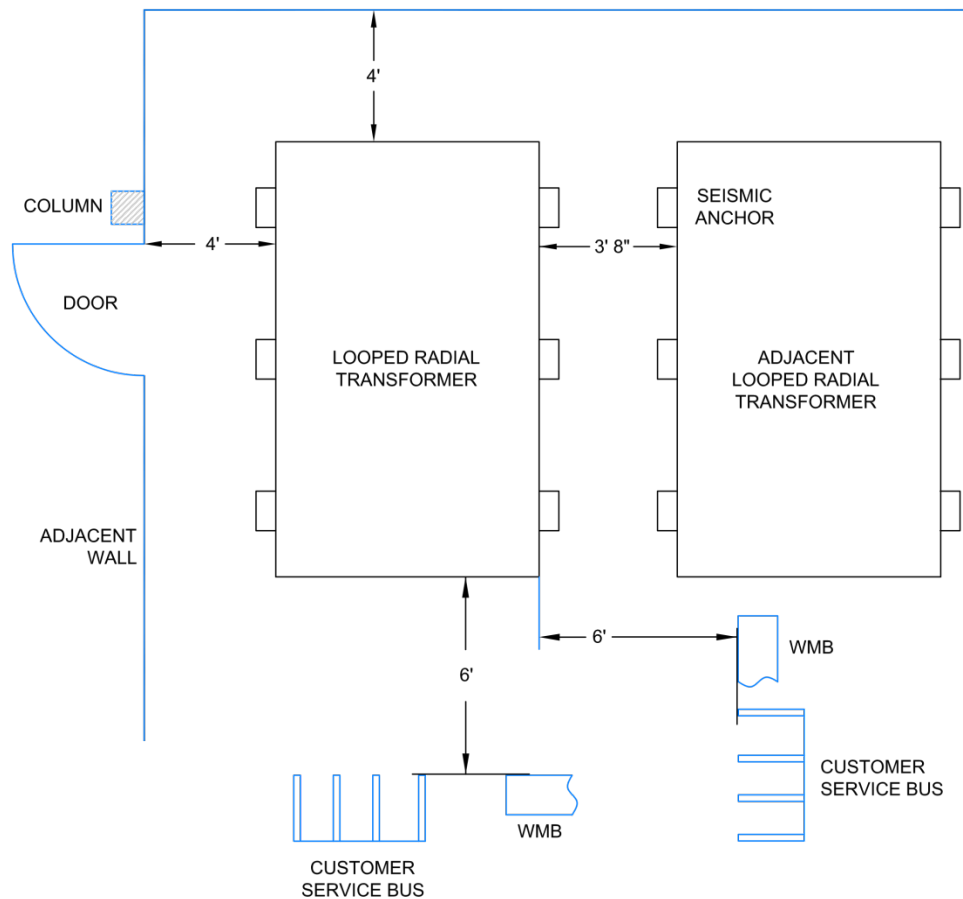
The transformer connects to the primary service and customer gear using heavy cables overhead and requires a lift to train and connect the cables.

Each 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.

Figure 3.7a. Looped Radial Transformer



Figure 3.7b. Looped Radial 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)

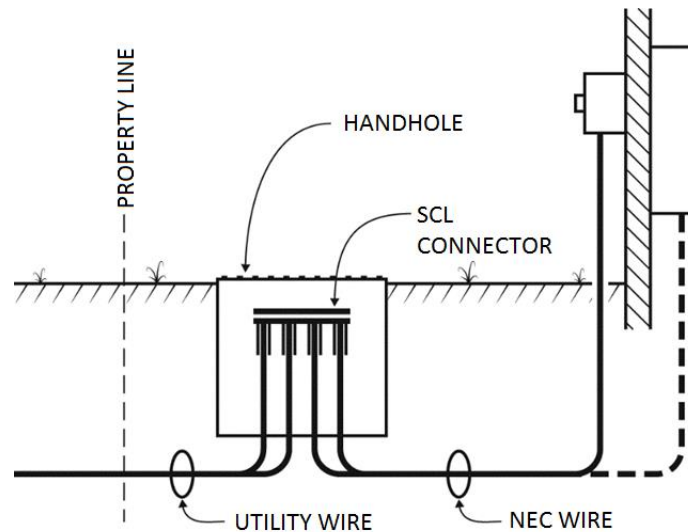
Edwards, Tommy; SCL Inspector, originator and subject matter expert for 0751.77
(tommy.edwards@seattle.gov)

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 Secondary Service Termination Facilities



1. Scope

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 services are outside the scope of this standard. See SCL U12-1.3/NMT-10.

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.

Standards Coordinator
Yaochiem Chao

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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 in driveways and other vehicular access areas. Otherwise, surface-mount conduit may be Schedule 40 PVC. The conduit shall be securely fastened to a wall by a minimum of two conduit straps.

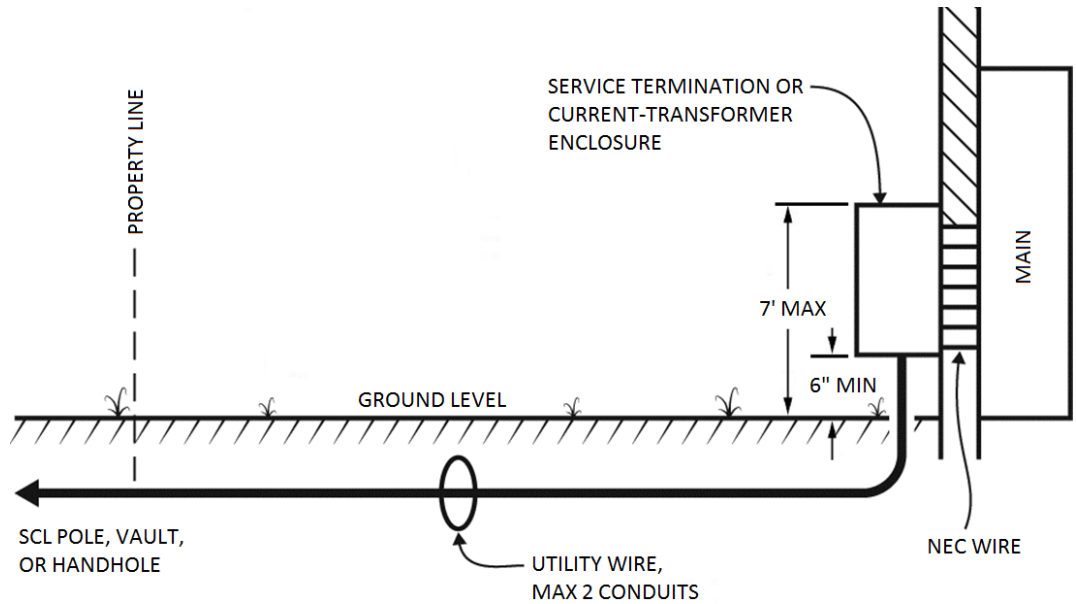
The 90-degree conduit bend under the service termination facility shall have the bell end toward the property line.

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.

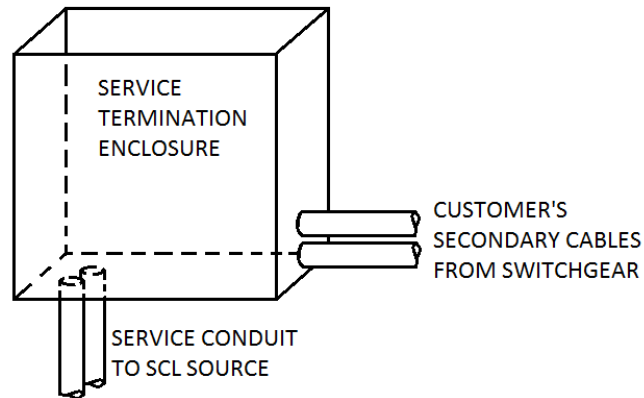
5.2 Service Termination Enclosure

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

Size (W x H x D) (in)	Maximum NEC Wires from Customer		
	# of Sets	kcmil	Max Amps
24 x 32 x 11	2	4/0	400
30 x 36 x 11	2	250	400
36 x 36 x 11	3	350	600
	2	500	600
48 x 48 x 11	4	500	1000

Figure 5.2 Service Termination Enclosure Detail



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

Size (W x H x D)	Maximum Service
24 x 48 x 11	Single-phase, 400 A
36 x 48 x 11	Single-phase, 600 A
36 x 48 x 11	Three-phase, 800 A

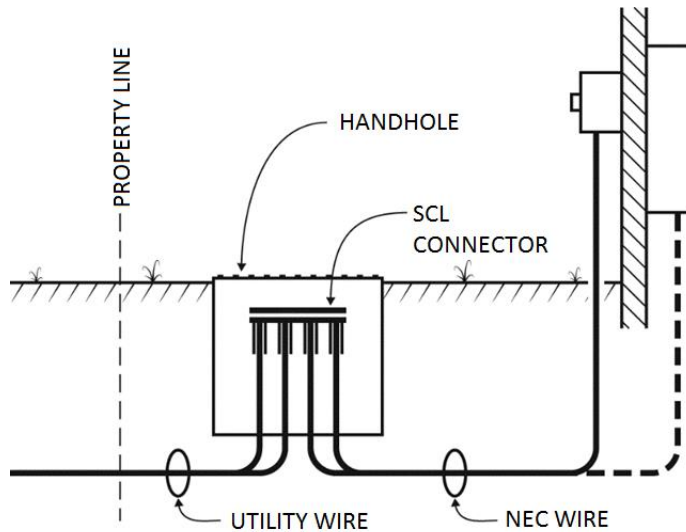
A switchboard termination is required for current transformers rated above 800 amperes.

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.

Figure 5.4. Handhole



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

Size (W x L x D)	Material	Material Std.	Maximum NEC Wires from Customer		Maximum Service
			# of Sets	kcmil	
17 x 28 x 24	Concrete	7203.10	3	4/0	Single-phase, 600A
17 x 30 x 24	Fiberglass	7203.12	3	4/0	Single-phase, 600A
30 x 30 x 24	Concrete	7203.04	4	4/0	Single-phase, 600A
24 x 36 x 36	Concrete	7203.08	4	350	Three-phase, 1000A
24 x 36 x 36	Fiberglass	7203.12	4	350	Single-phase, 1000A
48 x 48 x 48	Concrete	7203.26	4	500	Three-phase, 1000A

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. 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 6 shows allowable conductor sizes.

Table 6. Allowable Conductors for Electrical Service Connection

Conductor Size	Copper	Aluminum	
	Concentric Round Stranded	Concentric Round Stranded and Compressed Stranded	Compact Stranded
#2 AWG	OK	OK	–
#1 AWG	–	OK	OK
1/0	OK	OK	OK
2/0	OK	OK	OK
3/0	OK	OK	OK
4/0	OK	OK	OK
250 kcmil	OK	OK	OK
300 kcmil	OK	OK	OK
350 kcmil	OK	OK	OK
400 kcmil	–	OK	OK
500 kcmil	OK	OK	OK

The customer shall extend eight feet of excess cable per conductor into the service termination enclosure or handhole for connection by SCL.

7. 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 U12-1.3/NMT-10; “Meter Location and Conduit Entrance Details for Secondary Underground Residential Service, Class 320 Maximum”

8. Sources

Chao, Yaochiem; SCL Standards Engineer, originator, and subject matter expert for 1561.07 (yaochiem.chao@seattle.gov)

Franklin, Stephanie; SCL Electrical Service Representative and subject matter expert for 1561.07 (stephanie.franklin@seattle.gov)

Hanowell, Manny; SCL North Distribution Engineer and subject matter expert for 1561.07 (manny.hanowell@seattle.gov)

Panomvana, Tanya; SCL North Distribution Engineer and subject matter expert for 1561.07 (tanya.panomvana@seattle.gov)

Perander, Eivind; SCL North Distribution Supervisor and subject matter expert for 1561.07 (eivind.perander@seattle.gov)

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.

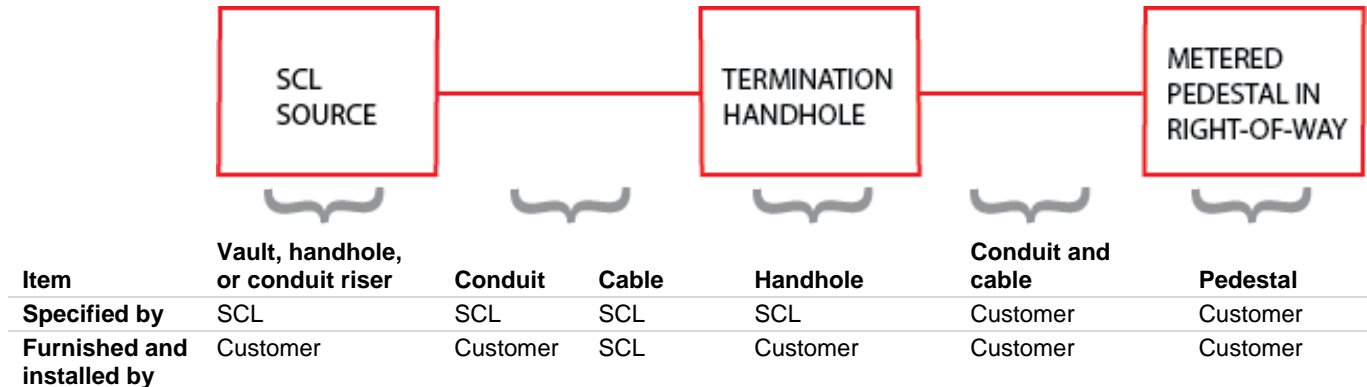
See Figure 3 for SCL and customer responsibilities.

Standards Coordinator
Brett Hanson

Standards Supervisor
John Shippek

Unit Director
Darnell Cola

Figure 3. Basic Infrastructure of a Customer System in the Right-of-Way



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, Looped 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)

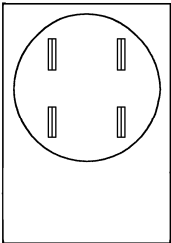
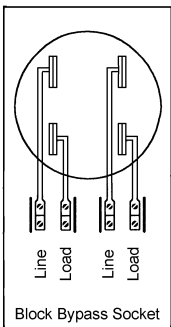
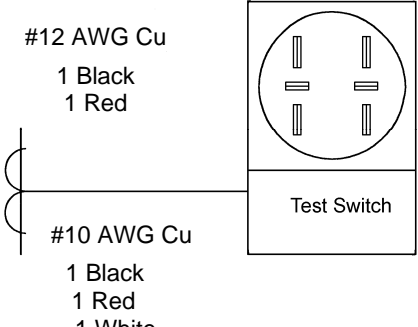
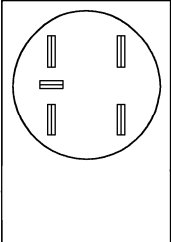
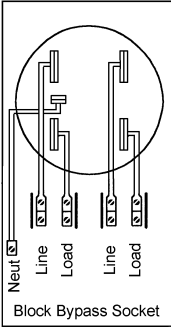
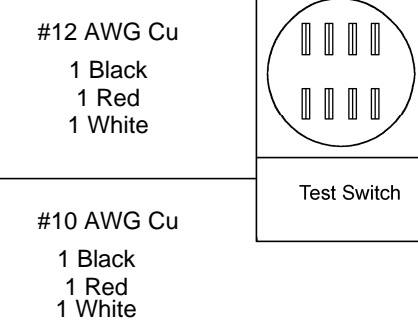
SEATTLE CITY LIGHT CONSTRUCTION GUIDELINE

STANDARD NUMBER: **DU13-4/NMT-30**
 PAGE: 1 of 2
 DATE: January 28, 1974
 REV: April 1, 2004

METER BASE ARRANGEMENTS

Notes:

- 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.
- When neutral is insulated, it shall be bonded to the socket. All sockets shall be U.L. listed. Applies to all Figures.
- Circuit closing devices are **not approved**. Applies to all Figures.
- All 480V services 200 amps or less require a 200 amp continuous duty safety socket.
- All commercial services 200 amps or less and under 300 volts require a continuous duty block bypass socket.
- 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.
- 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 2A.
- 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.
- All EUSERC requirements refer to the latest revisions of EUSERC documents. Typical EUSERC drawing number **339**
- C.T. secondary wire sizes increase for 50 feet and greater.
- Block bypass sockets are recommended for all residential use.

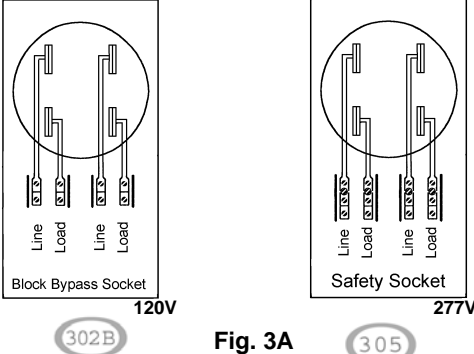
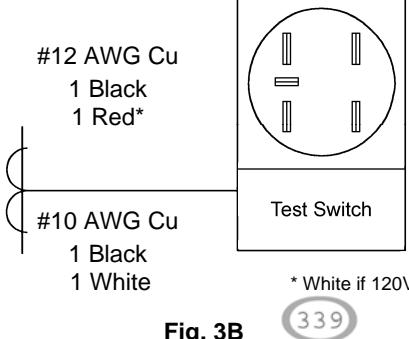
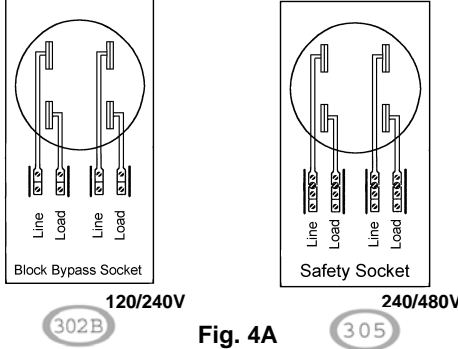
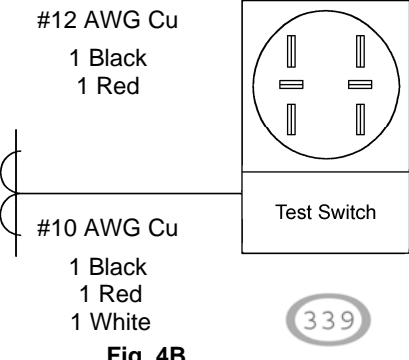
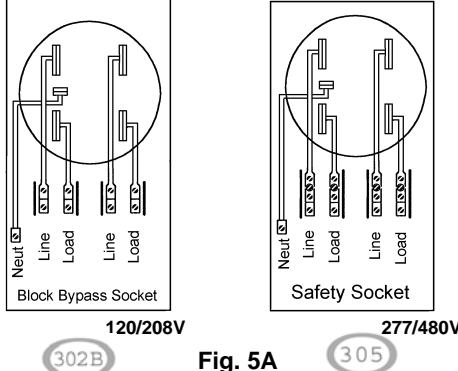
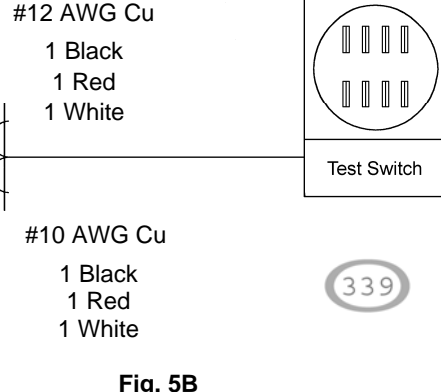
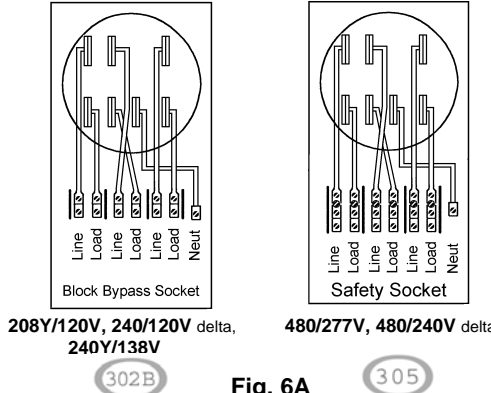
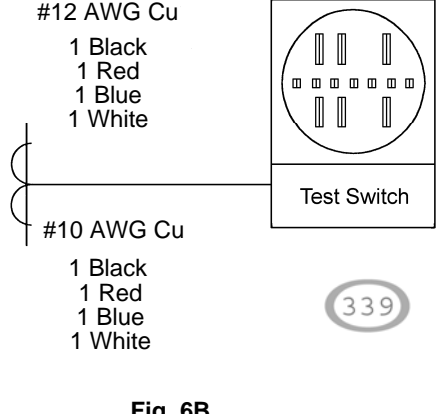
Types of Service	Residential Metering Requirements	
	Maximum Metering Capacity Up to 400 Amp	Metering Capacity Over 400 Amp
1 Ø 3W 120/240V EUSERC Compliance Fig. 1A EUSERC Dwg. F-1 Code 4 with EUSERC Dwg. 302A (up to 225 amps) or 302B (over 225 amps and up to 400 amps). Fig. 1B EUSERC Dwg. F-1 Code 6 with EUSERC Dwg. 339 (over 400 amps).	  <p style="text-align: center;">Fig. 1A</p>	<p>#12 AWG Cu 1 Black 1 Red</p>  <p style="text-align: center;">Fig. 1B</p>
1 Ø 3W 120/208V EUSERC Compliance Fig. 2A EUSERC Dwg. F-1 Code 5A with EUSERC Dwg. 302A (up to 225 amps) or 302B (over 225 amps and up to 400 amps). Fig. 2B EUSERC Dwg. F-1 Code 8 (Code 15 Alternate) with EUSERC Dwg. 339 (over 400 amps).	  <p style="text-align: center;">Fig. 2A</p>	<p>#12 AWG Cu 1 Black 1 Red 1 White</p>  <p style="text-align: center;">Fig. 2B</p>

ORIGINATOR	STANDARDS COORDINATOR	STANDARDS SUPERVISOR	UNIT DIRECTOR
Ted Allestad	Charles L. Shaffer	John Schinner	Hardee Jry.

SEATTLE CITY LIGHT CONSTRUCTION GUIDELINE

STANDARD NUMBER: **DU13-4/NMT-30**

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Types of Service	Commercial Metering Requirements	
	Maximum Metering Capacity Up to 200 Amp	Metering Capacity Over 200 Amp
1 Ø 2W 120V 1 Ø 2W 277V 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).	 <p>120V 302B Fig. 3A 305 277V</p>	 <p>Fig. 3B 339</p>
1 Ø 3W 120/240V 1 Ø 3W 240/480V 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).	 <p>120/240V 302B Fig. 4A 305 240/480V</p>	 <p>Fig. 4B 339</p>
1 Ø 3W 120/208V 1 Ø 3W 277/480V EUSERC Compliance Fig.5A EUSERC Dwg. F-1 Code 5A with EUSERC Dwg. 305 (up to 200 amps). Fig. 5B EUSERC Dwg. F-1 Code 8 (Code 15 Alternate) with EUSERC Dwg. 339 (over 200 amps).	 <p>120/208V 302B Fig. 5A 305 277/480V</p>	 <p>Fig. 5B 339</p>
3 Ø 4W 208Y/120V 3 Ø 4W 240/120V delta 3 Ø 4W 240Y/138V 3 Ø 4W 480Y/277V 3 Ø 4W 480/240V delta 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).	<p>High leg on right-hand terminals if delta (orange).</p>  <p>208Y/120V, 240/120V delta, 240Y/138V 302B Fig. 6A 305 480/277V, 480/240V delta</p>	 <p>Fig. 6B 339</p>

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

Item	Description	Stock No.	Quantity
1	Pulling iron, stainless steel	720235	Project specific
2	Form for embedded pulling iron	013525	"
3	Pulling iron cover	720236	"

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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

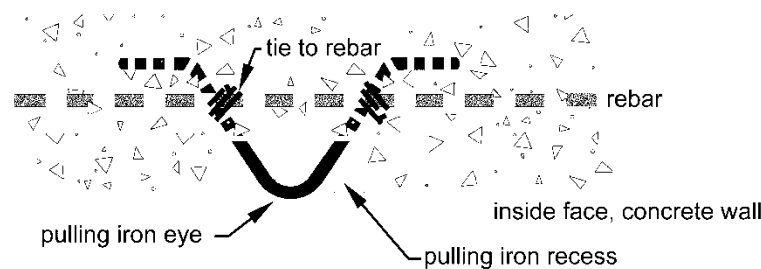
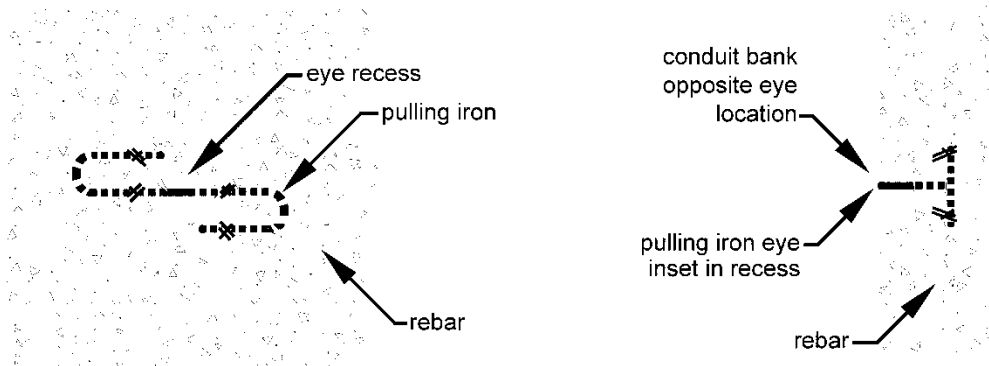


Figure 4b. Pulling Iron, Vault Interior, Front and Side Views



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.

Standards Coordinator
Yaochiem Chao



Standards Supervisor
John Shipek

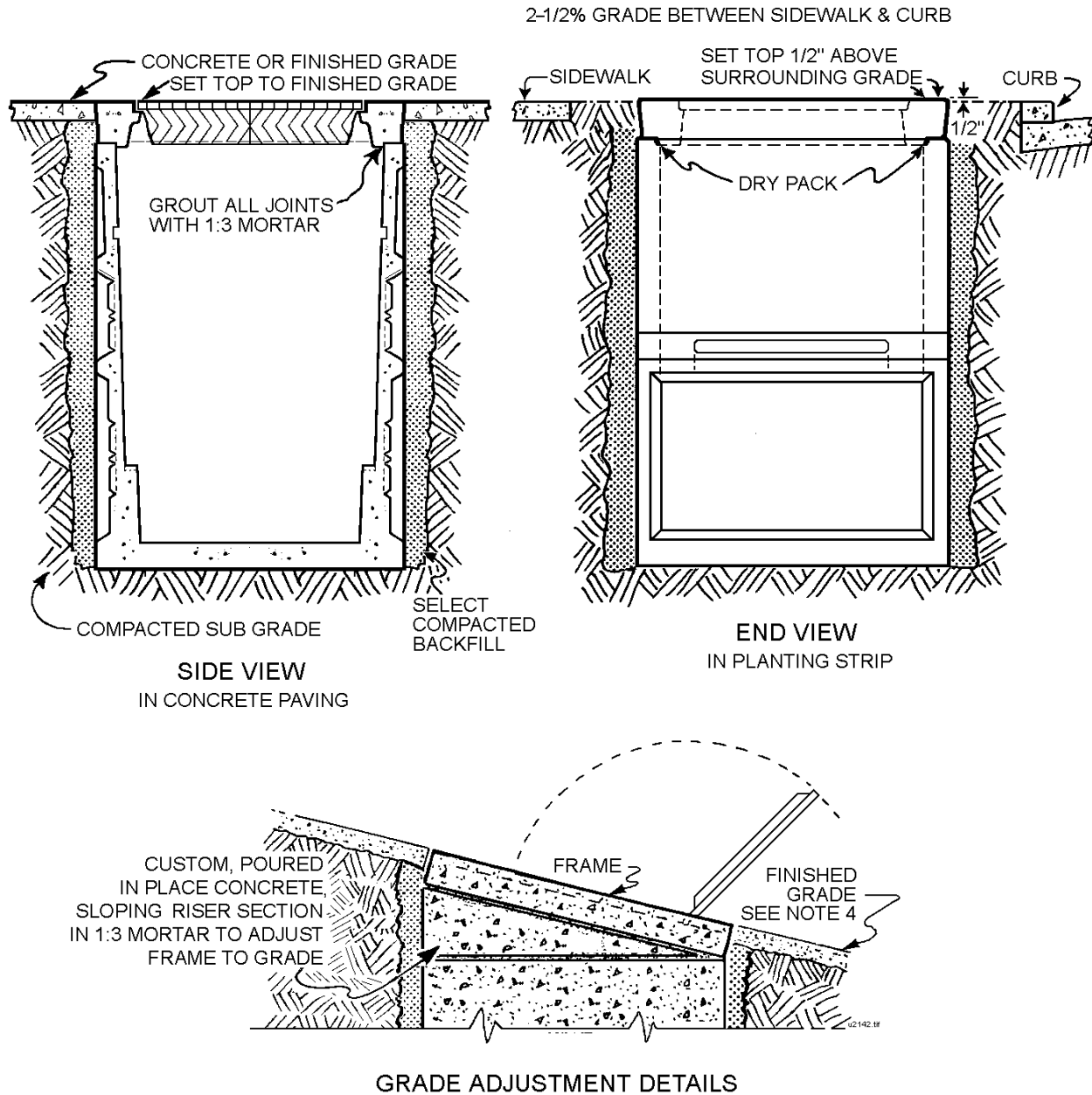


Unit Director
Darnell Cola



VAULT INSTALLATION

Figure 1

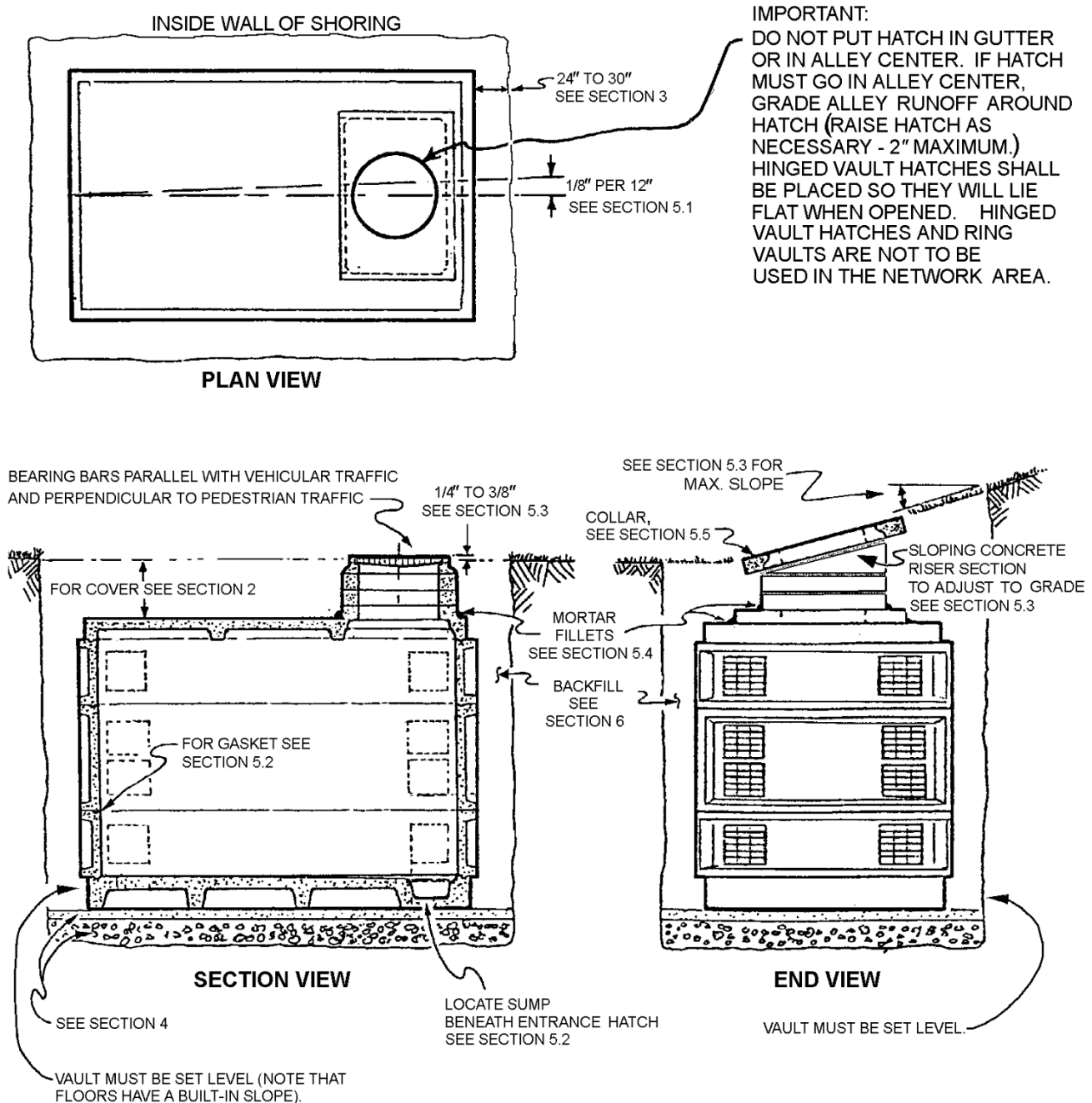


1. **All work, including shoring and bracing**, shall be in compliance with the latest editions of: State of Washington Department of Labor and Industries WAC 296-46B-450 "Equipment for General Use – Transformers and Transformer Vaults," Chapter 296-155- WAC "Safety Standards for Construction Work", Seattle Building Code Section 414 "Transformer Vaults" and Appendix Chapter 4, Division IV, Section 436 "Utility Transformer Vaults", and Seattle Board of Public Works, "Street and Sidewalk Pavement Openings and Restoration Rules".
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. 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 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.



Standards Coordinator
Brett Hanson

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

Brett Hanson

John Shipek

Darnell Cola

1. Codes

All work, including shoring and bracing, shall be in compliance with the latest editions of: State of Washington Department of Labor and Industries WAC 296-46B-450 "Equipment for General Use – Transformers and Transformer Vaults," Chapter 296-155 WAC "Safety Standards for Construction Work," Seattle Building Code Section 422 "Private and Utility Transformer Vaults," and the SDOT Director's Rule 2004—02, "Street and Sidewalk Pavement Opening and Restoration Rules."

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 $\pm 1/8$ 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 $\pm 1/8$ 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:
 - Precast concrete sloping riser section
 - 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:
 - Brick and mortar if the mortar is less than 1 inch thick
 - Precast concrete sloping riser section
 - 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 fillets 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. Proximity to Sewers

Vaults or manholes set within 5 feet 0 inches of, or over, sewers will require replacement of the sewer pipe with ductile iron. The new ductile iron pipe must be placed beyond the vault at each end, a minimum of 3 feet 0 inches and/or into undisturbed soil at least 2 feet 0 inches. Contractor shall do excavation, backfill, and restoration. Installation of the pipe will be made by the Seattle Public Utilities Department.

9. Grounding Electrode System

Install and test grounding electrodes per SCL 0461.10.

11. 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"

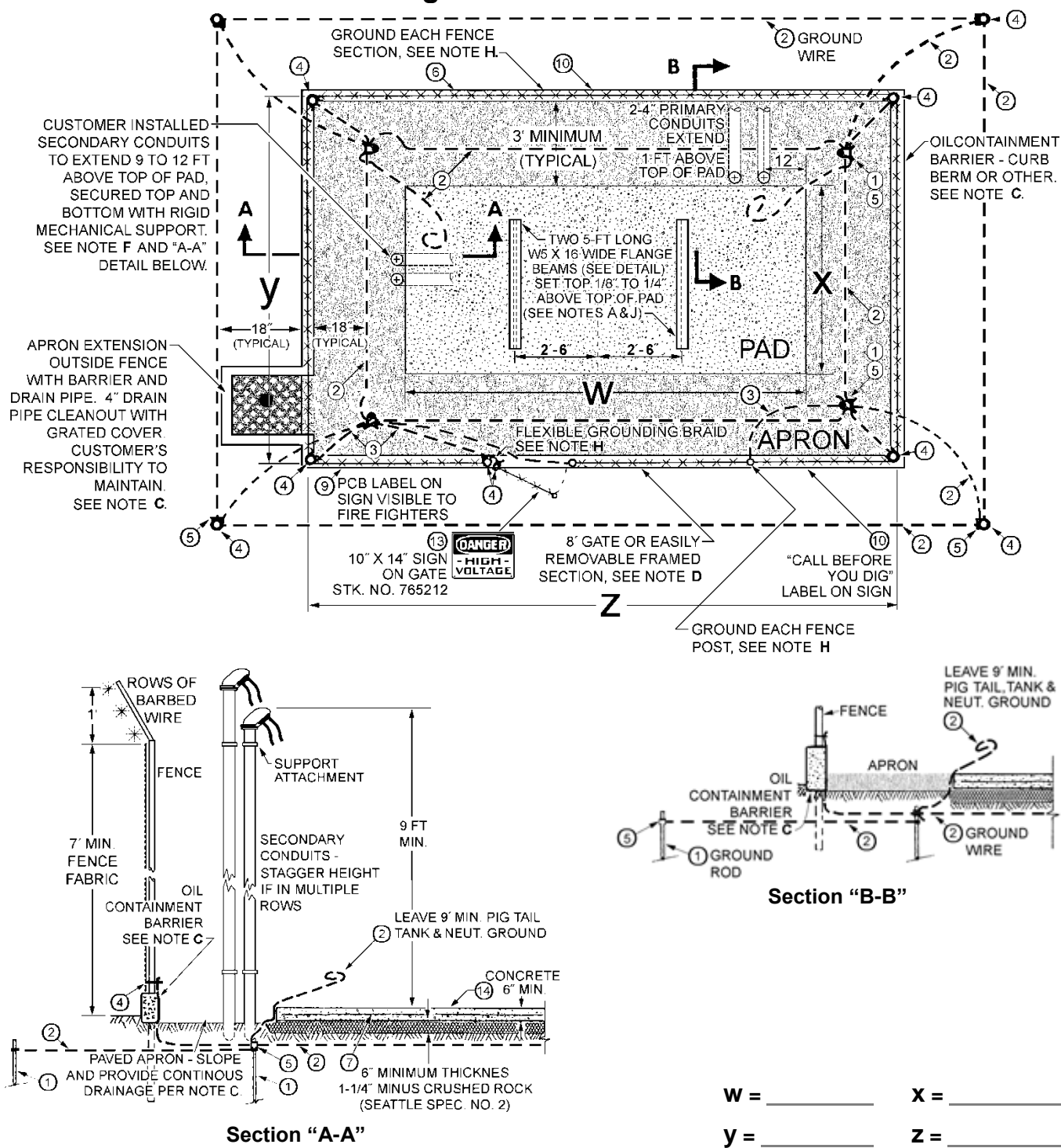
SCL Construction Standard 0461.10; "Grounding Electrodes for Handholes and Vaults"

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



Pad and Apron Dimensions for

(site location)

Standards Coordinator
Laura Vanderpool

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

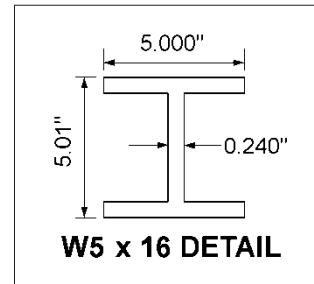
Notes:

- 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 Devco 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

Item	Quantity	Description	Material Std.	Stock No.
1	8	GROUND ROD, 5/8" X 8', copper clad steel, sectional	6762.25	564238 E
2	200' (est.)	WIRE, 2/0 bare stranded copper, SD	6103.90	610425
3	10' (est.)	WIRE, #2 bare stranded copper, SD	6103.90	610434
4	6 (est.)	CONNECTOR #4 thru 2/0 to 1-1/4" IPS	6762.7	676271
		#4 thru 2/0 to 1-1/2" IPS	6762.7	676277
		#4 thru 2/0 to 2" IPS	6762.7	676283
5	8	CONNECTOR, 2 cables (#4 thru 2/0) to 5/8" rod	6762.7	676551
6	as req'd.	FENCE fabric, 7', 9 gauge, with 3 strands of barbed wire on support pipe with 3" spacing between strands, Cyclone or equal.	—	—
7	as req'd.	REINFORCING BAR, #5	—	—
8	1	LABEL, "Danger Hazardous Voltage", pressure sensitive, to be mounted on transformer.	7651.27	765182
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. <i>PCB label must show the same PCB level as that on the transformer.</i>		
		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. 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

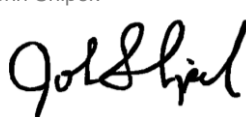
Provide properly supported, unobstructed access from the right-of-way to the transformer pad/vault for SCL equipment-handling machinery. SCL must be able to move to the transformer pad/vault, or remove from the transformer pad/vault, all electrical equipment, including tall, heavy transformers, and to 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 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

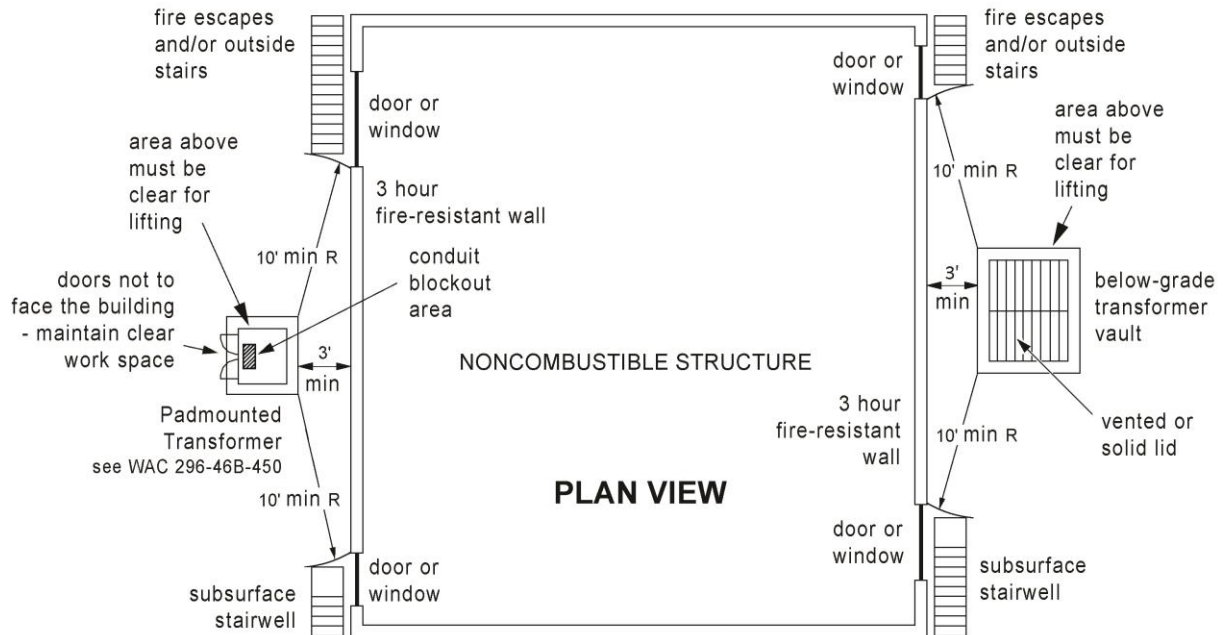
Isolate transformer pad so that sound and vibration levels from transformers satisfy applicable laws and ordinances of the State of Washington, King County, and the appropriate municipality.

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)



9. Figures, Clearances of Vaults and Padmounted Enclosures from Buildings, continued

Figure 9.1b. Noncombustible Structures (Structures Designed to Resist Fire for Three Hours), elevation view
 (for combustible structures, see Figure 9.2)

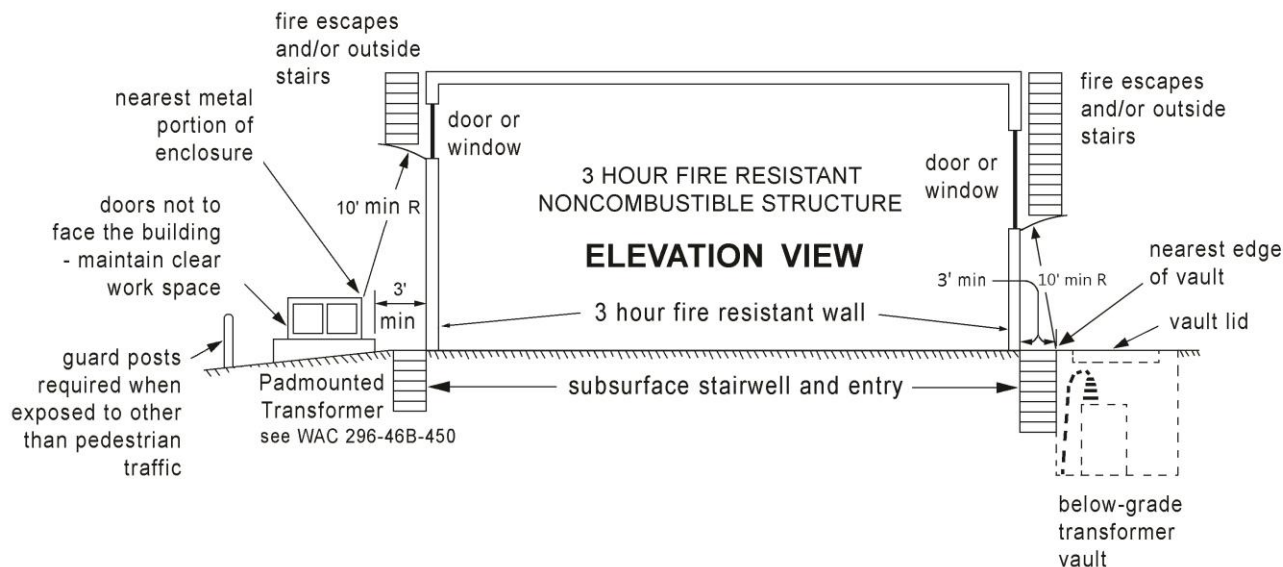
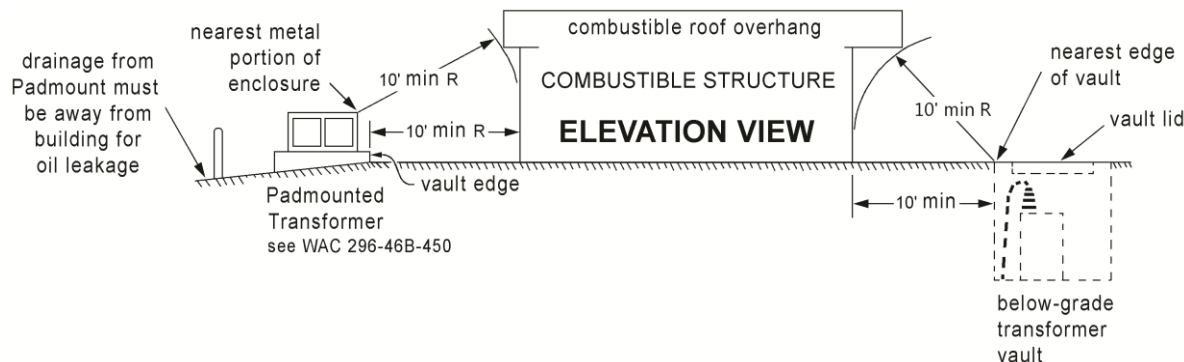


Figure 9.2. Combustible Structures, elevation view



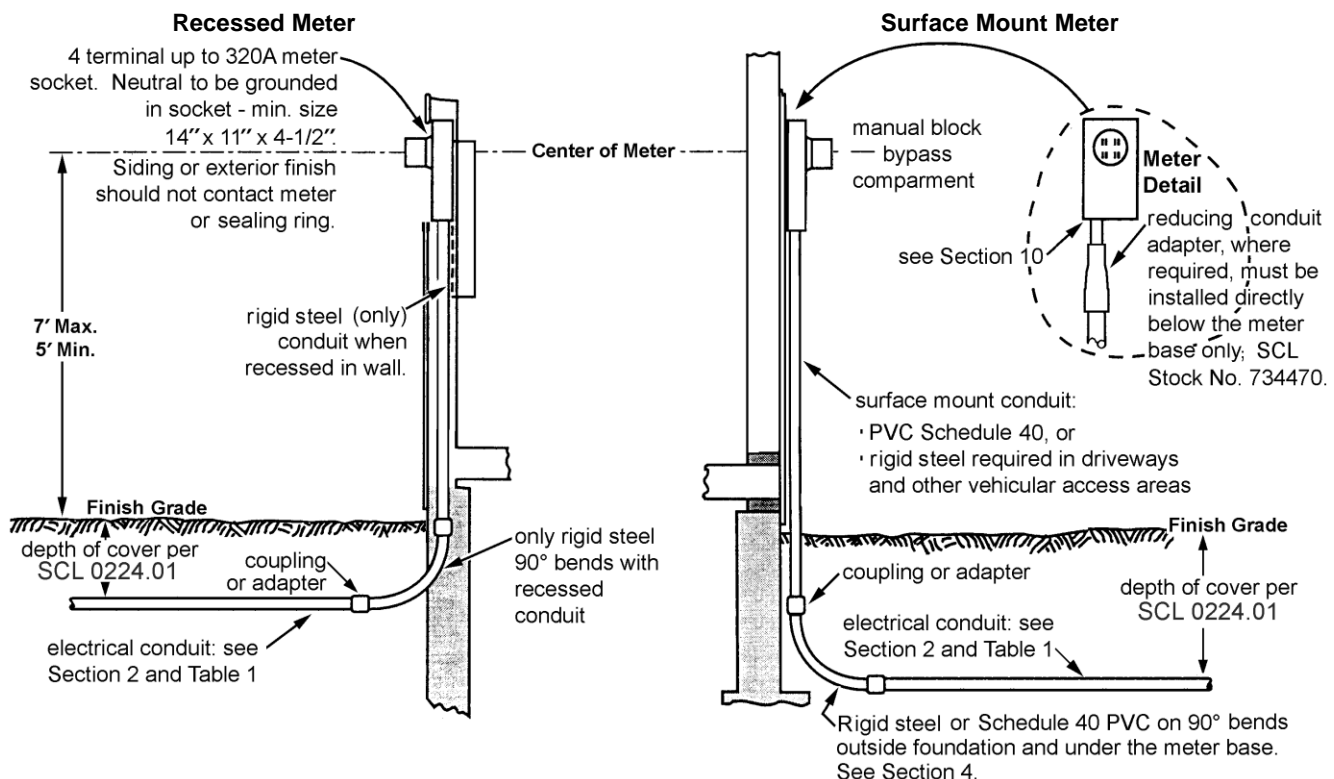
10. References

- 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, Looped Radial System"
- SCL Construction Standard 0224.34;** "Steel Conduit Risers"
- SCL Construction Standard 0461.10;** "Grounding Electrodes for Handholes and Vaults"
- 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, Single Phase, 75-300 kVA"
- SCL Construction Standard 0652.05;** "Transformer Pad, Installation and Grounding, Single Phase, 500-1500 kVA"
- SCL Construction Standard 0652.07;** "Transformer Pad, Installation and Grounding, Single 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 LOCATION AND CONDUIT ENTRANCE DETAILS FOR SECONDARY UNDERGROUND RESIDENTIAL SERVICE, CLASS 320 MAXIMUM

1. **Scope:** This guideline provides installation details for residential metering equipment that does not require current transformers. These requirements are not typically applied to temporary services.
2. **Underground service conductors** shall be in either Schedule 40 PVC conduit or galvanized rigid steel conduit as shown in the illustrations below. Direct buried conductors are not allowed. All Steel conduit and steel elbows shall be completely buried or concrete encased.
3. All **horizontal bends** shall be rigid steel.
4. The conduit bend under the meter base may be PVC Schedule 40 if the SCL Electric Service Representative determines that the SCL service lateral conductor will be fed *from* under the meter base, otherwise the bend shall be rigid galvanized steel.
5. See SCL 0224.34 for **pole riser** requirements.
6. **Manual bypass meter sockets** are encouraged but not required. If a manual bypass is installed, the bypass section shall be accessible to City Light.
7. **320 class meter sockets** may be used for services over 200 amperes and up to and including 400 amperes.
8. **Approved meter sockets** shall be installed on all residences in an accessible location either on an outside wall or on a free-standing pedestal, in accordance with the City Light publication *Requirements for Electrical Service Connection*.
9. For aid in determining the **proper type of meter socket and location**, contact your City Light Customer Service Representative at (206) 615-0600 north of Denny Way and (206) 386-4200 south of Denny Way.

Figure 1, Wall Mount



Standards Coordinator
Yaochiem Chao

Standards Supervisor
John Shippek

Unit Director
Darnell Cola

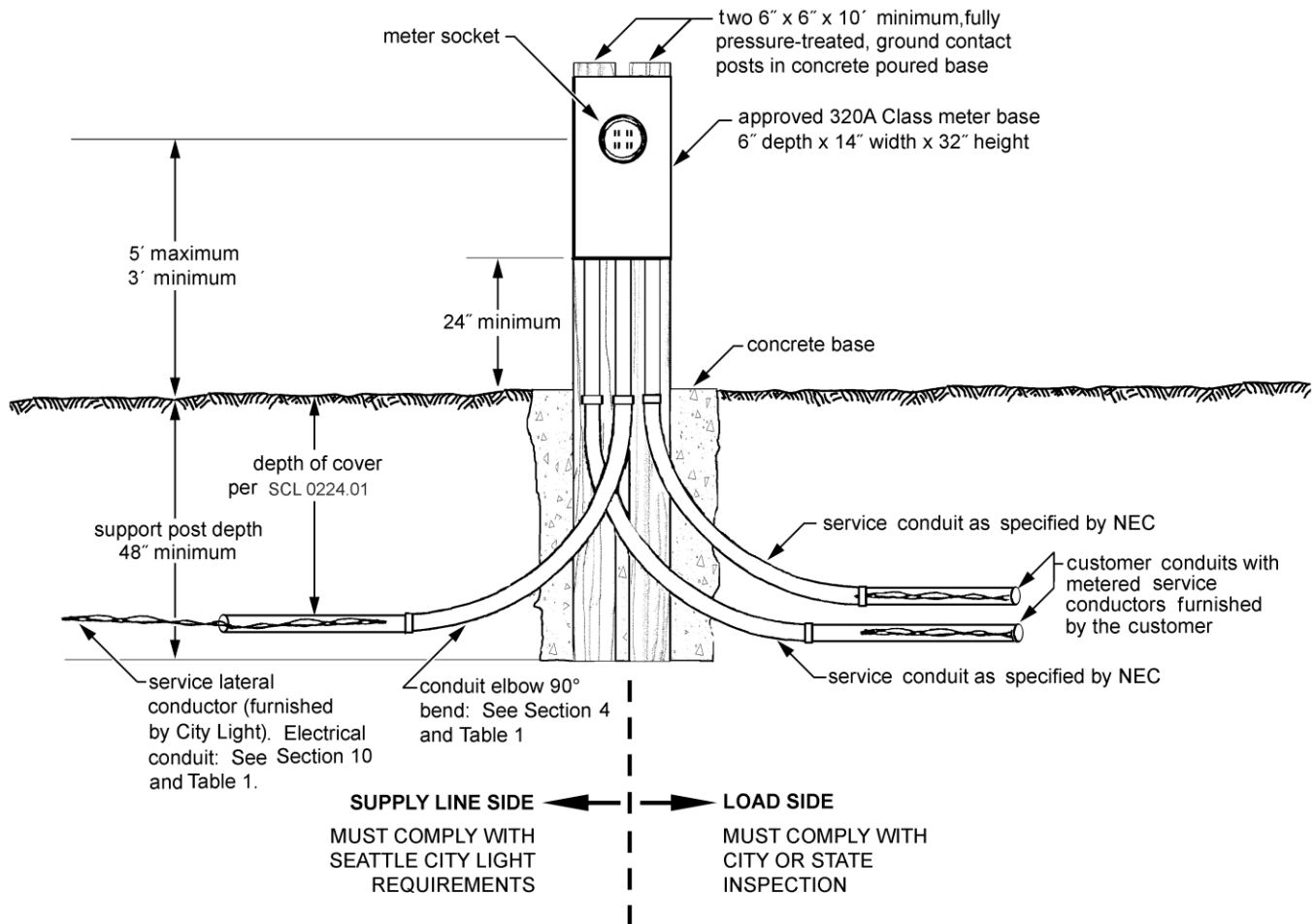
CONSTRUCTION GUIDELINE

Meter Location and Conduit Entrance Details for Secondary
Underground Residential Service, Class 320 Maximum

standard number: **U12-1.3/NMT-10**

superseding: October 1, 2008
effective date: December 15, 2016
page: 3 of 3

Figure 3, 320 A Single Phase Pedestal Mount



14. References:

0224.01, "Customer Requirements for Underground Secondary Service, Looped Radial System"; *Construction Standard*; SCL

0224.05, "Requirements for Underground Services on Private Property"; *Construction Standard*; SCL

0224.34, "Steel Conduit Risers"; *Construction Standard*; SCL

7015.05, "Schedule 40 PVC Conduit and Fittings"; *Material Standard*; SCL

7050.05, "Zinc-Coated Steel Conduit and Fittings"; *Material Standard*; SCL

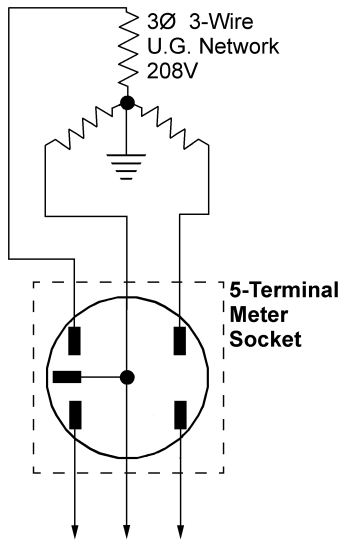
Detter, Chris; SCL Standards Engineer, subject matter expert and originator of U12-1.3/NMT-10 (chris.detter@seattle.gov)

EUSERC Drawing 300; Electric Utility Service Equipment Requirements Committee (EUSERC); 2007

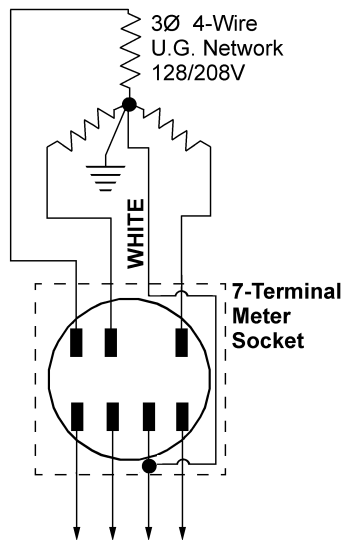
Requirements for Electrical Service Connection (RESC); SCL; January 26, 2007

U12-5/NMT-20, "Meter Socket Connections and Conductor Identification, 200 Ampere Maximum"; *Construction Guideline*; SCL

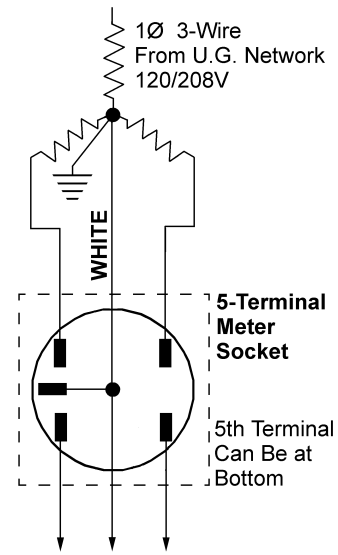
METER SOCKET CONNECTIONS AND CONDUCTOR IDENTIFICATION 200 AMPERE MAXIMUM



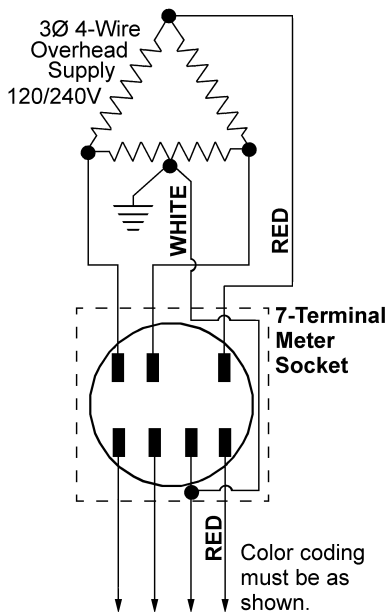
**3Ø 3-Wire
POWER LOAD**



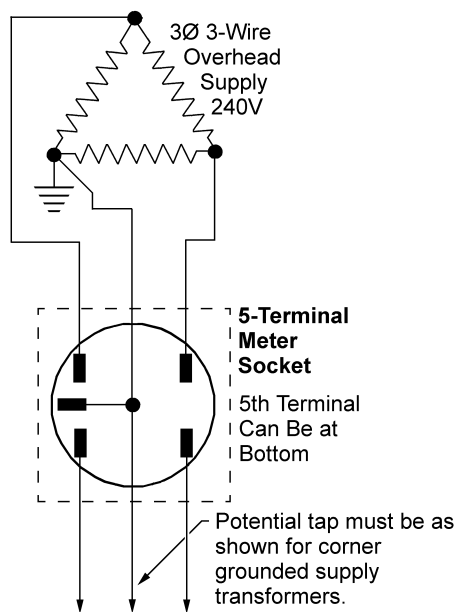
**3Ø 4-Wire
LIGHT & POWER LOAD**



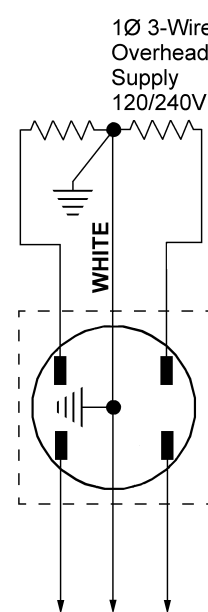
**3Ø 3-Wire
LOAD 120/208V**



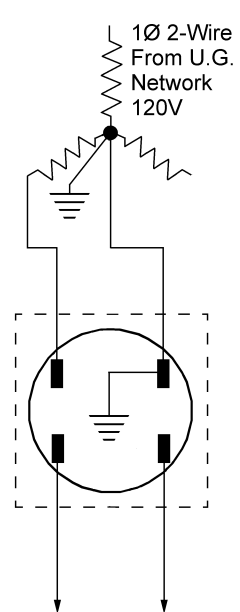
**3Ø 4-Wire
LIGHT & POWER LOAD**



**3Ø 3-Wire
POWER LOAD
(grounded at one corner)**



**1Ø 3-Wire
LOAD 120/240V**



**1Ø 2-Wire
LOAD 120**

ORIGINATOR

STANDARDS COORDINATOR

STANDARDS SUPERVISOR

UNIT DIRECTOR

MATERIAL STANDARDstandard number: **6103.90**superseding: June 11, 2010
effective date: December 8, 2011
page: 1 of 2**WIRE, COPPER, BARE, SOFT-DRAWN****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:

Stock Number	Size, AWG/kcmil	Packaging
610434	#2	reel
610425	2/0	reel
610414	4/0	reel
610412	250	reel
610397	500	reel

2. Application

For grounding, jumpers, and other general use.

3. Industry Standards

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

ASTM B3-01 – Standard Specification for Soft or Annealed Copper Wire, 2001

ASTM B8-04 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft, 2004

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

Stock Number	Size, AWG/kcmil	Number of Strands	Class
610434	#2	7	B
610425	2/0	7	A
610414	4/0	19	B
610412	250	37	B
610397	500	37	B

5. Packaging**5.1 Quantity**


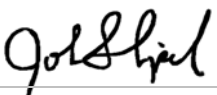

Actual quantity per reel may vary from the quantity stated on the Purchase Order by plus or minus 10%.

5.2 Reels

Reels shall be reusable wood type, Class 1 or 2.

Reels may be new or recycled.

Recycled reels (when provided) shall have the surface of both outside flanges painted over with a solid color.

standards coordinator	standards supervisor	unit director
 John Shipek	 John Shipek	 Darnell Cola

MATERIAL STANDARD

Wire, Copper, Bare, Soft-Drawn

standard number: **6103.90**

superseding: June 11, 2010

effective date: December 8, 2011

page: 2 of 2

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 inner end shall not be brought out through the reel arbor.

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

Stock Number	Size, AWG/ kcmil	Length per Reel ± 10%, ft	Outside Flange Diameter, Maximum, in	Inside Traverse Width, Maximum, in	Weight per 100 ft., Approx., lbs	Weight per Reel, Approx., lbs
610434	#2	5,280	40	24	021	1,108
610425	2/0	5,280	40	24	041	2,165
610414	4/0	3,450	40	24	65	2,243
610412	250	3,000	40	24	77	2,310
610397	500	1,500	40	24	154	2,310

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:**

Stock No.	Description	Hubbell	Eritech	Galvan Industries, Inc.	Southern Grounding Products	Wilcor
564235	5/8-in x 5-ft ground rod	—	635850	6255-10MS	CS 586	WA 585CT
564238	5/8-in x 8-ft ground rod	C635880	635880	6258S	CS 588	WA 588CT
564260	3/4-in x 10-ft ground rod	C633400	633400	7510S	CS 3410	WA 3410CT
564074	5/8-in coupling	CTC58	CR-58	60-C	58C	C 158
564075	3/4-in coupling	CTC34	CR-34	70-C	34C	C 134
564604	5/8-in driving stud	CTDH58	DS58	60-DS	DS 58	D 358
013282	3/4-in driving stud	CTDH34	DS34	70-DS	DS 34	D 334

In October 2015, this standard was renumbered from 5642.10 to 6762.25.

Standards Coordinator
Laura Vanderpool

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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.

A handwritten signature in black ink, appearing to read 'Quan Wang'.

A handwritten signature in black ink, appearing to read 'John Shipek'.

A handwritten signature in black ink, appearing to read 'Darnell Cola'.

3. Industry Standards

Schedule 40 PVC conduit and fittings shall meet the requirements of the following industry standard:

UL 651 - Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings, 7th Edition, dated October 4, 2005

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.

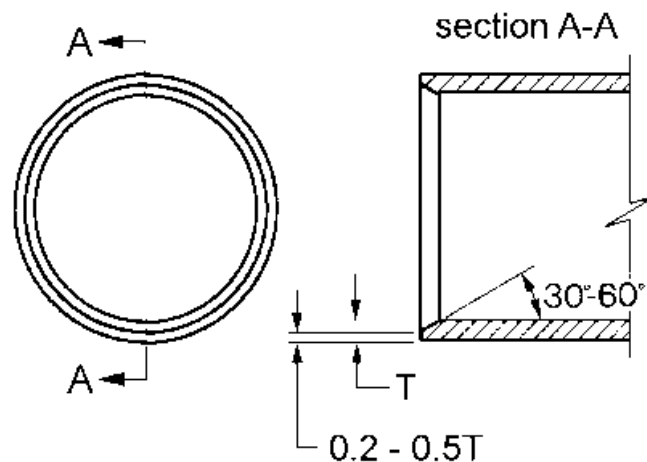
Conduit and fitting color shall be medium to dark gray.

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

Description	UL 651 Section
Tensile strength	7
Deflection under heat and load	8
Extrusion process	9
Low-temperature handling	10
Water absorption	11
Resistance to crushing	12
Resistance to impact	13
Flame	14
Conduit for use with 90 degree C wire	17
Resistance to specific reagents	18
Sunlight resistance	19
Pipe stiffness	20
Pull-joint separation	21
Bending and pull-joint separation	22
Joint water tightness	23
Elastomeric materials accelerated aging	24
Permanency of printing	25

Table 4.2b. Conduit Dimensions, Straight (str)

Stock No.	Trade Size, IPS (in)	End #1	End #2	Outside Diameter, Min (in)	Outside Diameter, Average, (in)	Outside Diameter, Max (in)	Inside Diameter, Min, Average (in)	Wall Thickness, Min (in)	Weight, Nominal, (lb / ft)
734525	1/2	Bell	Str cut	0.832	0.840	0.848	0.578	0.109	0.16
734526	3/4	"	"	1.040	1.050	1.060	0.780	0.113	0.22
734527	1	"	"	1.305	1.315	1.325	1.004	0.133	0.32
734528	1-1/4	"	"	1.648	1.660	1.672	1.335	0.140	0.43
734529	1-1/2	"	"	1.888	1.900	1.912	1.564	0.145	0.52
734530	2	"	"	2.363	2.375	2.387	2.021	0.154	0.70
734531	2-1/2	"	"	2.860	2.875	2.890	2.414	0.203	1.11
734532	3	"	"	3.485	3.500	3.515	3.008	0.216	1.45
734533	3-1/2	"	"	3.950	4.000	4.050	3.486	0.226	1.74
734523	4	"	"	4.450	4.500	4.550	3.961	0.237	2.10
734524	5	Str cu	"	5.513	5.563	5.613	4.975	0.258	2.80
010334	6	Bell	"	6.575	6.625	6.675	5.986	0.280	3.63



4.3 Elbows

Table 4.3a. Elbow Dimensions, 90 and 45 Degree

Stock No.	Trade Size, IPS (in)	Degree Bend	End #1	End #2	Radius (in)
734551	1/2	90	Bell	Str. cut	4
734671	3/4	90	"	"	4-1/2
734550	1	90	"	"	5-3/4
734546	1-1/4	90	"	"	7-1/4
734547	1-1/2	90	"	"	8-1/4
734548	2	90	"	"	24
734549	2-1/2	90	"	"	24
734553	1-1/4	45	"	"	7-1/4
734554	1-1/2	45	"	"	8-1/4
734555	2	45	"	"	18
734557	3	45	"	"	36
734558	3-1/2	45	"	"	36
734559	4	45	"	"	36



90-degree elbow



45-degree elbow

Table 4.3b. Elbow Dimensions, 22-1/2 and 5 Degree

Stock No.	Trade Size, IPS (in)	Degree Bend	End #1	End #2	Radius (in)
734561	2	22-1/2	Bell	Str. cut	18
734562	2-1/2	22-1/2	"	"	18
734563	3	22-1/2	"	"	24
734564	3-1/2	22-1/2	"	"	24
734566	4	22-1/2	"	"	24



22-1/2 degree elbow

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)

Stock No.	Trade Size, IPS (in)	Description	Ends
734508	1/2	Female adapter	S x F
734540	3/4	"	"
734541	1	"	"
734542	1-1/4	"	"
734543	1-1/2	"	"
734544	2	"	"
734545	2-1/2	"	"
734537	3	"	"
734538	3-1/2	"	"
734539	4	"	"
734536	5	"	"
010342	6	"	"
734920	1/2	Male adapter	S x M
734914	3/4	"	"
734918	1	"	"
734924	1-1/4	"	"
734925	1-1/2	"	"
734926	2	"	"
734921	3	"	"
734923	4	"	"
010341	6	"	"



Female adapter



Male adapter

Coupling fittings, 2 inch (IPS) and larger, shall be of molded manufacture, not expanded.

Table 4.4b. Fittings, Straight Couplings, Slip (S)

Stock No.	Trade Size, IPS (in)	Description	Ends
734512	1/2	Straight coupling	S x S
734513	3/4	"	"
734514	1	"	"
734515	1-1/4	"	"
734516	1-1/2	"	"
734517	2	"	"
734518	2-1/2	"	"
734519	3	"	"
734520	3-1/2	"	"
734521	4	"	"
734522	5	"	"
010343	6	"	"



Table 4.4c. Fitting, Swedge Reducer

Stock No.	End #1 Trade Size, IPS (in)	End #2 Trade Size, IPS (in)	Description	End #1	End #2
734470	3	2-1/2	Reducer	Chamfered Str. Cut	Chamfered Str. Cut
012503	4	3-1/2	Reducer	Chamfered Str. Cut	Chamfered Str. Cut



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)

Stock No.	Trade Size, IPS (in)	Description	Ends
013705	2	Long sleeve coupling	S x S
013706	3	"	"
013707	4	"	"
013708	5	"	"

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

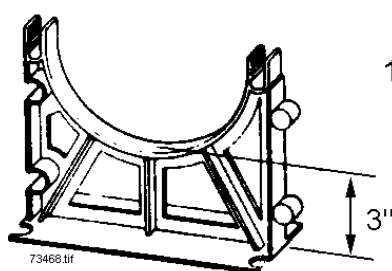
ASTM F 512; "Standard Specification for Smooth-Wall Poly Vinyl Chloride (PVC) Conduit and Fittings for Underground Installation"

ASTM F891; "Standard Specification for Coextruded Poly Vinyl Chloride (PVC) Plastic Pipe With a Cellular Core"

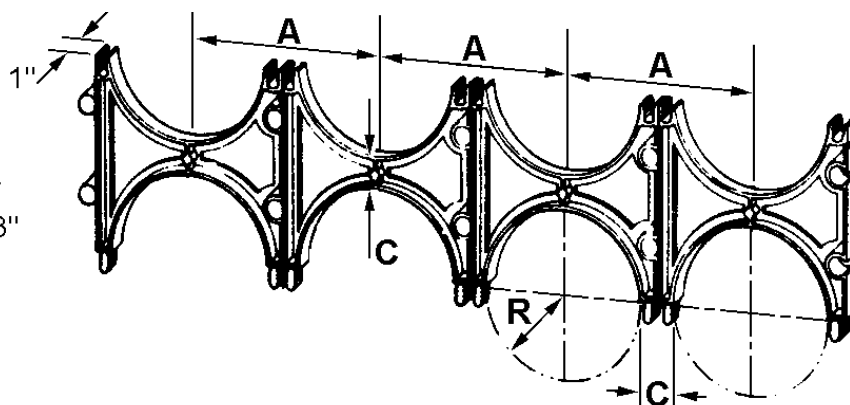
Shipek, John; SCL Standards Engineer, subject matter expert and originator of 7015.05 (john.shipek@seattle.gov)

Wang, Quan; SCL Standards Engineer and subject matter expert for 7015.05

Conduit Spacers for PVC and FG Conduit



Base Spacer
Figure 1



Intermediate Spacer
Figure 2

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.

Reference Specification: ASTM D4549, latest revision.

Stock Unit: EA

Stock Number	Figure Number	Nominal Conduit Size	Dimensions in Inches			Approved Manufacturers		
			A	C	R	CalAm	*GS Industries	Kraloy/lpex
intermediate	734669	3	5.6	2.0	1.8	4130-20	158-1	IV-3020
	734670	4	6.6	2.0	2.3	4140-20	124-1	IV-4020
	734680	5	7.9	2.0	2.9	4150-20	130-1	IV-5020
	010447	6	8.7	2.0	3.4	4160-20	134-1	IV-6020
base	010448	3	5.6	2.0	1.8	4030-20	159-1	BV-3020
	734690	4	6.6	2.0	2.3	4040-20	125-1	BV-4020
	734692	5	7.9	2.0	2.9	4050-20	131-1	BV-5020
	010446	6	8.7	2.0	3.4	4060-20	135-1	BV-6020

* 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.

ZINC-COATED STEEL CONDUIT AND FITTINGS**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 ERMCS. 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:

UL 6 - Standard for Electrical Rigid Metal Conduit - Steel, 14th Edition, dated November 30, 2007

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.

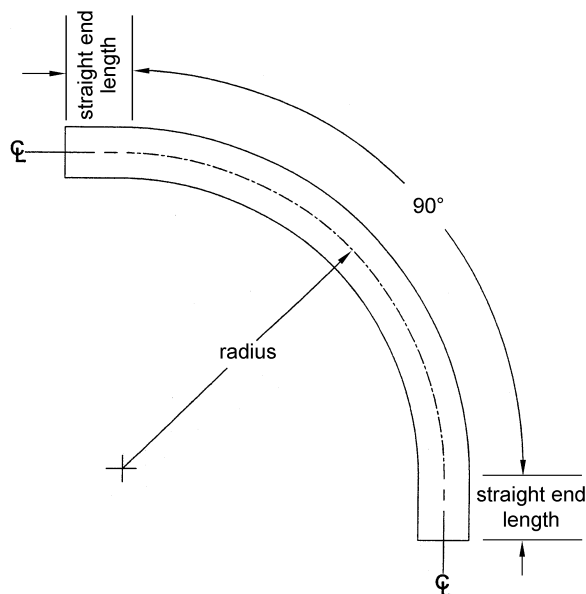
**Table 4.2. Conduit**

Stock No.	Trade Size (in)	Outside Diameter min (in)	Outside Diameter average (in)	Outside Diameter max (in)	Inside Diameter nom (in)	Wall Thickness nom (in)	Weight min (lbs / ft)
012085	1/2	0.825	0.840	0.855	0.632	0.104	0.79
012086	3/4	1.035	1.050	1.065	0.836	0.107	1.05
012087	1	1.300	1.315	1.330	1.063	0.126	1.53
734740	1-1/2	1.885	1.900	1.915	1.624	0.138	2.49
734741	2	2.351	2.375	2.399	2.083	0.146	3.32
734742	2-1/2	2.846	2.875	2.904	2.489	0.193	5.27
734743	3	3.465	3.500	3.535	3.090	0.205	6.82
734744	3-1/2	3.960	4.000	4.040	3.570	0.215	8.31
734745	4	4.455	4.500	4.545	4.050	0.225	9.27
734747	5	5.507	5.563	5.619	5.073	0.245	13.1

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

Stock No.	Trade Size (in)	Degree Bend	Radius (in)	Straight End Length (in)
734805	3/4	90	4-1/2	1-1/2
734806	1	"	5-3/4	1-7/8
734808	1-1/2	"	8-1/4	2
734809	2	"	9-1/2	2
734810	2-1/2	"	10-1/2	3

Table 4.3c. Large Sweep Elbows

Stock No.	Trade Size (in)	Degree Bend	Radius (in)	Straight End Length (in)
734820	2	90	36	11
734821	2-1/2	"	36	11
734822	3	"	36	11
734823	3-1/2	"	36	11
734824	4	"	36	11
012176	4	"	48	12
734826	5	"	60	12
013749	4	22-1/2	48	12
013750	4	45	48	12

Figure 4.3b. Standard Sweep Elbows**Figure 4.3c.** Large Sweep Elbows**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

Stock No.	Trade Size (in)
731091	1/2
731092	3/4
731093	1
731094	1-1/4
731095	1-1/2
731096	2
731097	2-1/2
731098	3
731099	3-1/2
731100	4
731102	5

Figure 4.4. Threaded Coupling

4. Detailed Requirements, continued**4.5 Nipple Stock**

Nipple stock shall be provided in three-foot lengths.

Table 4.5. Nipple Stock

Stock No.	Trade Size (in)	Threads per in
734868	1/2	14
734869	3/4	14
734870	1	11-1/2
734872	1-1/2	11-1/2
734873	2	11-1/2
734874	2-1/2	8

Figure 4.5. Nipple Stock**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	Shamrock
Cal Conduit Products	Steelduct
Conduit Pipe Products	Torrance
Occidental	Triangle
Picoma	Western
Republic	Wheatland

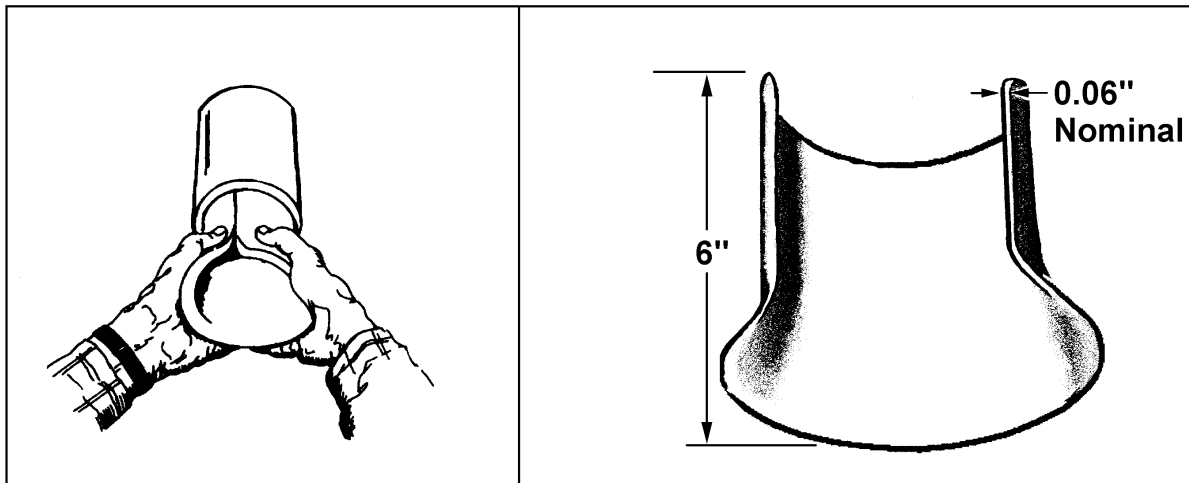
11. References

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)

Conduit Fitting, Cable Protector

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.

Reference Specification: ASTM D789, ASTM D1248, ASTM D635

Stock Unit: EA

Stock Number	Conduit Size (in)	Approved Manufacturers			
		Virginia Plastics	Anchor Industrial Plastics	Condux	Electrical Materials Co. (EMCO)
731800 E	2 to 2½	LG-225	APCP-2	80423-01	27-2 Grey
731801 E	3 to 6	LG-345	APCP-3	80423-00	27-1 Grey

In October 2015, this standard was renumbered from 7318.1 to 7050.09.

Standards Coordinator
Laura Vanderpool

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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

End Bells (see note 1)		Plugs (see note 2)	
Stock No.	Size, nominal (in)	Stock No.	Size, nominal (in)
734944	2	734938	2
734946	3	734940	3
734947	3-1/2	—	—
734948	4	734942	4
734949	5	734943	5
010340	6	010338	6

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

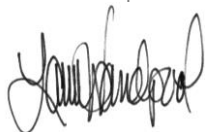
Approved adapter manufacturers: Carlon; J-M Manufacturing Inc.; Picoma; PW Eagle Inc., dba PWPipe; Raceways Tech.

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)

Standards Coordinator
Laura Vanderpool



Standards Supervisor
John Shippek



Unit Director
Darnell Cola



Fluidized Thermal Backfill



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:

Stock No.	Description	Unit
013711	High strength FTB	CYU
013712	Low strength FTB	CYU

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.

Standards Coordinator
Ponet Neuansourinh

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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 C136; Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

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

Criteria	Unit	Low Strength FTB		High Strength FTB		Testing Method
		Mix Design	Field Test	Mix Design	Field Test	
Thermal Resistivity						
Maximum at 0% Moisture Content	(°C-cm)/W	100	100	75	75	Consultant
Maximum at Critical Moisture Content	(°C-cm)/W	70	80	60	65	Consultant
Minimum 28-Day Compressive Strength	lb/sq-in	100	100	3000	3000	ASTM C873
Maximum 28-Day Compressive Strength	lb/sq-in	130	150	none	none	ASTM C873
Minimum Slump	in	6	6	6	6	ASTM C143
Maximum Slump	in	9	9	9	9	ASTM C143

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: Pozzolite 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

Supplier	Stock No. 013711		Stock No. 013712	
	High Strength FTB Mix ID	Expiration Date	Low Strength FTB Mix ID	Expiration Date
Salmon Bay Sand and Gravel	SCLHSFTB	3/30/2017	SCLLSFTB	3/30/2017
Stoneway Concrete (Plant 11)	SCLHSFTB	5/17/2017	SCLLSFTB	5/17/2017
Stoneway Concrete (Plant 14)	SCLHSFTB	5/17/2017	SCLLSFTB	5/17/2017
Cadman, Inc.	SCLHSFTB	3/30/2017	SCLLSFTB	7/28/2017
CalPortland	SCLHSFTB/505	6/15/2017	SCLLSFTB	9/9/2016

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)

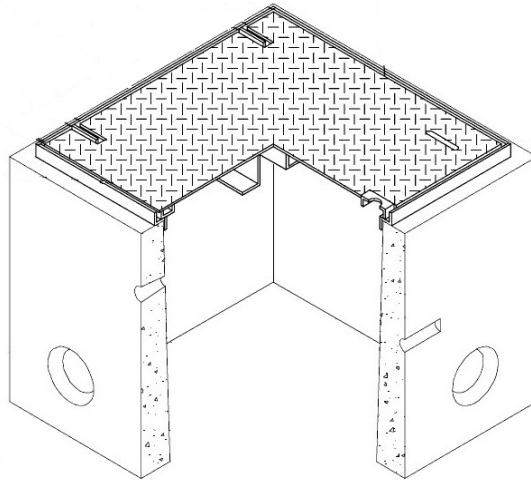
Read, Steven; SPU Materials Engineering Supervisor and subject matter expert for 7150.00 (steven.read@seattle.gov)

SCL Construction Standard 0226.06; "Fluidized Thermal Backfill"

SCL Design Standard 9266.06; "Understanding Fluidized Thermal Backfill" (*not yet published*)

Stewart, Bob; SCL Civil Inspector, subject matter expert and major contributor to 7150.00 (bob.stewart@seattle.gov)

3030 Handhole, Precast, Secondary



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.

Stock No.	Description
013186	3030 handhole base with frame and cover (labeled "Electric")
013187	3030 handhole, base only
013188	3030 handhole frame and cover assembly (labeled "Electric")

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."

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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)

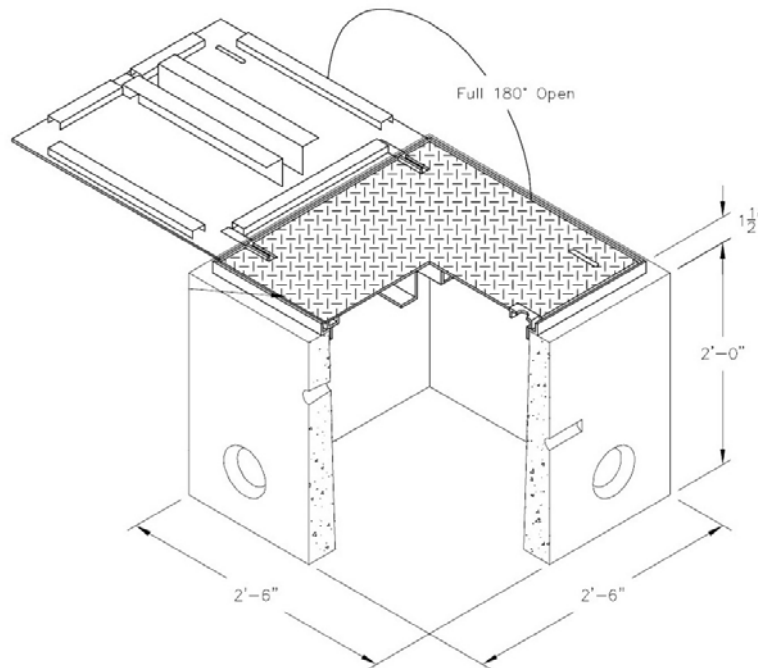
Stock No.	Item	Outside (in)			Inside (in)		
		Length	Width	Height	Length	Width	Cover Label
013186	Handhole base, frame and cover	30	30	25.5	24	24	ELECTRIC
013187	Handhole base only	30	30	24	24	24	-
013188	Frame and cover only	28	28	1.5	25	25	ELECTRIC

Table 4.2b. Handhole Features

Feature	Size, Nominal (in)	Location	Per Location	Total No.
Knockouts, round	5 dia	All 4 walls, on bottom	2 ea side	8
Lift Holes	1-1/2 dia	Upper center on 2 walls, opposite	1 ea side	2
Ground Inserts, bronze	1/4 dia	One wall, internal	1 ea side	1

Note: Approximate weight is 700 pounds.

Figure 4.2. 3030 Handhole



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.

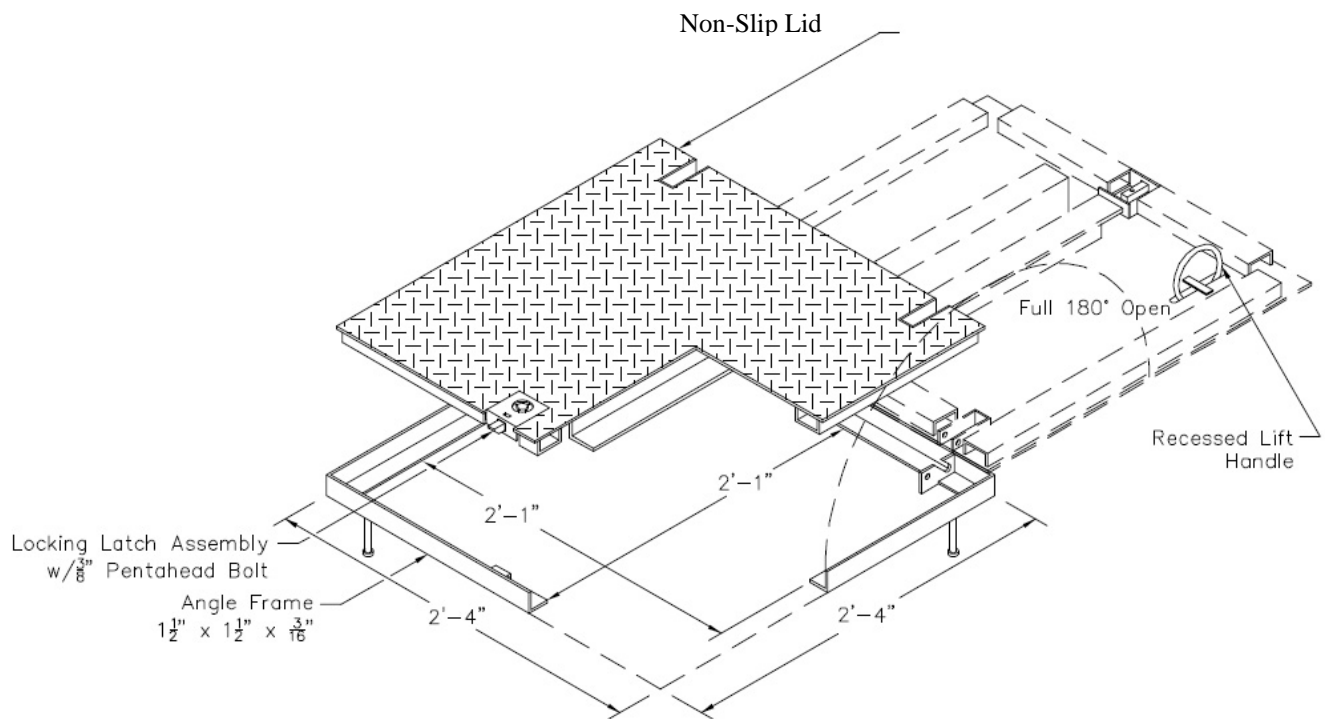
The cover and frame shall be made of slip resistant steel plate

The angle frame shall be securely anchored in the concrete.

Table 4.3. Frame and Cover Features

Non-Slip Surface, (COF)	0.8
Galvanizing	Hot-Dipped Galvanized
Load Rating	H-20
Grounding	Inserts or Lugs
Locking Device	Penta-Bolt Lock
Lift Handle	Recessed Lift Handle

Figure 4.3. 3030 Frame and Cover



5. Issuance

EA

6. Approved Manufacturer

Stock No.	Description	OldCastle Precast / Utility Vault
013186	3030 handhole base with frame and cover	3030 LA Handhole – Electric
013187	3030 handhole, base only	3030-B
013188	3030 handhole frame and cover	3030-No Slip Door – Electric w/ Locking Latch

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
http://www.seattle.gov/util/stellent/groups/public/@spu/@esb/documents/webcontent/spu01_003112.pdf

Standard Plan J-40.10-00; "Locking Lid Standard. Junction Box Types 1 & 2;"
Washington State Department of Transportation;
http://www.wsdot.wa.gov/publications/fulltext/Standards/4_09StdPlanmanual.pdf

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)

231 and 233 Handholes, Precast, Secondary and Streetlight, Detailed**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:

Stock No. 231 and 233 Handhole Components and Assemblies

013182	Base, 231 handhole
013183	Base, 233 handhole
013184	Cover with hatch, "Electric"
013185	Cover with hatch, "SL"
013484	Cover with hatch, "SL/TC"
013180	Assembly, 231 handhole base with cover, "Electric"
013181	Assembly, 231 handhole base with cover, "SL"
720388	Assembly, 233 handhole base with cover, "Electric"
013179	Assembly, 233 handhole base with cover, "SL"
013485	Assembly, 233 handhole base with cover, "SL/TC"

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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

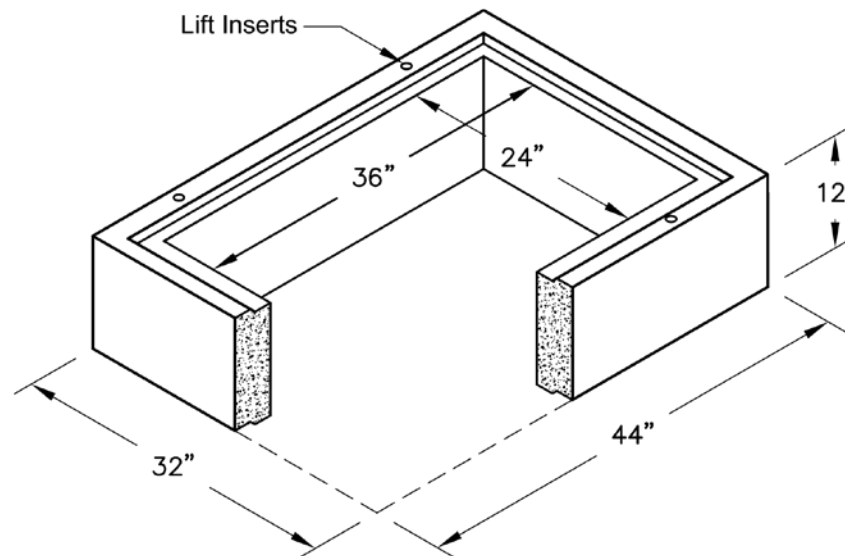
4.1 231 Handhole Base (Stock No. 013182)

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 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



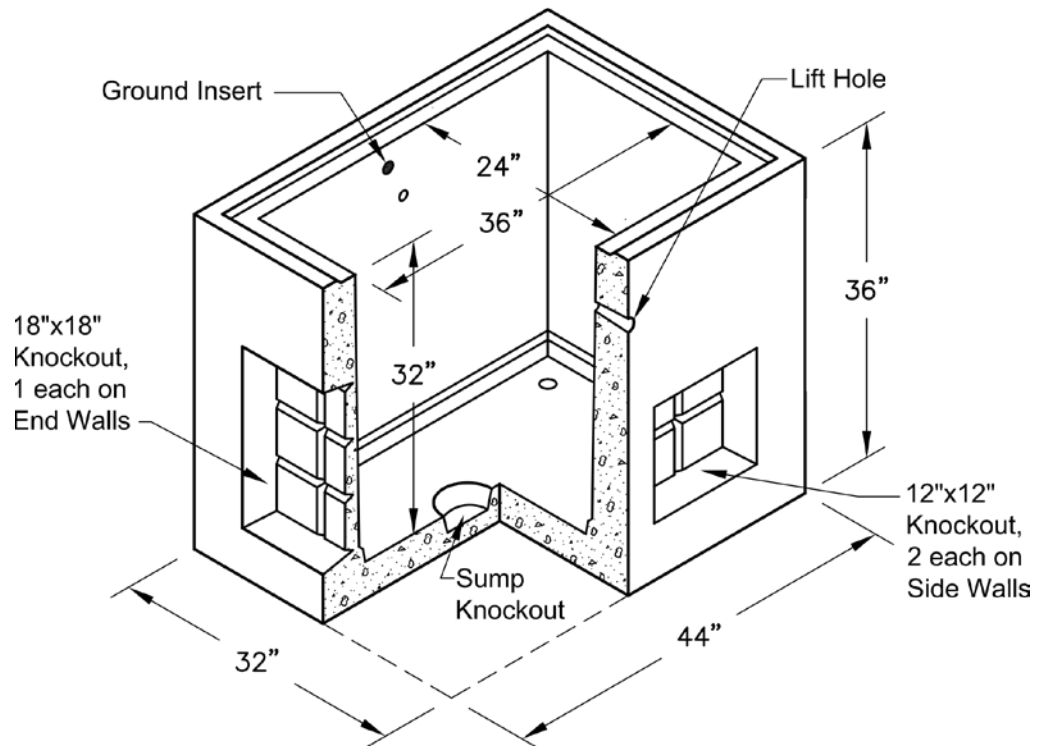
4.2 233 Handhole Base (Stock No. 013183)

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.

Figure 4.2. 233 Handhole Base



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

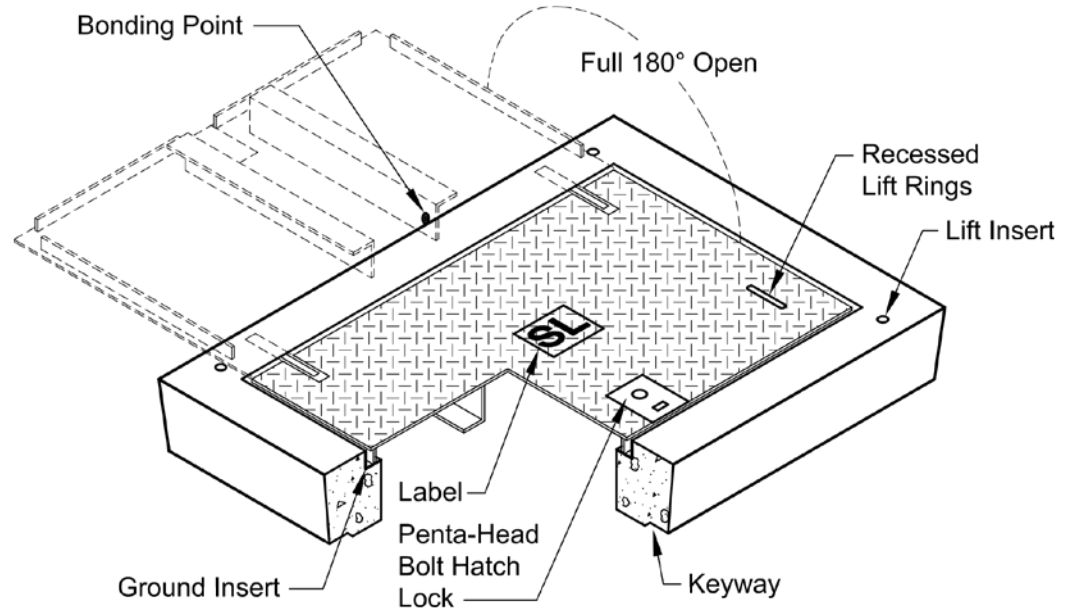


Table 5. Hatch Label

Stock No.	Label
013184	Electric
013185	SL
013484	SL/TC

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

Fig #	Stock No.	Assembly Description	Quantity				
4.1	013180	231 handhole base with cover, "Electric"					
4.1	013181	231 handhole base with cover, "SL"					
4.2	720388	233 handhole base with cover, "Electric"					
4.2	013179	233 handhole base with cover, "SL"					
4.2	013485	233 handhole base with cover, "SL/TC"					
	Stock No.	Material Description					
	013182	Base, 231 handhole	-	-	-	1	1
	013183	Base 233 handhole	1	1	1	-	-
	013184	Cover with hatch, "Electric"	-	-	1	-	1
	013185	Cover with hatch "SL"	-	1	-	1	-
	013484	Cover with hatch, "SL/TC"	1	-	-	-	-

7. Issuance

Unit: EA

8. Approved Manufacturers

Stock No.	Description	OldCastle Precast/ Utility Vault.	H2 Pre-Cast Inc.
013182	231 Handhole base	23R-12	VR233CL-12
013183	233 Handhole base	233 – LA Base	VR233CL
013184	Cover , with hatch, "Electric"	23-2436F Cover w/ ID Marker "Electric"	VR233-2436SN-ELECTRIC
013185	Cover with hatch, "SL"	23-2436F Cover w/ ID Marker "SL"	VR233-2436SN-SL
013484	Cover with hatch, "SL/TC"	23-2436F Cover w/ ID Marker "SL/TC"	VR233-2436SN-SL/TC
013180	231 handhole base with cover, "Electric"	Type 3 Handhole – SCL – "Electric"	TYPE 3 HANDHOLE-SCL- "ELECTRIC"
013181	231 handhole base with cover, "SL"	Type 3 Handhole –SCL – "SL"	TYPE 3 HANDHOLE-SCL-"SL"
720388	233 handhole base with cover, "Electric"	233 Handhole – SCL – "Electric"	233 HANDHOLE-SCL- "ELECTRIC"
013179	233 handhole base with cover, "SL"	233 Handhole – SCL – "SL"	233 HANDHOLE-SCL-"SL"
013485	233 handhole base with cover, "SL/TC"	233 Handhole – SCL – "SL/TC"	233 HANDHOLE-SCL-"SL/TC"

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@seattle.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.

Stock No.	Description
012945	Type 1 handhole, with frame and cover labeled "S/L"
720391	Type 2 handhole, with frame and cover, "ELECTRIC"
013178	Type 2 handhole, with frame and cover, "S/L"
012978	Type 2 handhole, with frame and no cover
720402	Type 2 handhole stacking riser, without frame or cover
012660	Type 2 handhole cover, labeled "ELECTRIC"
012979	Type 2 handhole cover, labeled "S/L"

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.

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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 A123/A123M - 08; "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings
on Iron and Steel Products;" ASTM

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 C39 / C39M - 12; "Standard Test Method for Compressive Strength of Cylindrical
Concrete Specimens;" 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:

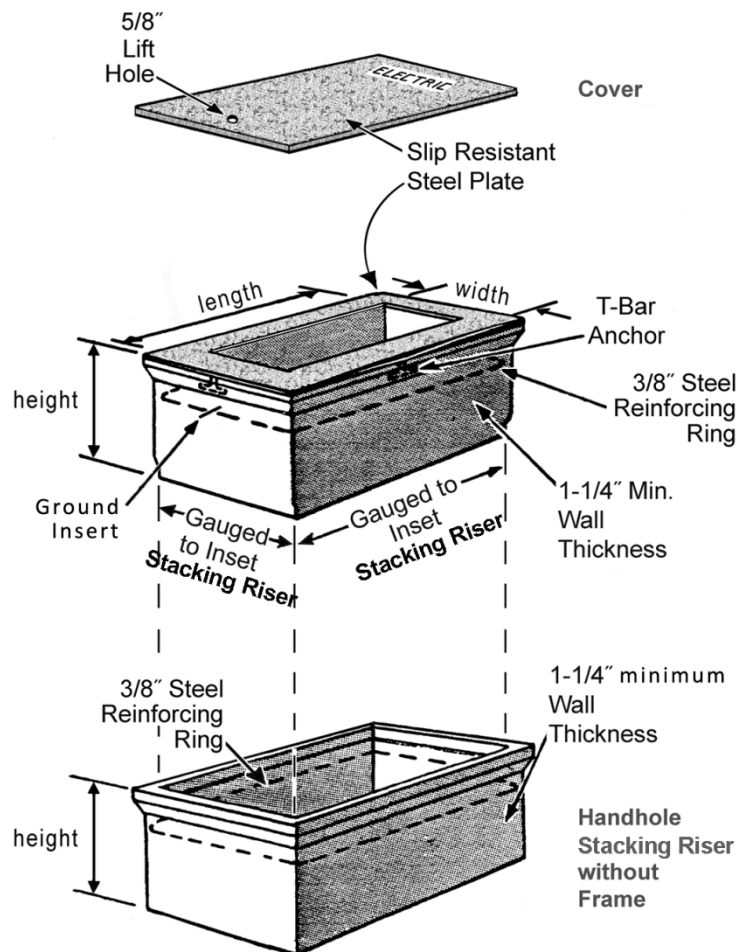
- Seattle City Light Purchase Order (PO)
- Seattle City Light General Terms and Conditions
- This material standard
- Other industry standards

5. Construction

The handhole shall meet Washington State Department of Transportation Standard Plan J-40.10 with the following clarifications.

Stock No.	Item	Type	Dimensions, nominal (in)					Cover Label
			Inside Length	Inside Width	Outside Length	Outside Width	Height/ Thickness	
012945	Handhole with frame	1	19	14	—	—	12	—
	Cover	1	—	—	17	13	5/16	"SL"
720391	Handhole with frame	2	28	17	—	—	12	—
	Cover	2	—	—	26-5/8	16-1/2	5/16	"ELECTRIC"
013178	Handhole, with frame	2	28	17	—	—	12	—
	Cover	2	—	—	26-5/8	16-1/2	5/16	"SL"
012978	Handhole with frame	2	28	17	—	—	12	—
720402	Stacking riser	2	—	—	28	17	12	—
012660	Cover only	2	—	—	26-5/8	16-1/2	5/16	"ELECTRIC"
012979	Cover only	2	—	—	26-5/8	16-1/2	5/16	"SL"

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

Stock No.	Manufacturers	Catalog Numbers
012945	Fog-Tite	J-11 Type 1, with non-skid cover, "SL"
	H2-Pre-Cast Inc	WDOT Type 1 Box with Cover – Galvanized, Non-Slip, "SL"
720391	Fog-Tite	J-11 Type 2 , with non-skid cover, "Electric"
	H2-Pre-Cast Inc	WDOT Type 2 Box with Cover – Galvanized, Non-Slip, "Electric"
013178	Fog-Tite	J-11 Type 2 , with non-skid cover, "S/L"
	H2-Pre-Cast Inc	WDOT Type 2 Box with Cover – Galvanized, Non-Slip, "SL"
012978	Fog-Tite	J-11 Type 2 bottom
	H2-Pre-Cast Inc	WDOT Type 2 Box - Galvanized
720402	Fog-Tite	J-11 Type 2 ext.
	H2-Pre-Cast Inc	WDOT Type 2 riser
012660	Fog-Tite	J-11 Type 2 with non-skid cover, "Electric"
	H2-Pre-Cast Inc	WDOT Type 2 Cover - Galvanized, Non-Slip, "Electric"
012979	Fog-Tite	J-11 Type 2 non-skid cover, "SL"
	H2-Pre-Cast Inc	WDOT Type 2 Cover - Galvanized, Non-Slip, "SL"

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)

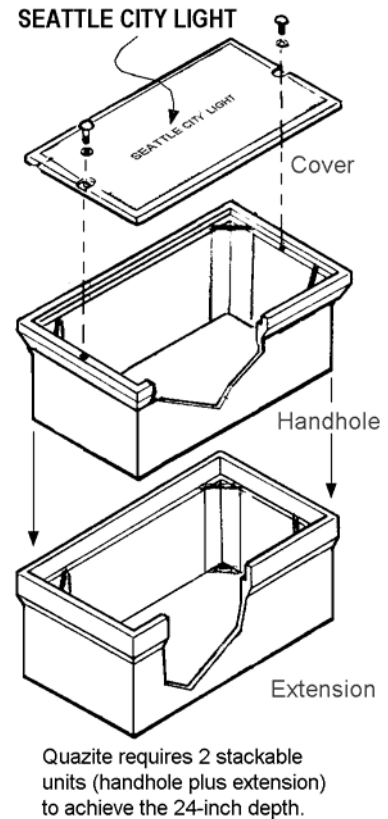
MATERIAL STANDARD

**HANDHOLE, 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.
- 6. Reference Specification.** Western Underground Committee, Guide 3.6, latest revision.
- 7. Stock Unit:** EA



Stock No.	Item	Description	Approved Manufacturers		
			Carson Ind.	Electrimold	Quazite
720393*	Handhole	17" x 30" x 12" or 24-26"	H1730-24	ECBA-173024 DO-EH	PC1730BA
720397	Cover	17" x 30" x 3/4" or 2"	H1730-P1	ECCA-173002 DO-EH	PC1730CA
720394	Handhole	24" x 36" x 18"	H2436-24	ECBA-243618 DO-EH	PG2436BA
720399	Cover	24" x 36" x 2" or 3"	H2436-P1	ECCA-243603 DO-EH	PG2436CA

* Quazite requires two PC1730BA sections for the 24-inch depth and for the City Light stock number.

formerly Material Standard 7203.10.1

STANDARDS COORDINATOR

Rick Rice

STANDARDS SUPERVISOR

John Barnett

UNIT DIRECTOR

Hardev Juj

444 ELECTRIC VAULT, PRIMARY SERVICE



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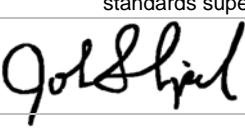
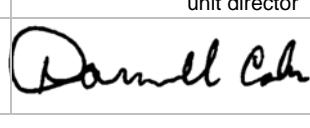
2. Scope

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:

Stock Number	444 Vault Components
013093	vault base , standard 444
013094	cover slab , 4- by 4-foot slab with one 3-by 3-foot, non-slip, H-20, solid cover hatch
013095	cover slab , 4- by 4-foot slab with one 42-inch round, solid cover and frame, H-20
013157	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

Stock Number	Assembled 444 Vaults with Cover Slabs
013120	assembled 444 vault with 4- by 4-foot cover slab with one 3-foot by 3-foot, non-slip, H-20, solid cover hatch
013121	assembled 444 vault with 4- by 4-foot cover slab with one 42-inch round, solid cover and frame, H-20
013158	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

standards coordinator	standards supervisor	unit director
 Quan Wang	 John Shipek	 Darnell Cola

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

Stock Number	Nominal Dimensions, ft-in					
	Wall, Outside		Wall, Inside		Height	
	Length	Width	Length	Width	Outside	Inside
013093	4-0	4-0	3-6	3-6	3-6	3-3

MATERIAL STANDARD

444 Electric Vault, Primary Service

standard number: **7203.26**

superseding: June 29, 2012

effective date: June 7, 2013

page: 3 of 6

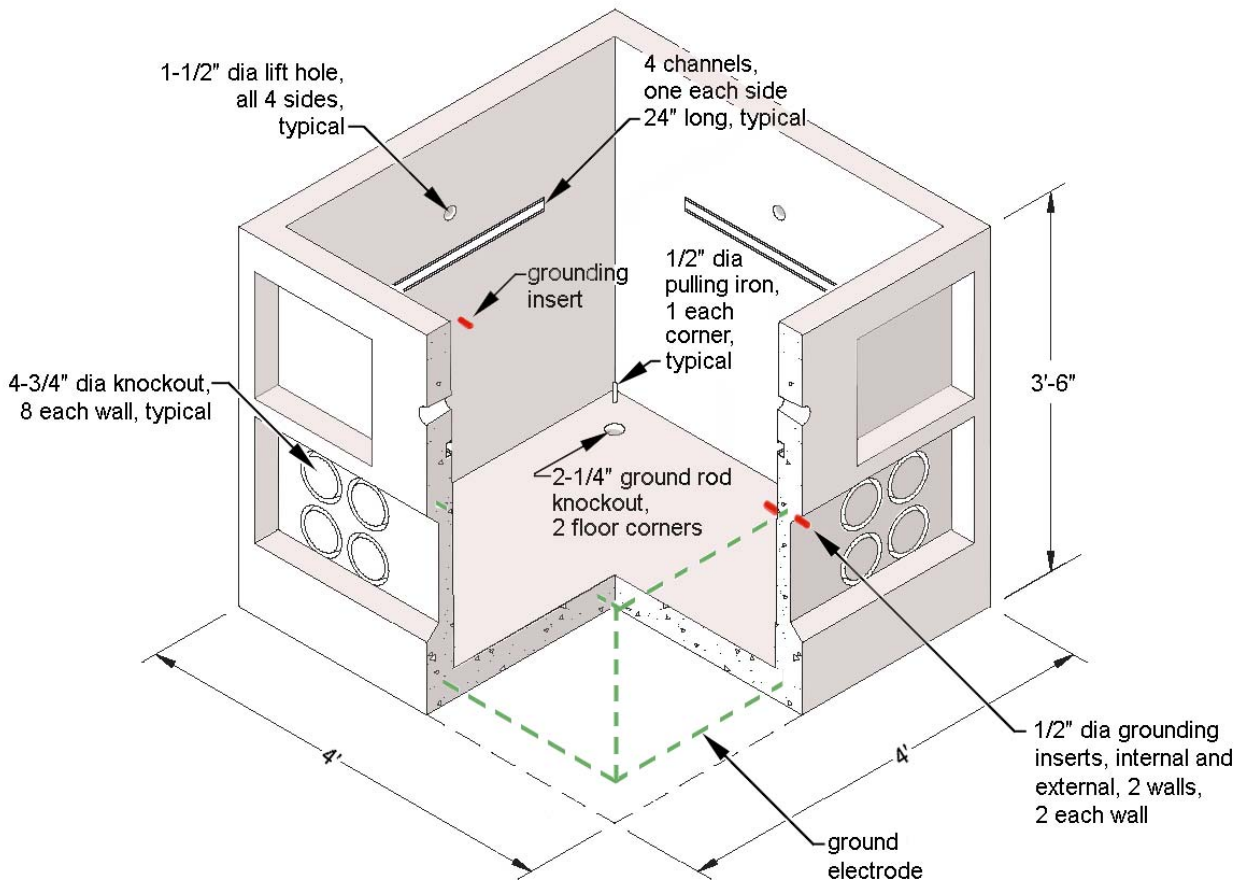
5. Component Requirements, continued**5.2 Vault Base, continued****Table 5.2b, Vault Base Attributes**

All Standard 444 Vault Bases Shall Have the Following Features:

	Size, Nominal, in	Location	Per Location	Total Number
Knockouts				
round	4-3/4 dia	all 4 walls, on bottom	8 ea side	32
ground rod	2 dia	2 corners of floor	1 ea	02
Channels				
galvanized "C" channel, horizontal, embedded in walls	24 long	all walls, above all knockouts	1 ea side	04
Pulling Irons	1/2 dia	1 ea corner of floor (typical)	1 ea corner	04
Lift Holes	1-1/2 dia	4 walls, center of wall, above channel	1 ea side	04
Ground Inserts, bronze	1/2 dia	2 walls, opposite, internal and external	2 ea side	04
Ladder		not required		

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 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

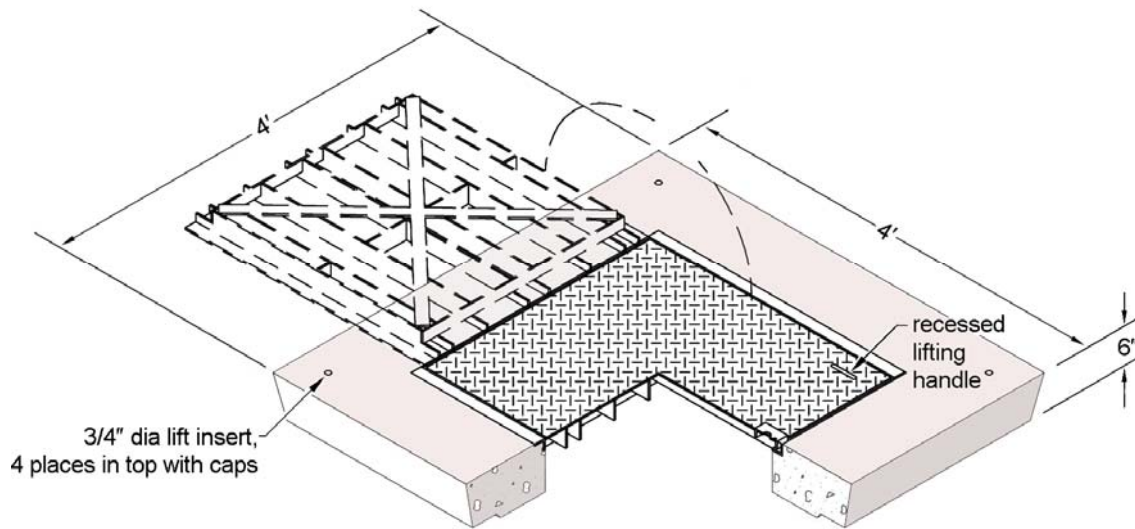


Table 5.3, Cover Slab

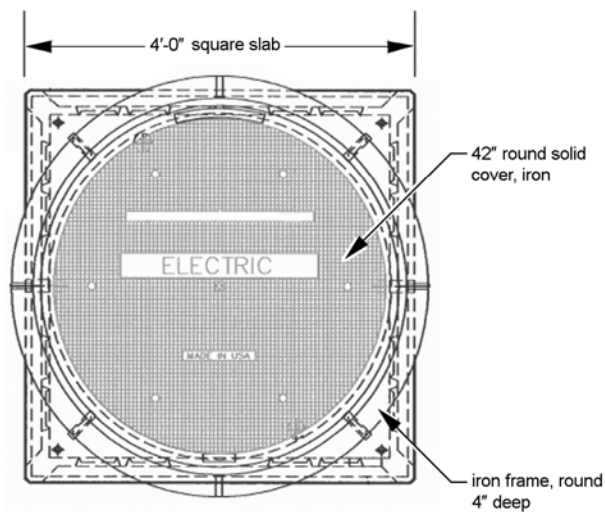
Stock Number	Cover Slab Dimensions, Nominal, ft-in			Opening, in	Cover/Hatch
	Length	Width	Thickness		
013094	4-0	4-0	0-6	36 by 36, square	one 3- by 3-foot, non-slip, solid cover hatch, H-20
013095	4-0	4-0	0-6	38, dia, round	one 42-inch round, solid cover and frame, H-20
013157	4-4	4-7	0-6	36 by 36, square	one 36- by 36-inch, non-slip, solid cover hatch, H-30

5. Component Requirements, continued**5.3 Cover Slab, continued**

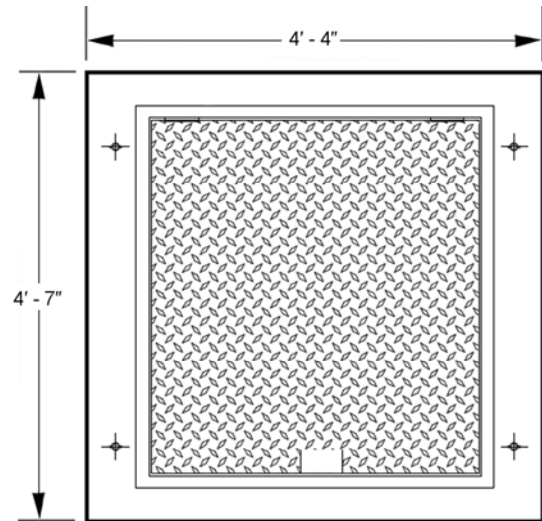
4-Foot, 8-inch Square Cover Slabs, dimensions shown are nominal values

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**

Assembled Vault Stock Number	Vault Base Stock Number	Cover Slab Stock Number	Cover
013120	013093	013094	H-20 solid square hatch, 3- by 3-foot
013121	013093	013095	H-20 solid round, 42-inch
013158	013093	013157	H-30 solid square hatch, 3- by 3-foot

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.

MATERIAL STANDARD

444 Electric Vault, Primary Service

standard number: **7203.26**

superseding: June 29, 2012

effective date: June 7, 2013

page: 6 of 6

7. Issuance

Unit: EA

8. Approved Manufacturers

Stock Number	Description	Catalog Number
		Oldcastle/Utility Vault
013093	standard base	444-LA Base w/ Iron and GRD In & Out
013094	cover slab , 4-foot by 4-foot cover slab with one 3- by 3-foot, non-slip solid cover	44-33F Cover w/ I.D. Marker
013095	cover slab , 4- by 4-foot slab with one 42-inch round, solid cover and frame, H-20	44-38C Cover w/ I.D. Marker with 42" Cover & Frame
130157	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	Oversized Special 44 Top w/3636 LW Hatch
013120	assembled vault with 4-foot by 4-foot cover slab with one 3-foot by 3-foot, non-slip, H-20, solid cover hatch	444-LA Base w/ Iron and GRD In & Out w/332P Non-Slip-SCL
013121	assembled vault with 4-foot by 4-foot cover slab with one 42-inch round, solid cover and frame, H-20	444-LA Base w/ Iron and GRD In & Out w/42" Cover & Frame-SCL
013158	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	444-LA Base w/ Iron and GRD In & Out w/ Oversized Special 44 Top w/3636 LW Hatch

9. References

Detter, Chris; SCL Distribution Engineer, subject matter expert for 7203.26 (chris.detter@seattle.gov)

Ng, Sharon; SCL Civil Engineer, subject matter expert for 7203.26 (sharon.ng@seattle.gov)

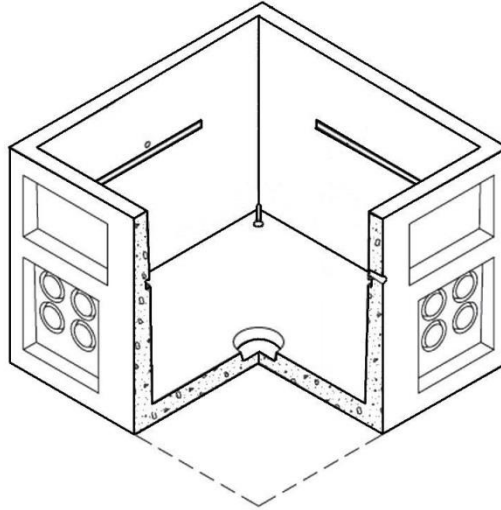
SCL 7203.21; "Precast Reinforced Concrete Structure, General"; Material Standard

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)

504 Electric Vault, Primary Service



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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.

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

This standard applies to the following Seattle City Light (SCL) stock numbers:

Stock No.	Description
013096	Base , standard 507
013097	Cover with hatch, H-20
013098	Cover with 42-in round solid hatch and frame, H-20
013159	Cover with solid hatch, H-30
013122	Assembly , base and cover with solid hatch, H-20
013123	Assembly , base and cover with 42-in round solid hatch and frame, H-20
013160	Assembly , base and cover with solid hatch, H-30

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

	Size, Nominal (in)	Location	Per Location	Total Number
Knockouts				
Round	4-3/4 dia	All 4 walls, on bottom	8 ea side	32
Ground rod	2 dia	2 corners of floor	1 ea	02
Channels				
Galvanized "C" channel, horizontal, embedded in walls	36 length	All walls, above all knockouts	1 ea side	04
Sump	12 dia	Floor, center	1, to one side	01
Pulling Irons	1/2 dia	1 ea corner of floor (typical)	1 ea corner	04
Lift Holes	1-1/2 dia	2 walls, center of wall, above channel, opposite	1 ea side	02
Ground Inserts , bronze	1/2 dia	2 walls, opposite, internal and external	2 ea side	04
Ladder	—	Not required	—	—

Base shall have dimensions as shown in Tables 5.2b and 5.2c, and Figure 5.2.

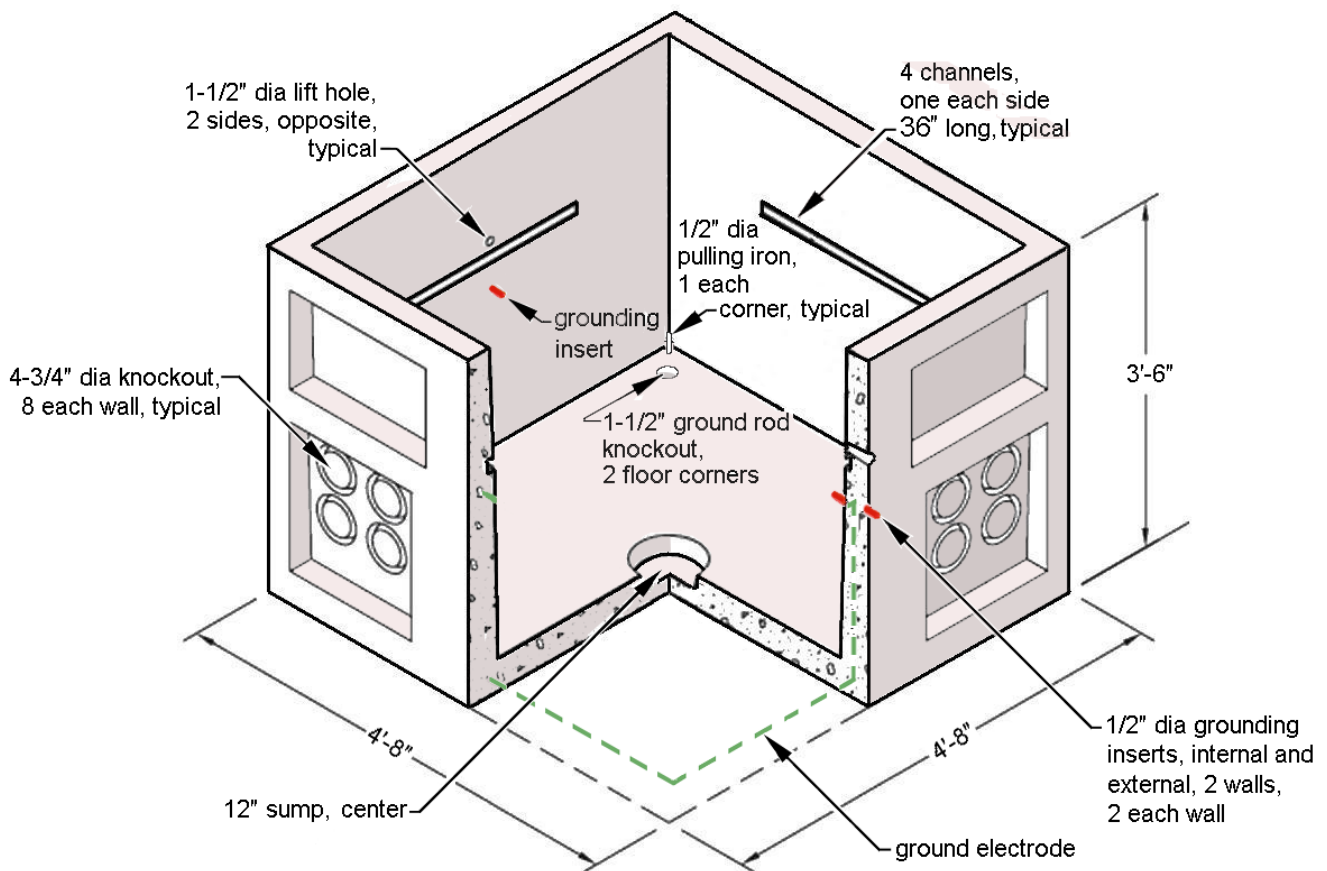
Table 5.2b. Base Dimensions, Inside, Nominal (ft-in)

Length	Width	Height
4-2	4-2	3-2

Table 5.2c. Base Dimensions, Outside, Nominal (ft-in)

Length	Width	Height
4-8	4-8	3-6

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

Figure 5.3a. Cover with Hatch

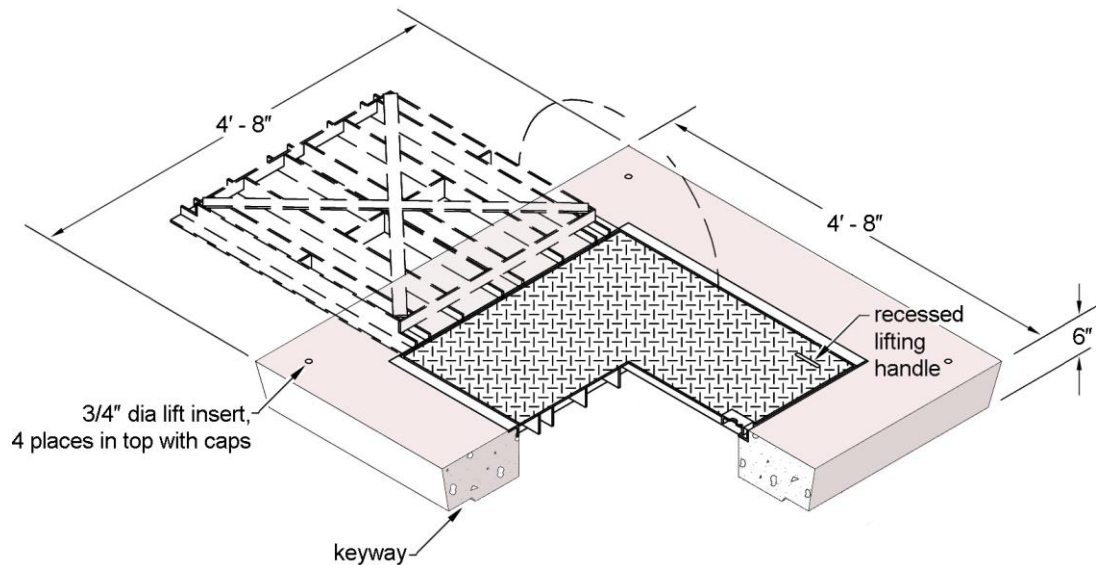


Table 5.3. Cover Dimensions, Nominal

Stock No.	Concrete Collar (ft-in)			Opening (in)	Hatch
	Length	Width	Thickness		
013094	4-8	4-8	0-6	36 x 36	Solid, H-20
013095	4-8	4-8	0-6	42 dia, round	42-in round, solid, H-20
013159	4-8	4-8	0-6	36 x 36	Solid, H-30

Figure 5.3b. Cover with 42-Inch Round Hatch

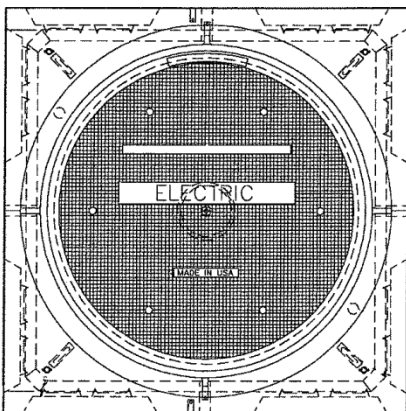
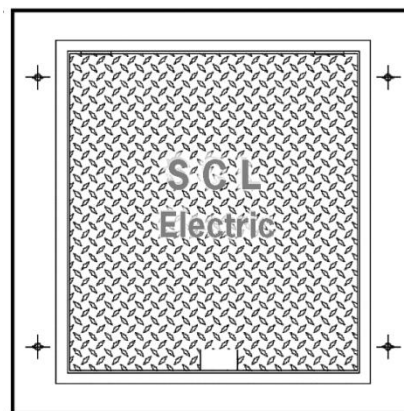


Figure 5.3c. Cover with H30 Hatch



6. Issuance

Unit: EA

7. Approved Manufacturers

Stock No.	Description	Oldcastle/Utility Vault Catalog No.
013096	Base , standard 504	504-LA Base w/ Iron and GRD In & Out
013097	Cover with hatch, H20	55-332p Cover w/ I.D. Marker
013098	Cover with 42-in round solid hatch and frame, H-20	55-42C Cover w/ I.D. Marker and 42" Cover & Frame
013159	Cover with solid hatch, H-30	55-w/3437 LW Hatch Cover w/ I.D. Marker
013122	Assembly , base and cover with solid hatch, H-20	504-LA Base w/ Iron and GRD In & Out w/332P Non-Slip-SCL
013123	Assembly , base and cover with 42-in round solid hatch and frame, H-20	504-LA Base w/ Iron and GRD In & Out w/42" Cover & Frame-SCL
013160	Assembly , base and cover with solid hatch, H-30	504-LA Base w/ Iron and GRD In & Out w/3437 LW Non-Slip-SCL

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

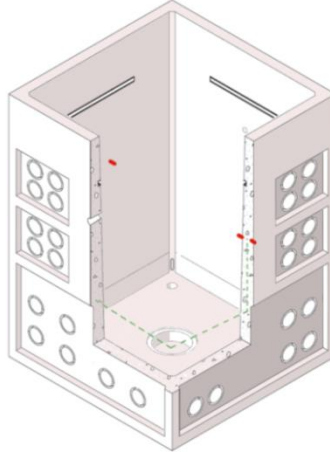
Detter, Chris; SCL Distribution Engineer and subject matter expert for 7203.31
(chris.detter@seattle.gov)

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)

507 Electric Vault, Primary Service



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:

Stock No.	Description
013101	Base , standard 507
013102	Cover with hatch
013124	Assembly (base and cover with hatch)
013688	Cover with 42-in blockout
013169	Assembly (base and cover with 42-in blockout)

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

	Size, Nominal (in)	Location	Per Location	Total Number
Knockouts				
Round	4-3/4 dia	All 4 walls, on bottom	8 ea side	32
Round	4-3/4 dia	4 panels of 4 on middle of all walls	16 ea side	64
Ground rod	2 dia	2 corners of floor	1 ea	2
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.

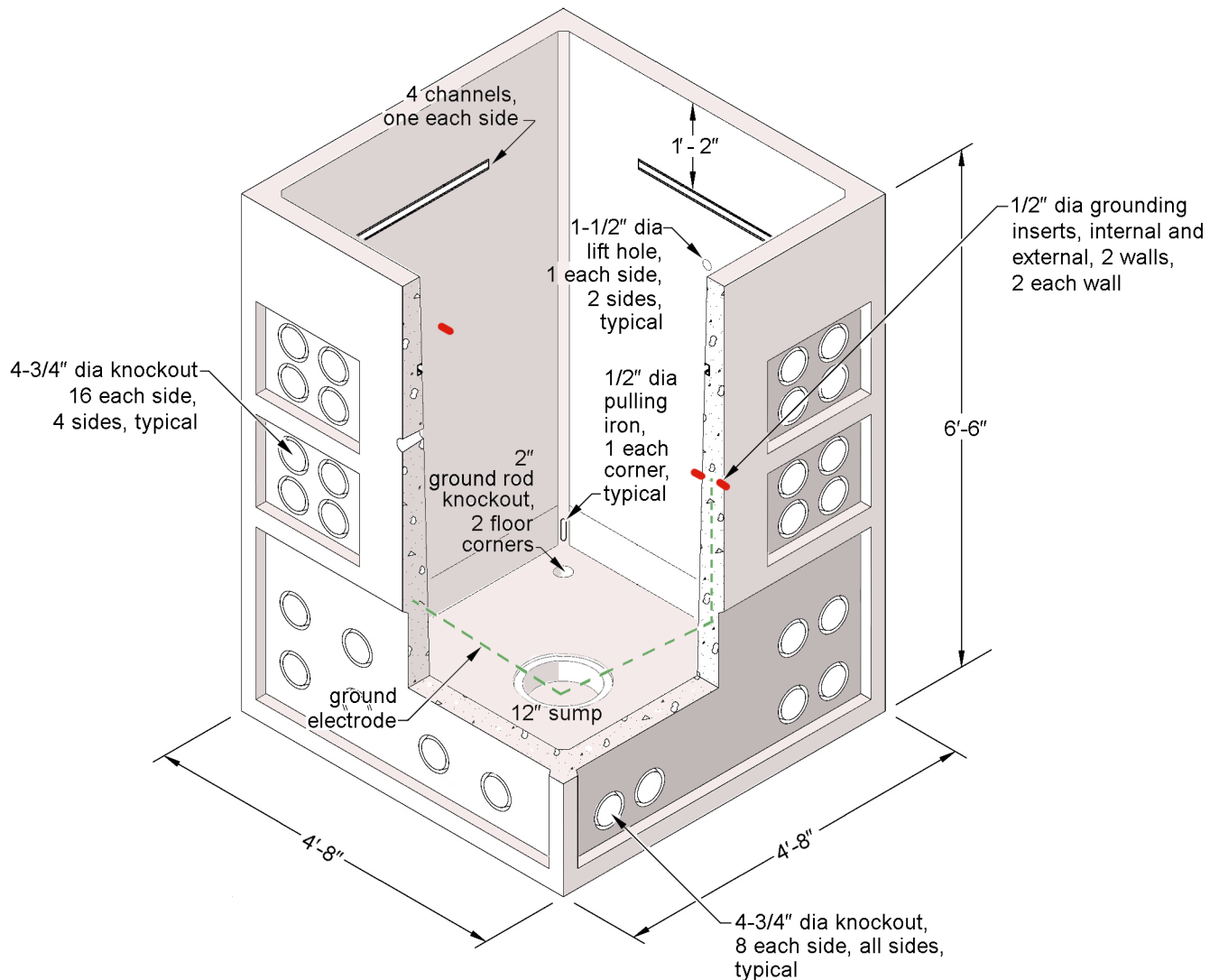
Table 4.2b. Base Dimensions, Inside, Nominal (ft-in)

Length	Width	Height
4-2	4-2	6-0

Table 4.2c. Base Dimensions, Outside, Nominal (ft-in)

Length	Width	Height
4-8	4-8	6-6

Figure 4.2. Base



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

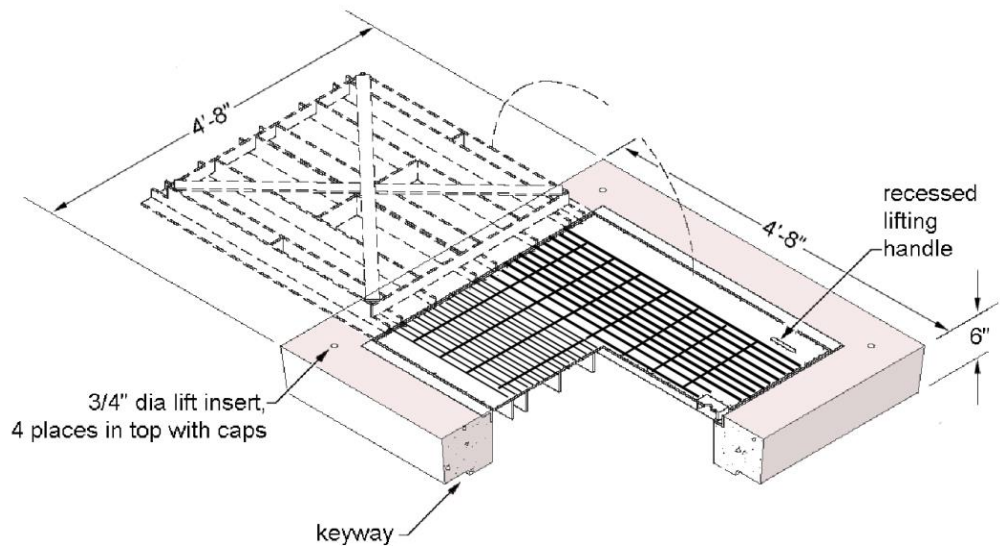


Figure 4.3b. Cover with 42-in Round Blockout

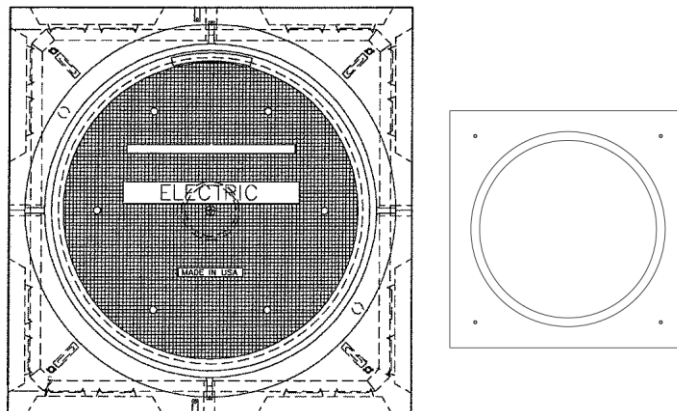


Table 4.3. Cover Dimensions, Nominal

Stock No.	Concrete Collar			Opening (in)
	Length (ft-in)	Width (ft-in)	Thickness (in)	
013102	4-8	4-8	6	36 x 36
013688	4-8	4-8	6	42 dia, round

5. Issuance

Unit: EA

6. Approved Manufacturer

Stock No.	Description	Catalog Number
		Oldcastle/Utility Vault
130101	Base , standard 507	507-LA Base w/ Irons and GRD In & Out
130102	Cover , with hatch	55-332 GV
013124	Assembly ; base and cover with hatch	507-LA Base w/ Iron and GRD In & Out w/Grate Vent, SCL
013688	Cover , with 42-in blockout	55-42C
013169	Assembly ; base and cover with 42-in blockout	507-LA with 55-42C

7. References

SCL Material Standard 7203.21; "Precast Reinforced Concrete Structure, General"

SCL Material Standard 7204.70; "Frames and Covers, 42-Inch Round, Iron"

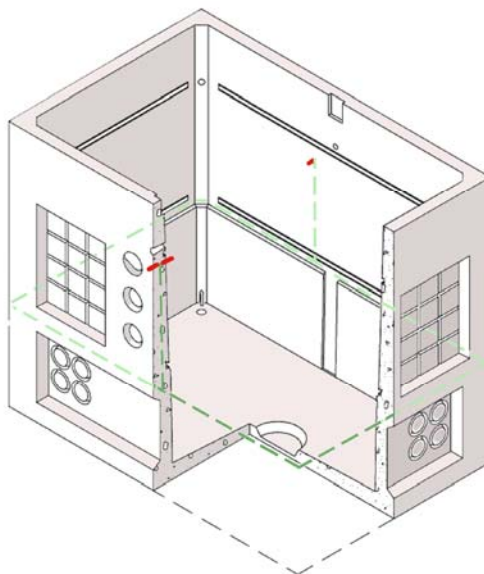
8. Sources

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)

577 ELECTRIC VAULT, PRIMARY SERVICE



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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.

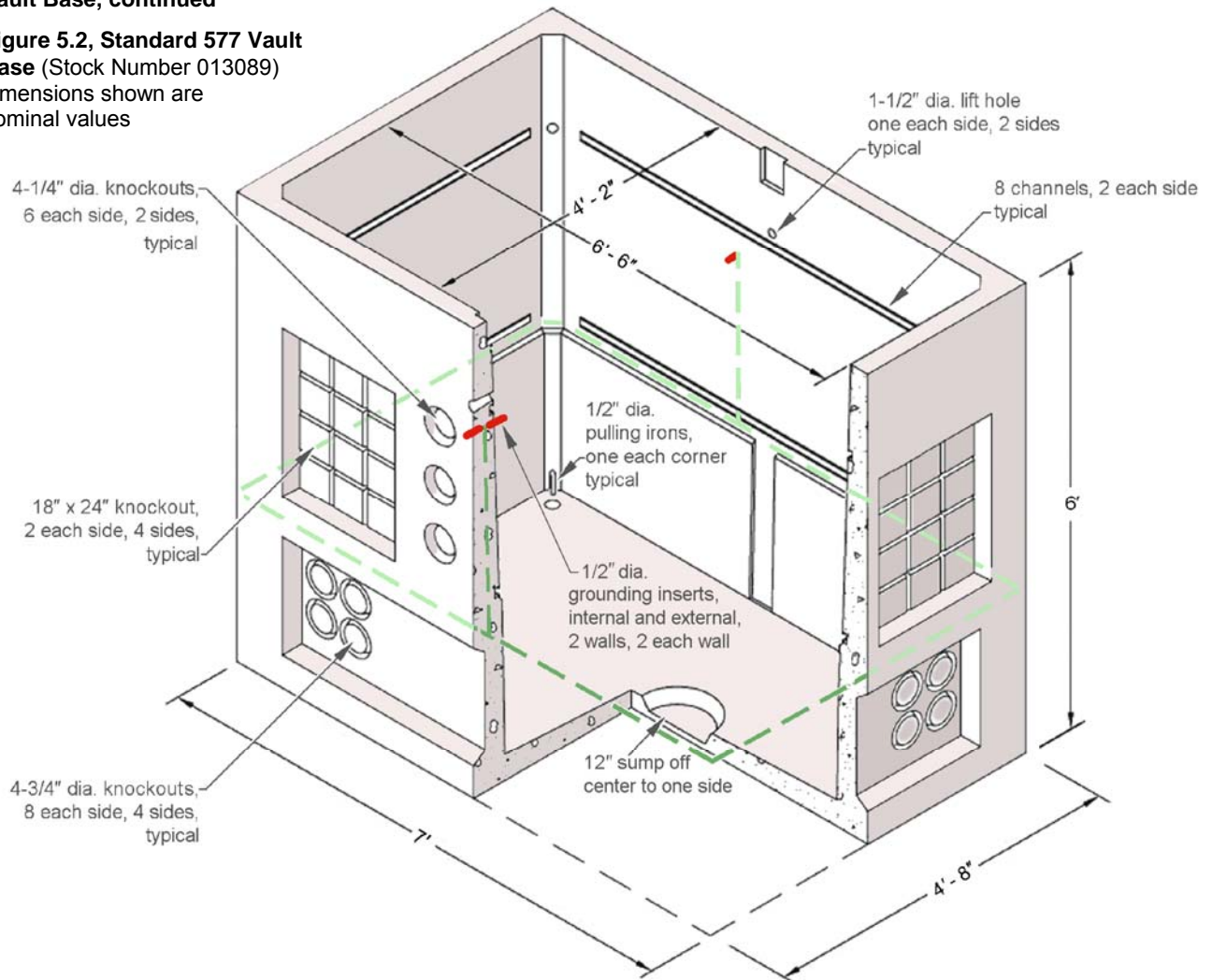
Table 5.2, Vault Base Attributes

All standard 577 vault bases shall have the following features:

	Size, Nominal, in	Location	Per Location	Total Number
Knockouts				
round	4-3/4 dia	all 4 walls, on bottom	8 ea side	32
round	4-3/4 dia	3 rows of 2 in center of 2 long walls	6 ea side	12
waffle (12 - 6" squares)	18 x 24	all 4 walls	2 ea side	8 waffles
ground rod	2 dia	2 corners of floor	1 ea	2
Channels				
galvanized "C"	42 long	short walls, above waffle	1 ea side	2
channel, horizontal,	42 long	short walls, below waffle	1 ea side	2
embedded	72 long	long walls, above waffle	1 ea side	2
in walls	72 long	long walls, below waffle	1 ea side	2
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)

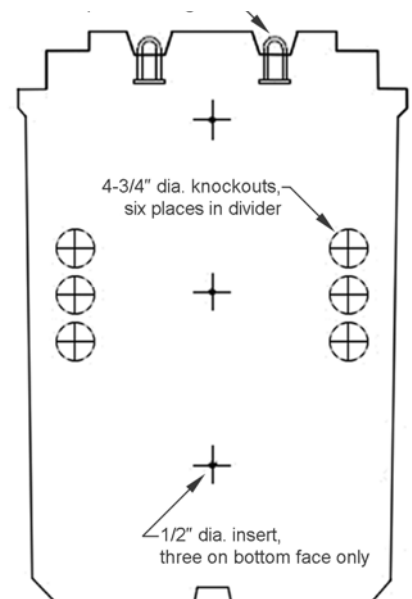
1/2-inch diameter lift ring, placed in the top edge

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

Figure 5.3, Removable Divider Wall



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.

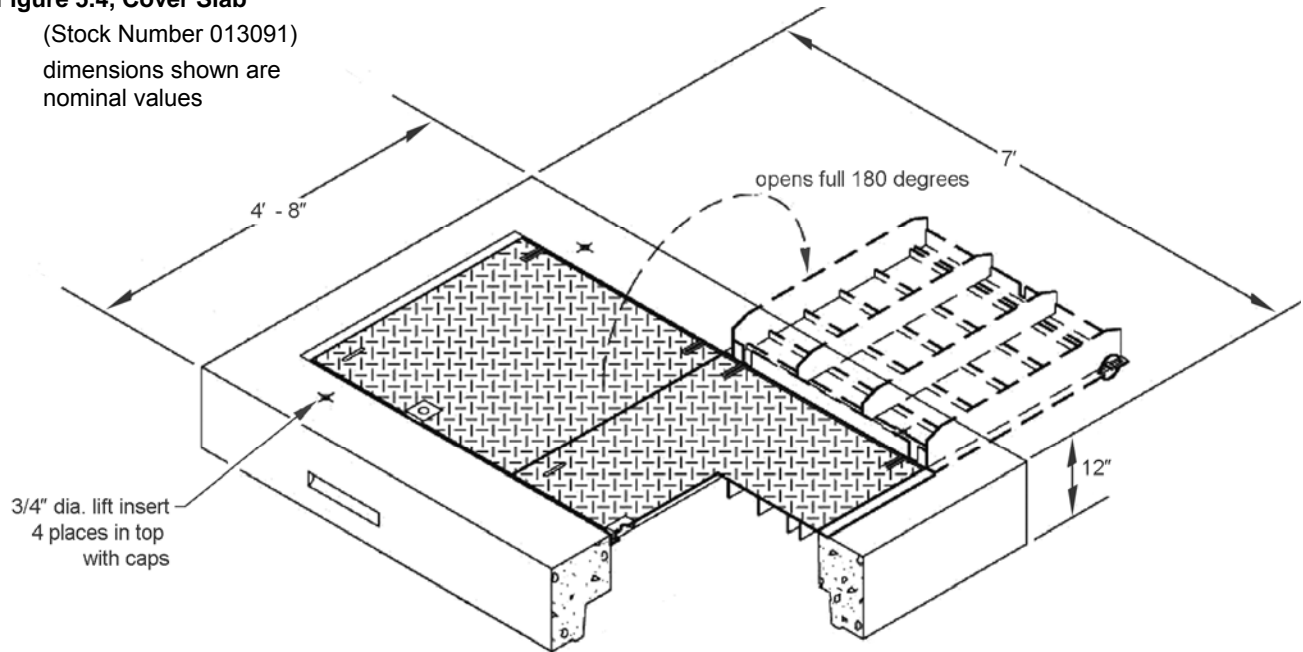
Hinges for the lids shall be along the length of the cover slab.

Cover slabs shall have a keyway to match the base for proper assembly.

Figure 5.4, Cover Slab

(Stock Number 013091)

dimensions shown are nominal values

**Table 5.4, 577 Vault Cover Slab Options**

Stock Number	Inside Dimensions, Nominal, ft-in		Outside Dimensions, Nominal, ft-in		Cover Hatch Options
	Length	Width	Length	Width	
013091	6-6	4-2	7-0	4-8	with two 3- by 3-foot, non-slip, H-20 solid cover hatches
013092	6-6	4-2	7-0	4-8	with two 3- by 3-foot, H-20 cover hatches: one non-slip, solid hatch and one grated vent hatch
013151	6-6	4-2	7-6	5-2	with two non-slip, H-30 LW cover hatches

MATERIAL STANDARD

577 Electric Vault, Primary Service

standard number: **7203.41**superseding: new
effective date: June 29, 2012
page: 5 of 6**6. 577 Vault Assemblies****Table 6, Assembled 577 Vault Components**

Assembled Vault Stock Number	Vault Base Stock Number	Divider Wall Stock Number	Cover Slab Number	Cover Hatches	
				1	2
013125	013089	none	013091	H-20 solid	H-20 solid
013126	013089	013090	013091	H-20 solid	H-20 solid
013127	013089	013090	013092	H-20 solid	H-20 grate
013152	013089	none	013151	H-30 solid	H-30 solid

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

Stock Number	Description	Catalog Number
		Oldcastle/Utility Vault
013089	vault base , standard 577	577-LA w/ GRD In & Out
013090	removable divider wall , standard 577	577-Divider Wall
013091	cover slab , 7-foot by 4-foot-8-inch slab with two 3- by 3-foot, non-slip, H-20, solid cover hatches	57-2-332-NS-SA-80
013092	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)	57-2-332-NS-GV-SA-80
013151	cover slab , 7-foot-6-inch by 5-foot-2-inch slab with two non-slip, H-30 cover hatches	57 Top w/ LW Hatch 34" x 74"
013125	assembled 577 vault with two 3- by 3-foot, non-slip, H-20 solid cover hatches	577-LA w/ GRD In & Out w/ 2-33 cover - SCL
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)	577-LA w/ Iron, GRD In & Out w/ grate and 33 cover - SCL
013127	assembled 577 vault with divider wall and with two 3- by 3-foot, non-slip, H-20 solid cover hatches	577-LA w/ Iron, GRD In & Out w/ 2-33 cover - SCL
013152	assembled 577 vault with two non-slip, H-30 cover hatches	577-LA w/ Iron, GRD In & Out w/ LW Hatches

MATERIAL STANDARD

577 Electric Vault, Primary Service

standard number: **7203.41**

superseding: new

effective date: June 29, 2012

page: 6 of 6

9. References

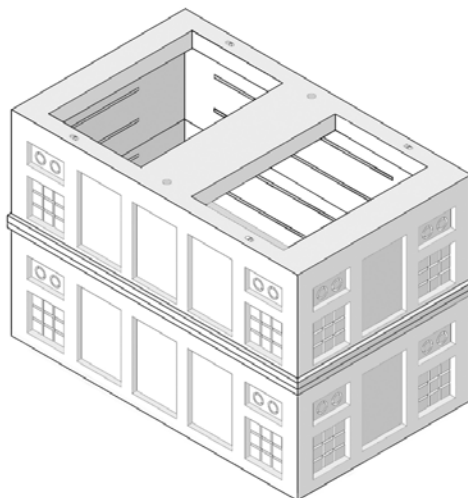
Detter, Chris; SCL Distribution Engineer, subject matter expert for 7203.41 (chris.detter@sattle.gov)

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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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

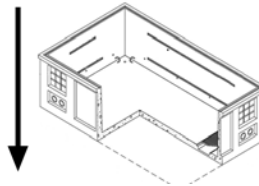
712 vaults are intended for use in the construction of underground electric systems. The precast concrete structure may be used to house medium-size transformers up to 501 kVA, three-phase load break junction boxes, and in making service connections and splices for the distribution system.

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.

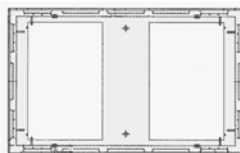
Due to different applications, the vault may need to be customized with different block-out configurations; various risers and access openings (see Figure 3).

Figure 3. Steps for selecting the proper vault assembly for your application:

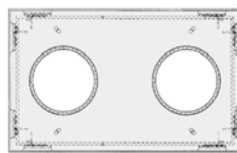
Step 1. Select standard 712-vault base, [A] (Stock Number 013112, see section 5).



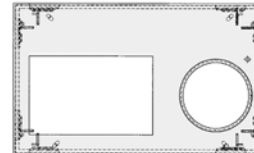
Step 2. Determine and select the type of blockout configuration needed for the vault top section [B#]. There are 4 possible options for the 712 top sections; each allowing a different set of access openings. (Stock Numbers 013113, 013114, 013395, or 013115, see section 6).



B1
Stk#013113



B2
Stk#013395

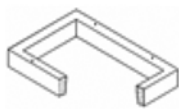
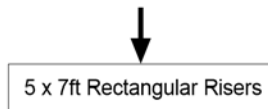


B3
Stk#013114

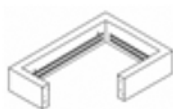


B4
Stk#013115

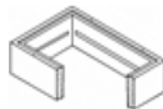
Step 3. Select appropriate risers [C#] to bring access opening up to grade. Each riser section for the 712 covers half of the top section. (Stock numbers 013105, 013106, 013162, 013107, 013108, and 013109)



C1 = 6"
Stk#013105



C2 = 18"
Stk#013106



C3 = 24"
Stk#013162



C4 = 4"
Stk#013107

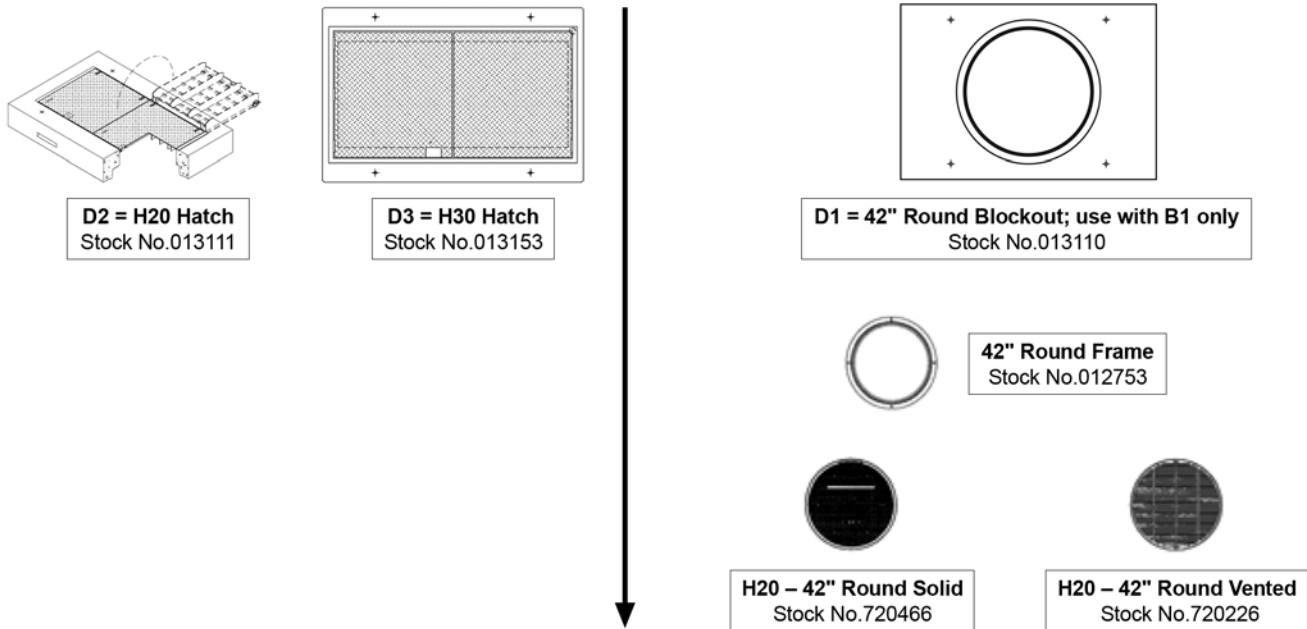


C5 = 6"
Stk#013108

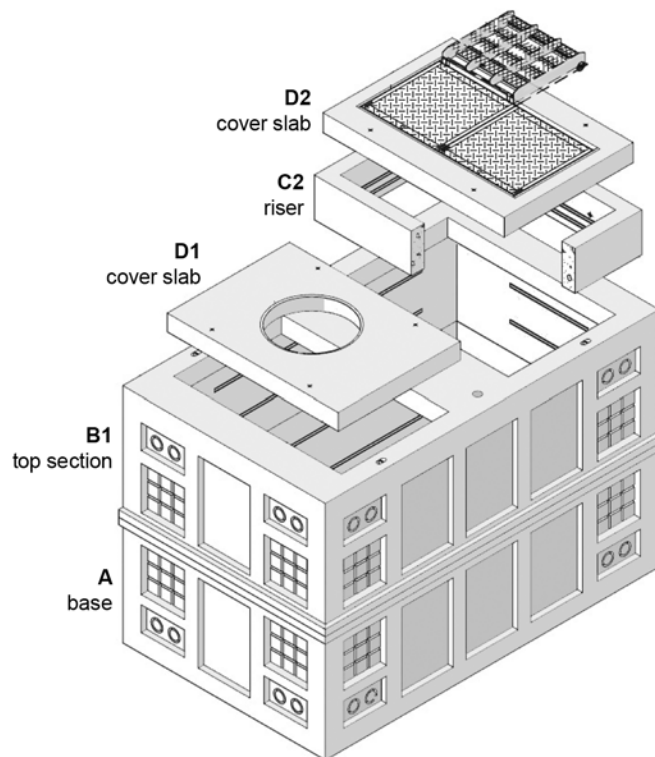


C6 = 12"
Stk#013109

Step 4. Determine the appropriate type of cover slabs and lids or hatches [D#]



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

Stock No.	Outside (ft-in)		Inside (ft-in)		Height (ft-in)		Figure No.
	Length	Width	Length	Width	Outside	Inside	
013112	12-11	7-10	12-3	7-2	4-2.5	3-9	5

Figure 5. Standard 712 vault base [A]

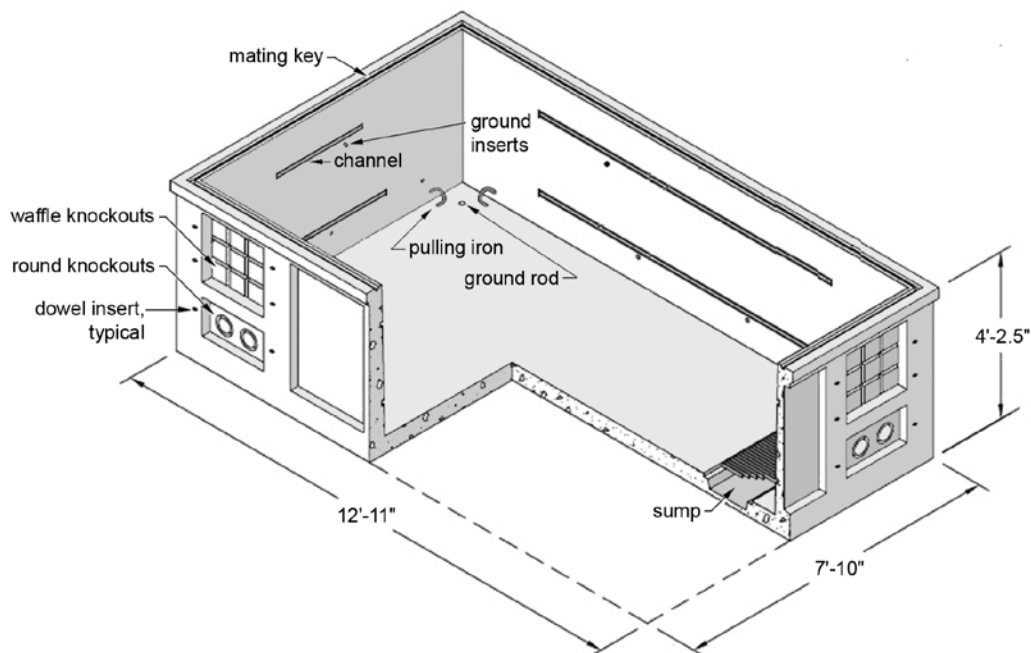


Table 5b. Vault Base Attributes

All standard 712 vault bases shall have the following features:

	Size, Nominal (in)	Location	Per Location	Total Number
Knockouts				
Round	4-3/4 dia	All 4 walls, on bottom corners of wall	4 ea side	16
Waffle, 9 - 6 in squares	18 x 18	All 4 walls, above round knockouts	2 ea side	8
Ground rod	2 dia	4 corners of floor	1 ea	4
Channels				
Galvanized "C" channel, horizontal, embedded in walls	36 length	End walls, 9 inches above floor, between knockouts, 22.5 inches on center between channels.	2 ea side	4
	96 length	Side walls, 9 inches above floor between knockouts, 22.5 inches on center between channel	2 ea side	4
Sump with galvanized grate	12 x 60	Floor, about 1 foot from and parallel to short wall	1	1
Pulling irons	7/8 dia	2 each corner of floor (typical)	2 ea corner	8
Ground inserts, bronze	1/2 dia	Side walls, 4 inches below top channel, internal and external	2 ea side	4
Dowel Inserts	1/2 dia	12 inches on center; around the perimeter of duct knockout		
Ladder		Not required		

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

Stock No.	Outside (ft-in)		Inside (ft-in)		Height (ft-in)		Blockout Configurations	Figure
	Length	Width	Length	Width	Outside	Inside		
013113	12-11	7-10	12-3	7-2	4-4.5	3-9	two 78-in by 50-in blockouts	6b, [B1]
013395	12-11	7-10	12-3	7-2	4-4.5	3-9	two 42-in round blockouts	6b, [B2]
013114	12-11	7-10	12-3	7-2	4-4.5	3-9	one 78-in by 50-in blockout and one 42-in round blockout, offset to left (Type 1) [B3]	6b, [B3]
013115	12-11	7-10	12-3	7-2	4-4.5	3-9	one 78-in by 50-in blockout and one 42-in round blockout, offset to right (Type 2) [B4]	6b, [B4]

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]

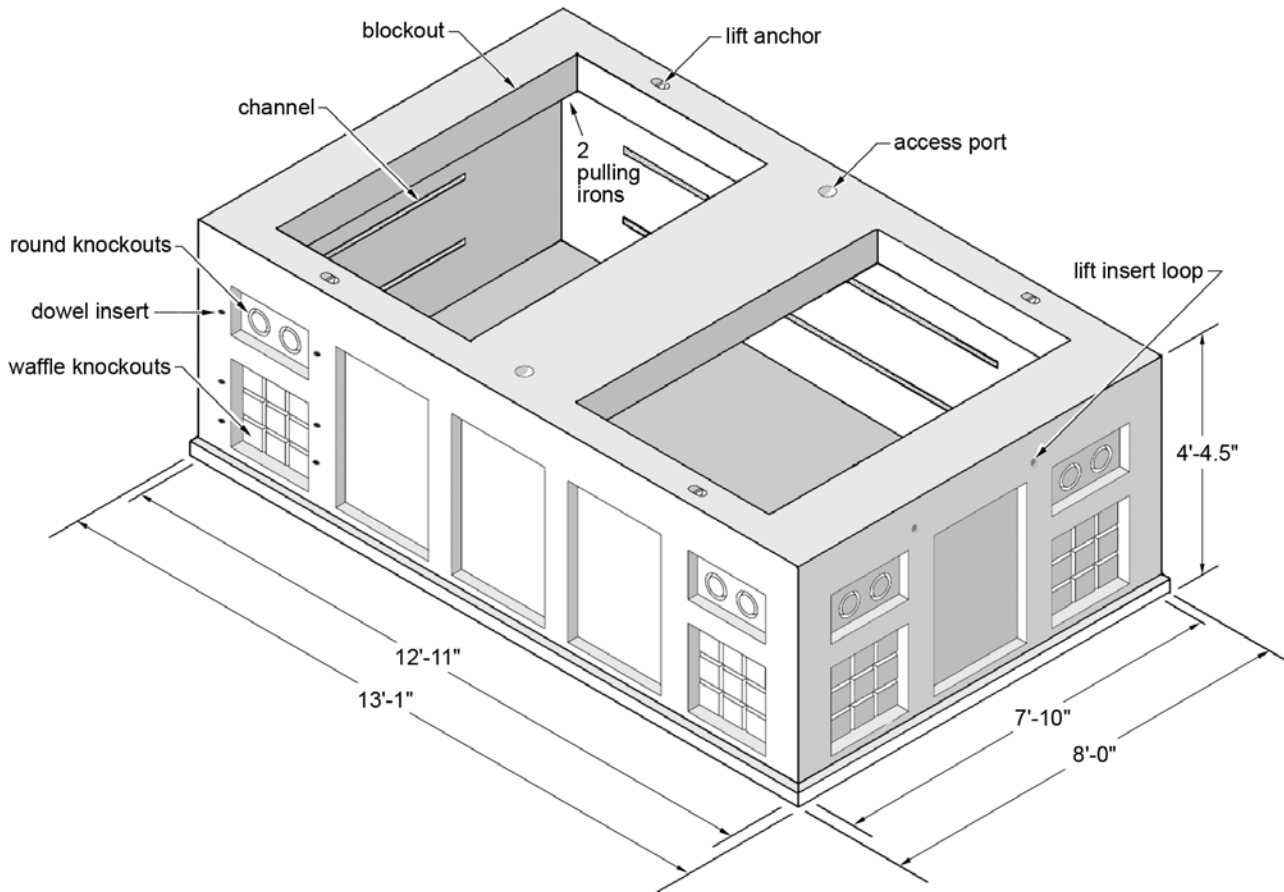
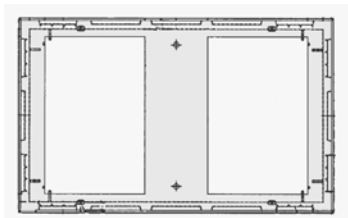
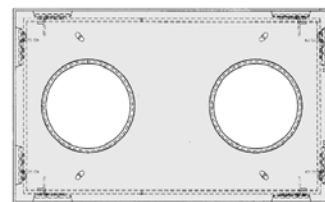


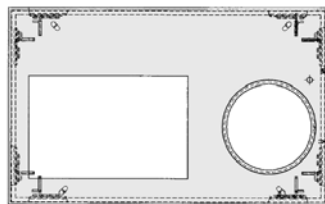
Figure 6b. Vault top section blockout options (top view)



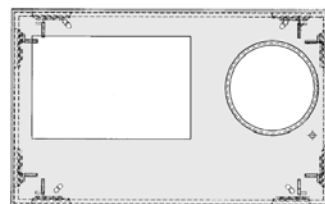
B1
 Stock No. 013113



B2
 Stock No. 013395
 (not available on separate order)



B3
 Stock No. 013114



B4
 Stock No. 013115

Table 6b. Top Section Attributes Required

	Size, Nominal (in)	Location	Per Location	Total Number
Knockouts				
round	4-3/4 dia	all 4 walls, on top corners of wall	4 ea side	16
waffle, 9 - 6 in squares	18 x 18	all 4 walls, below round knockouts	2 ea side	8 waffles
Channels				
galvanized "C" channel, horizontal, embedded in walls	36 length	end walls, 11.25-inches from ceiling, between knockouts, 22.5-inches on center between channels.	2 ea side	4
	96 length	side walls, 11.25-inches from ceiling, between knockouts, 22.5-inches on center between channels	2 ea side	4
Access Port				
[B1]	3 dia	1 each side on top, centered along length of top	1 ea side	2
[B2]	3 dia	1 each side on top, centered along length of top	1 ea side	2
[B3]	3 dia	1, right of 42-inch blockout	1 side	1
[B4]	3 dia	1, left of 42-inch blockout	1 side	1
Pulling irons	7/8 dia	2 ea corner of ceiling (typical)	2 ea corner	8
Lift anchor	6-1/4	4-ton anchor, 1 each corner on top	1 ea corner	4
Lift insert loop	3/4 dia	2 each on outside of one end wall, above knockouts	2, one side	2
Ground inserts, bronze	1/2 dia	side walls, 4 inches below top channel, internal and external	2 ea side	4
Dowel Inserts	1/2 dia	12-Inch on center; around the perimeter of duct knockout		

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

Stock No.	Description	Mtl. Std.	References to Figure 3
013105	5- by 7-foot by 6-inch riser without galvanized "C" channel	7204.15	C1
013106	5- by 7-foot by 18-inch riser with galvanized "C" channels	7204.15	C2
013362	5- by 7-foot by 24-inch riser with galvanized "C" channels	7204.15	C3
013107	42-inch diameter by 4-inch high round riser	7204.15	C4
013108	42-inch diameter by 6-inch high round riser	7204.15	C5
013109	42-inch diameter by 12-inch high round riser	7204.15	C6
013110	5- by 7-foot cover slab with one 42-inch round access opening	7204.15	D1
013111	5- by 7-foot adjustable cover slab with two 3- by 3-foot non-slip solid covers	7204.15	D2
012753 and 720466	42-inch frame with 42-inch solid cover	7204.70	
012753 and 720226	42-inch frame with 42-inch grated vent cover	7204.70	

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]

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013112	1	
Top Section	712 with 2 rectangular blockout	B1	013113	1	
Rectangular Riser	18 in	C2	013106		
42-in Round Riser	4 in	C4	013197	1	
42-in Round Riser	12 in	C6	013109	1	
42-in Round Blockout		D1	013110	1	
Cover Slab with H20 Hatch		D2	013111		
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 8b. 712 Vault Assembly 013117, With 2 Personnel (42-in Round Hatch) [A-B2]

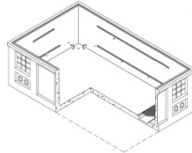
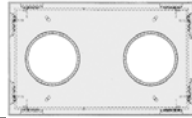
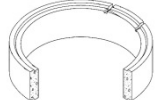
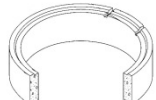
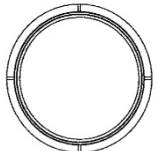

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013112	1	
Top Section	712 with 2 42-in round blackout	B2	013395	1	
42-in Round Riser	4 in	C4	013107	2	
42-in Round Riser	12 in	C6	013109	2	
42-in H20 Frame			012753	2	
42-in Solid			720466	2	

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]

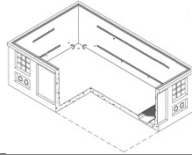

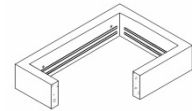
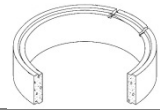
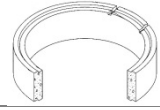
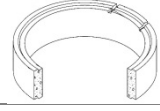
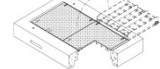
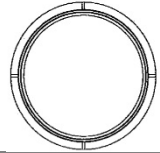

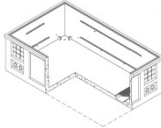
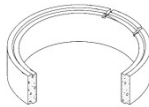
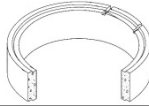
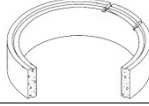
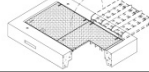
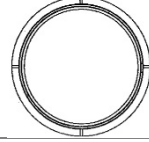
Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013112	1	
Top section	712 with rectangular and 42-inch round blackout	B3	013114	1	
Rectangular Riser	18 in	C2	013106	1	
42-in Round Riser	4 in	C4	013107	1	
42-in Round Riser	6 in	C5	013108	1	
42-in Round Riser	12 in	C6	013109	1	
Cover Slab with H20 Hatch		D2	013111	1	
42-in H20 Frame			012753	2	
42-in Solid			720466	2	

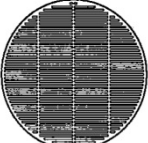
Table 8d. 712 Vault Assembly with 1 Equip. (72 in by 36 in) and 1 Personnel (42-in Round) Hatch, Offset Right (Type 2); [A-B4]

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013112	1	
Top Section	712 with rectangular and 42-in blackout	B4	013115	1	
Rectangular Riser	18 in	C2	013106	1	
42-in Round Riser	4 in	C4	013107	1	
42-in Round Riser	6 in	C5	013108	1	
42-in Round Riser	12 in	C6	013109	1	
Cover Slab with H20 Hatch		D2	013111	1	
42-in H20 Frame			012753	2	
42-in Solid			720466	2	

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:

Stock No.	Description	Figure
720226	42-in H20 vented cover	

9. Issuance

Stock Unit: EA

10. Approved Manufacturers

Stock No.	Components	Label	Catalog Number
			Old Castle/Utility Vault
013116	712 vault with one 72-inch by 36-inch and one 42-inch round entry access	[A-B1]	712 CLX Vault Assembly
013117	712 vault with two 42-inch round entry access	[A-B2]	712 TEE CLX Assembly w/ (2) 57-CLX-42C cover slabs
013118	712 vault with one 72-inch by 36-inch and one 42-inch round entry access, offset to left (Type 1)	[A-B3]	712-CLX Type 1 Vault Assembly
013119	712 vault with one 72-inch by 36-inch and one 42-inch round entry access, offset to right (Type 2)	[A-B4]	712-CLX Type 2 Vault Assembly
013112	712 vault base	[A]	712 Vault Base
013113	712 top with two 78-inch by 50-inch blockouts	[B1]	712-TEE-CLX
013395	712 top with two 42-inch blockouts	[B2]	712-TL-42EE
013114	712 top with one 78-inch by 50-inch blockout and one 42-inch round blockout, offset to left (Type 1)	[B3]	712 TEE CLX Top – Type 1
013115	712 top with one 78-inch by 50-inch blockout and one 42-inch round blockout, offset to right (Type 2)	[B4]	712 TEE CLX Top – Type 2

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]

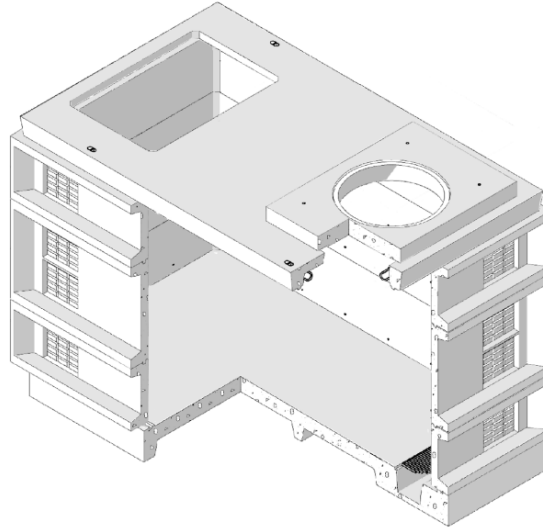
SCL Material Standard 7204.70; “Frames and Covers, 42-Inch Round, Iron,” September 2007

Detter, Chris; SCL Distribution Engineer and subject matter expert for 7203.46
 (chris.detter@seattle.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



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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.

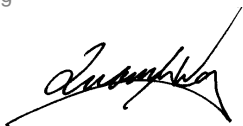
This standard applies to the Seattle City Light (SCL) stock numbers listed in Section 12.

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.

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola



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.

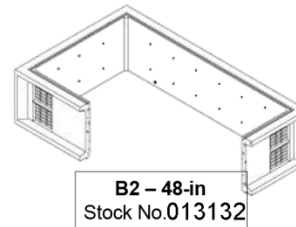
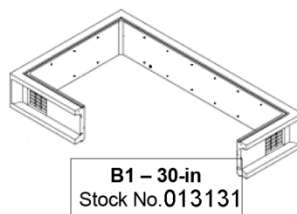
Due to different applications, the vault may need to be customized with tops with different block-out configurations, different combinations of center sections, various risers and access openings (see Figure 3).

Figure 3. Steps for selecting the proper vault assembly for your application:

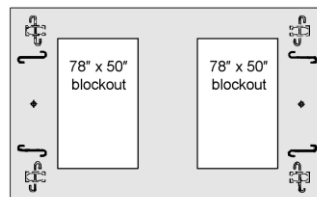
Step 1. Select standard 814 vault **base, [A]** (Stock No. 013130, Section 5).



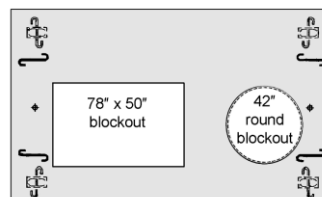
Step 2. Determine the height of vault needed, select any combination of 30-in **[B1]** or 48-in **[B2]** center sections (Stock Nos. 013131 and 013132, Section 6)



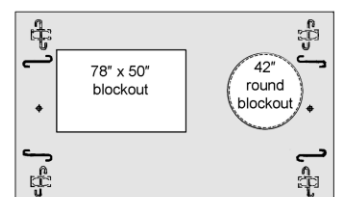
Step 3. Determine and select the type of blockout configuration needed for the vault **top section, [C1, C2 and C3]**. For the 814 top sections there are 4 possible options each allowing a different set of access openings. Note, the top section allowing for two 42-in round access openings is not an option 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).



C1
 Stk#013133

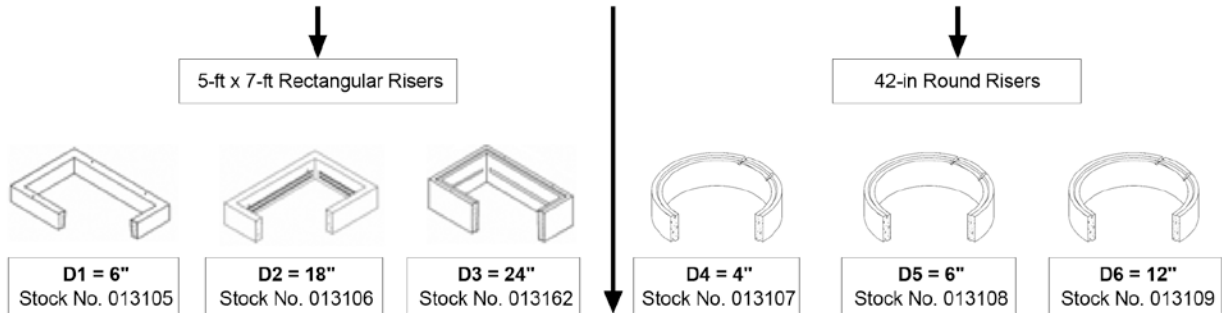


C2
 Stk#013134

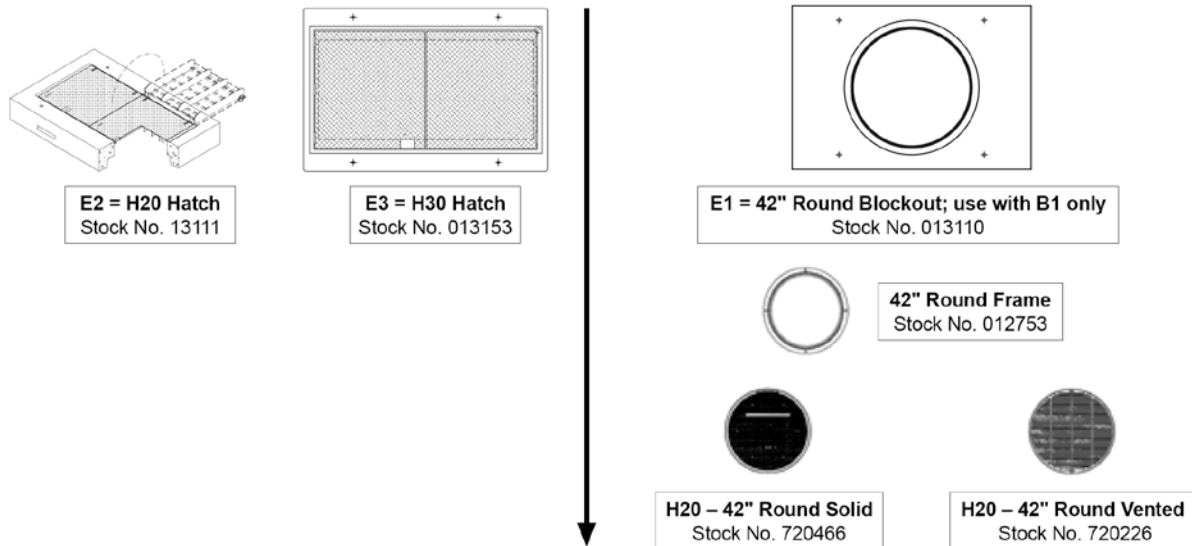


C3
 Stk#013135

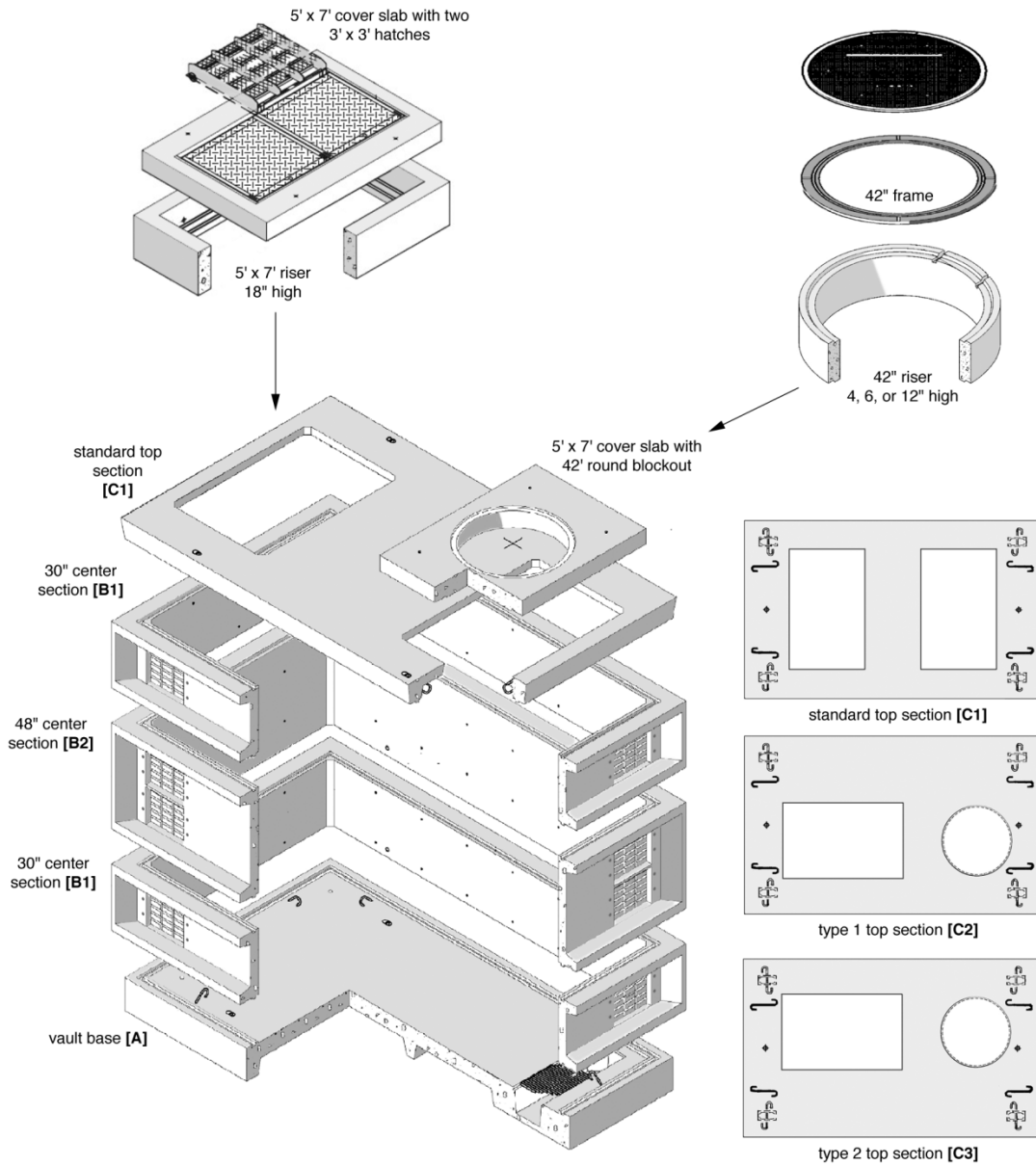
Step 4. Select appropriate risers [D#] to bring access opening up to grade. Each riser section for the 814 covers half of the top section. (Stock Nos. 013105, 013106, 013162, 013107, 013108, and 013109).



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

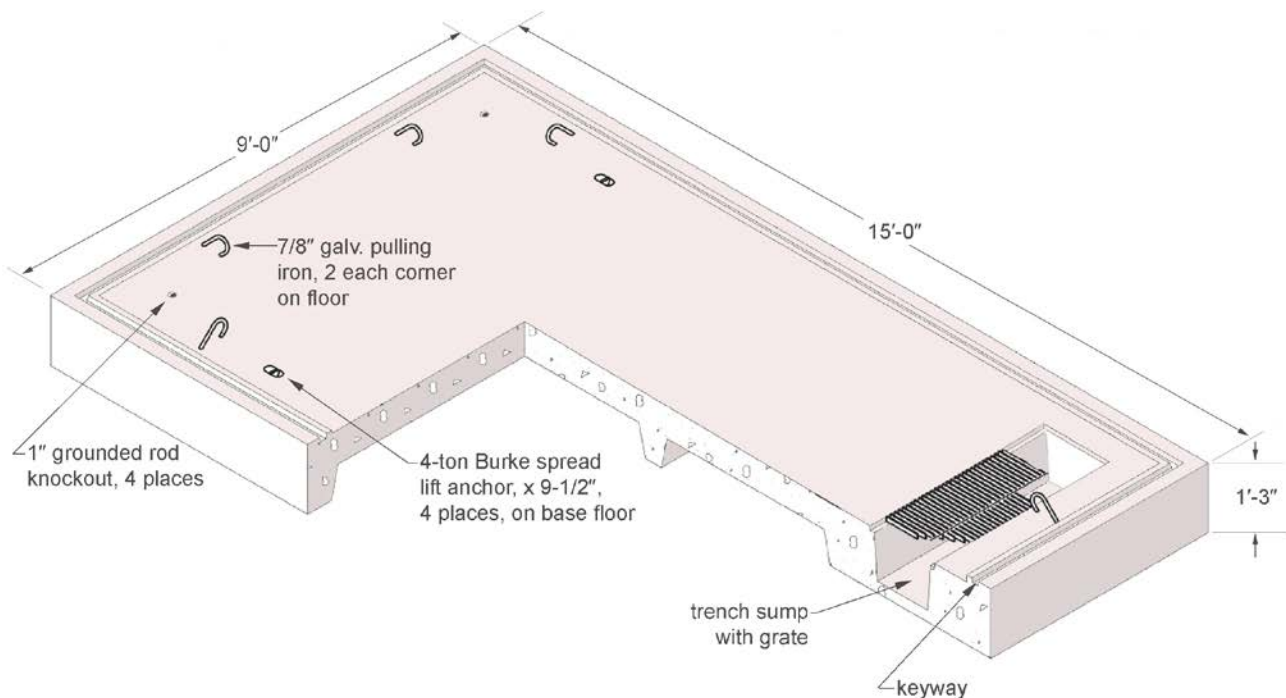
All 814 ring vault bases shall be constructed according to the dimensions shown in Table 5 and Figure 5.

The ring vault floor shall be sloped to drain toward the sump.

Table 5. Nominal Base Dimensions

Stock No.	Outside (ft-in)		Inside (ft-in)		Height (ft-in)		Figure
	Length	Width	Length	Width	Outside	Inside	
013130	15-0	9-0	14-0	8-0	1-3	-	5

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]

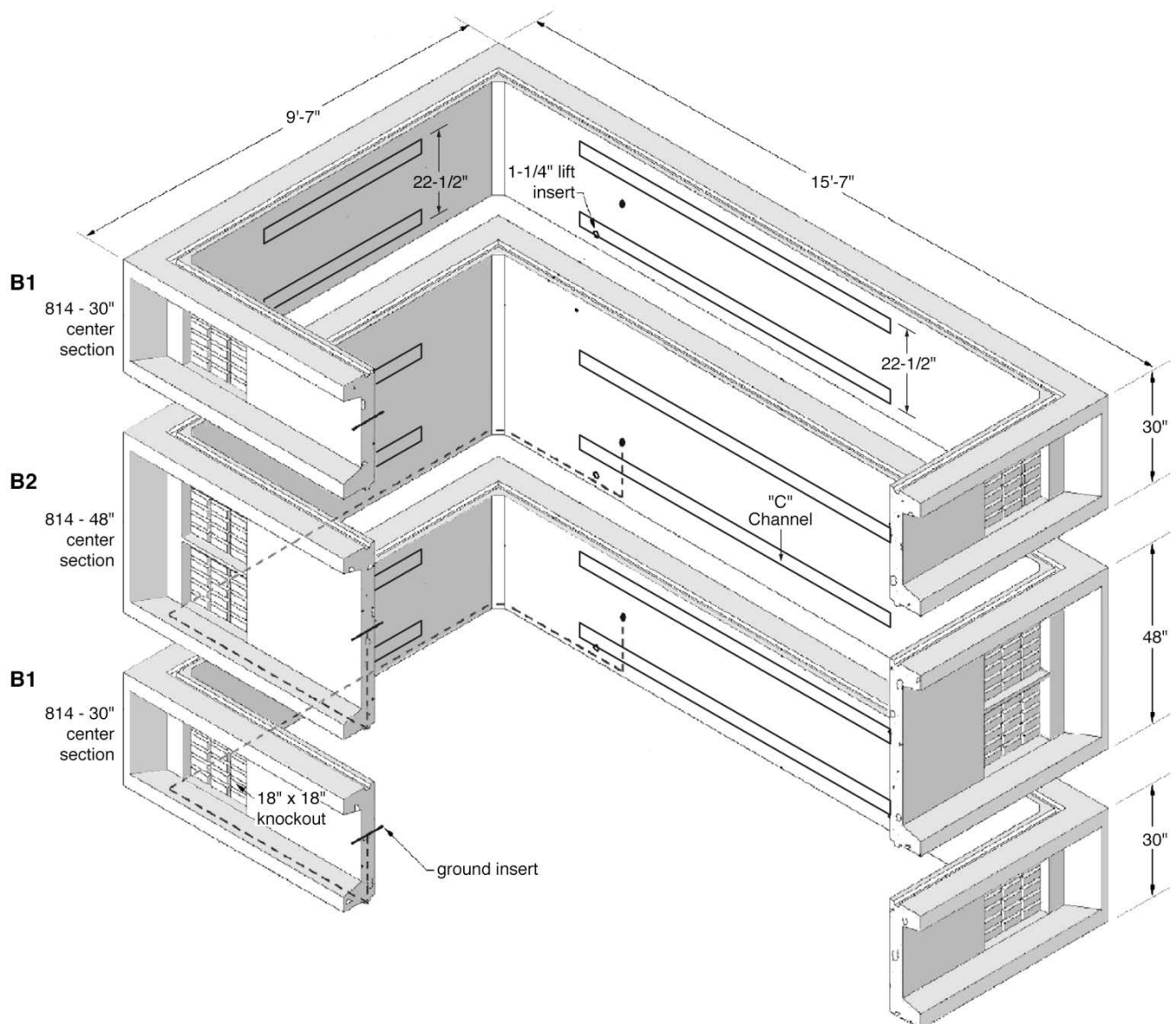
All 814 ring vault center sections shall be constructed according to the dimensions shown in Table 6.

Table 6. Vault Nominal Center Sections Dimensions

Stock No.	Outside (ft-in)		Inside (ft-in)		Height (ft-in)		Figure
	Length	Width	Length	Width	Outside	Inside	
013131	15-7	9-7	14-0	8-0	2-6	-	6 [B1]
013132	15-7	9-7	14-0	8-0	4-0	-	6 [B2]

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

Stock No.	Top Sections (ft-in)			Blockout Configurations	Figure
	Length	Width	Thickness (in)		
013133	15-2	9-2	9.5	Two 78-in x 50-in blockouts [C1]	7a & 7b [C1]
013134	15-2	9-2	9.5	One 78-in x 50-in blockouts and one 42-in round blockouts, offset to left (Type 1) [C2]	7a & 7b [C2]
013135	15-2	9-2	9.5	One 78-in x 50-in blockouts and one 42-in round blockouts, offset to right (Type 2) [C3]	7a & 7b [C3]

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 7a. Vault Top Section [C1]

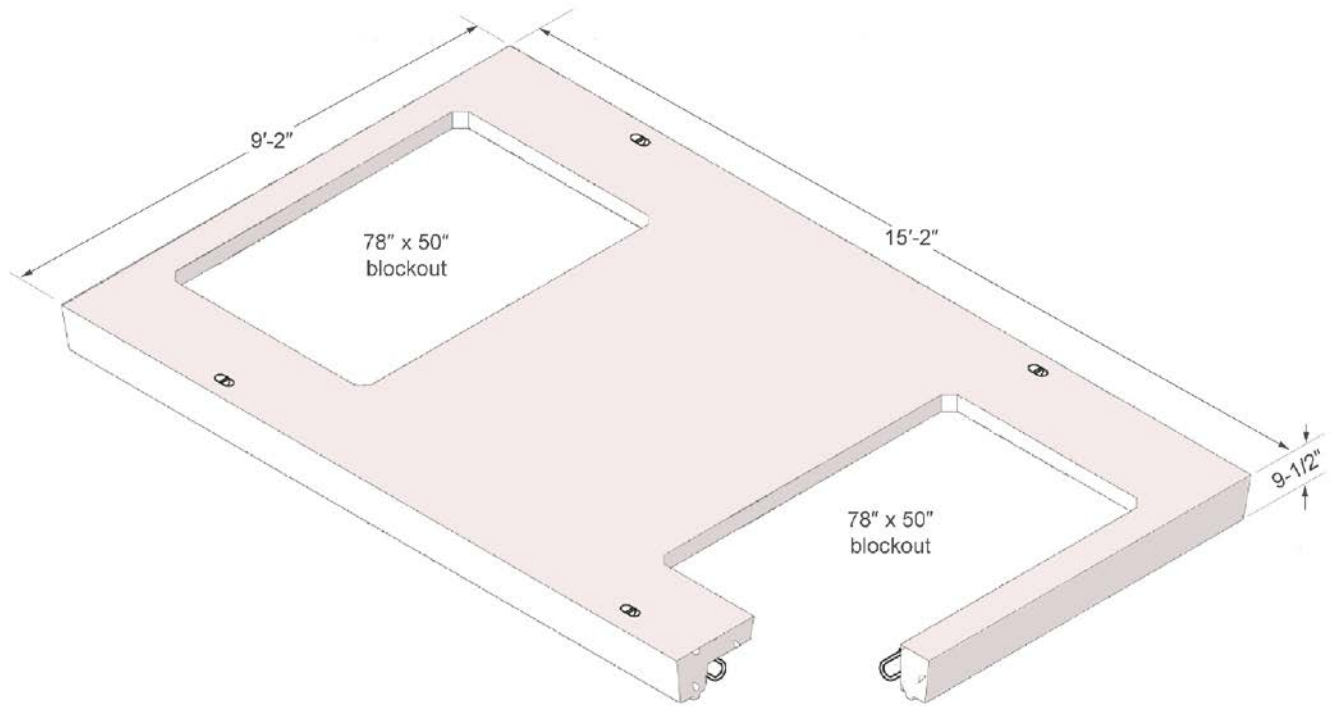
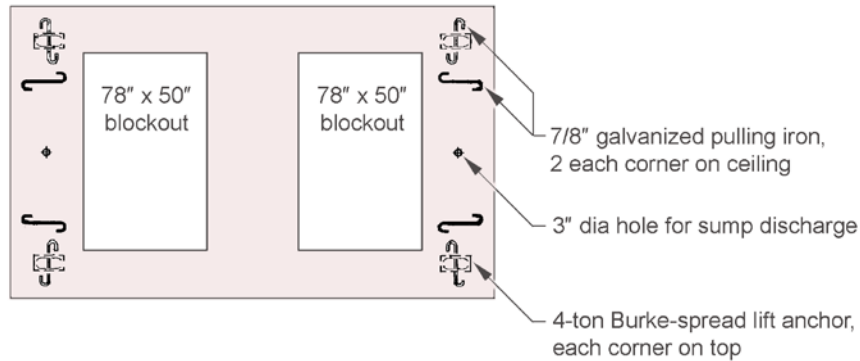
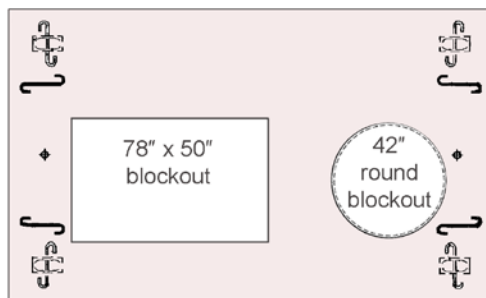


Figure 7b. Vault Top Section Blockout Options

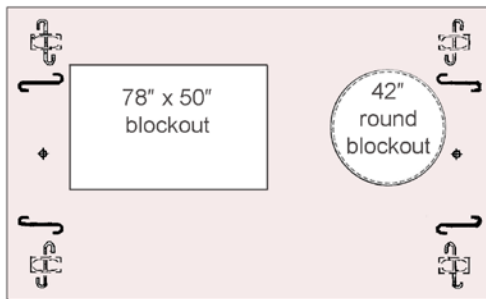
814 Standard Top, Stock No. 013133 [C1]



814 Type 1 Top, Stock No. 013134 [C2], blockout offset to left



814 Type 2 Top, Stock No. 013135 [C3], blockout offset to right



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

Stock No.	Description	Matl. Std.	References to Figure 3
013105	5-ft x 7-ft x 6-in riser without galvanized "C" channel	7204.15	D1
013106	5-ft x 7-ft x 18-in riser with galvanized "C" channels	7204.15	D2
013362	5-ft x 7-ft x 24-in riser with galvanized "C" channels	7204.15	D3
013107	42-in diameter by 4-in high round riser	7204.15	D4
013108	42-in diameter by 6-in high round riser	7204.15	D5
013109	42-in diameter by 12-in high round riser	7204.15	D6
013110	5-ft x 7-ft cover slab with one 42-in round access opening	7204.15	E1
013111	5-ft x 7-ft adjustable cover slab with two 3-ft x 3-ft non-slip solid covers	7204.15	E2
013153	5-ft x 7-ft cover slab with two H-30 solid cover	7204.15	E3
012753 and 720466	42-in frame with 42-in solid cover	7204.70	
012753 and 720226	42-in frame with 42-in grated vent cover	7204.70	

Rectangular blackout: For all top sections with rectangular openings cover slabs are necessary, one for each top section rectangular blackout. 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 blackout 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 blackout: 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

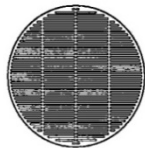
Stock No.	Description	Figure
720226	42-in H20 vented cover	

Table 9b. 8-ft Vault Assembly 013136: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) [A-C1]

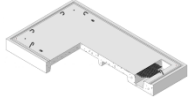
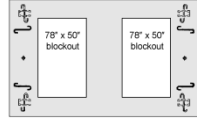
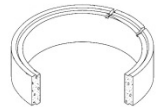
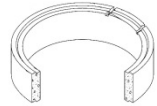
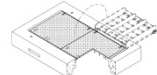
Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	48 in	B2	013132	2	
Top Section	814 with 2 rectangular blockout	C1	013133	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H20 Hatch		E2	013111	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

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]

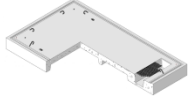
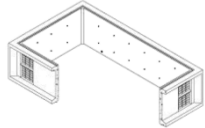

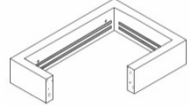
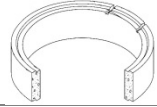
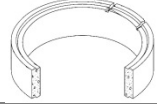
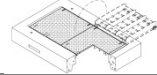

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	48 in	B2	013132	2	
Top Section	814 with rectangular and 42-inch round blackout, Type 1, offset to left	C2	013134	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H20 Hatch		E2	013111	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

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]

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	48 in	B2	013132	2	
Top Section	814 with rectangular and 42-in round blackout, Type 2, offset to right	C3	013135	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H20 Hatch		E2	013111	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9e. 9-ft Vault Assembly 013139: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) [A-C1]

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	2	
Mid-Section Riser	48 in	B2	013132	1	
Top Section	814 with 2 rectangular blockouts	C1	013133	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H20 Hatch		E2	013111	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9f. 9-ft Vault Assembly 013140: With 2 Personnel (42-in Round Hatch) [A-C1]

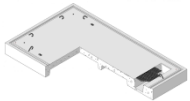
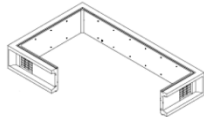
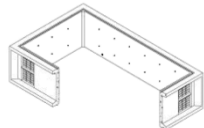
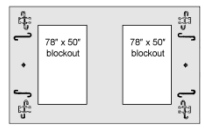
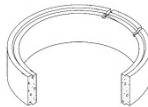
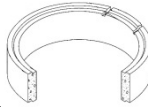
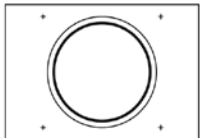
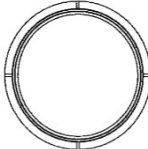

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	2	
Mid-Section Riser	48 in	B2	013132	1	
Top Section	814 with 2 rectangular blockouts	C1	013133	1	
42-in Round Riser	4 in	D4	013197	2	
42-in Round Riser	12 in	D6	013109	2	
42-in Round Blockout		E1	013110	2	
42-in H20 Frame			012753	2	
42-in Solid			720466	2	

Table 9g. 814 – 9 ft Vault Assembly 013141: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 1); [A-C2]

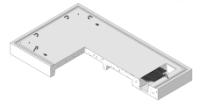
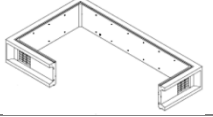
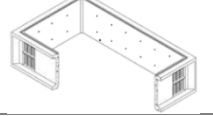
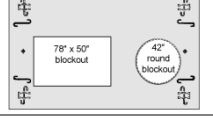
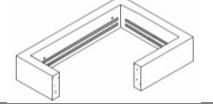
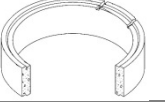
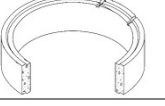

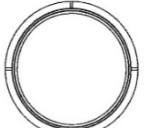

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	2	
Mid-Section Riser	48 in	B2	013132	1	
Top Section	814 with rectangular and 42-in round blackout, Type 1, offset to left	C2	013134	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H20 Hatch		E2	013111	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9h. 9-ft Vault Assembly 013142: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 2); [A-C3]

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	2	
Mid-Section Riser	48 in	B2	013132	1	
Top Section	814 with rectangular and 42-inch round blackout, Type 2, off-set to right	C3	013135	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H20 Hatch		E2	013111	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9i. 10-ft Vault Assembly 013143: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) [A-C1]

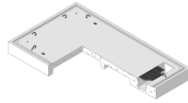
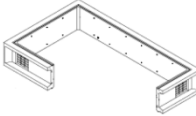
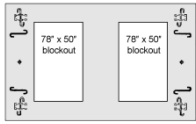
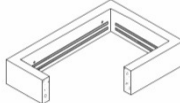
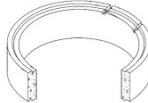
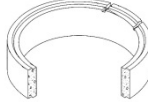
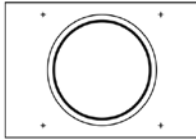
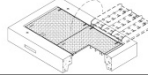
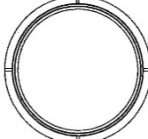

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	4	
Top Section	814 with 2 rectangular blackout	C1	013133	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H20 Hatch		E2	013111	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9j. 10-ft Vault Assembly 013144: With 2 Personnel (42-in Round Hatch) [A-C1]

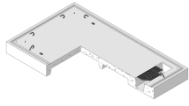
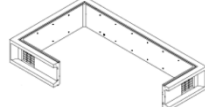
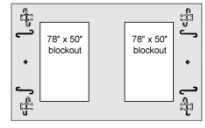
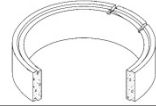
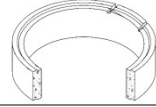
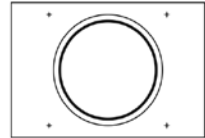
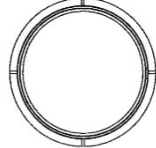

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	4	
Top Section	814 with 2 rectangular blockout	C1	013133	1	
42-in Round Riser	4 in	D4	013197	2	
42-in Round Riser	12 in	D6	013109	2	
42-in Round Blockout		E1	013110	2	
42-in H20 Frame			012753	2	
42-in Solid			720466	2	

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]

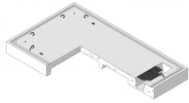
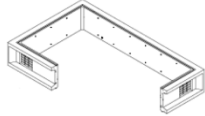
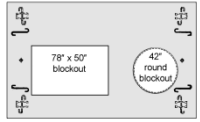
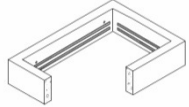
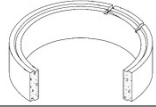
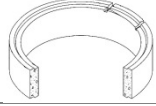
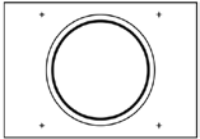
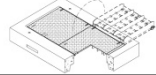
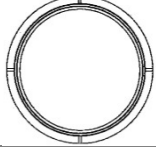

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	4	
Top Section	814 with rectangular and 42-inch round blockout, Type 1, off-set to left	C2	013134	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H2O Hatch		E2	013111	1	
42-in H2O Frame			012753	1	
42-in Solid			720466	1	

Table 9I. 10-ft Vault Assembly 013146: With 1 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 2); [A-C3]

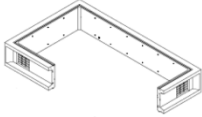
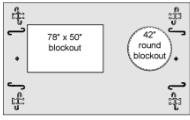

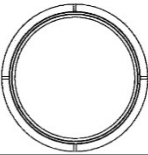
Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	30 in	B1	013131	4	
Top Section	814 with rectangular and 42-inch round blackout, Type 2, offset to right	C3	013135	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H2O Hatch		E2	013111	1	
42-in H2O Frame			012753	1	
42-in Solid			720466	1	

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]

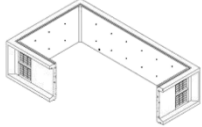
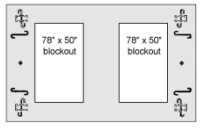
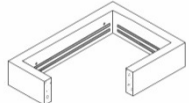
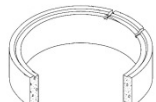
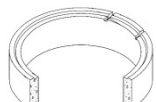
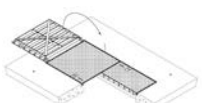


Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	48 in	B2	013132	2	
Top Section	814 with 2 rectangular blackout	C1	013133	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H30 Hatch		E2	013153	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9n. 8-ft Vault Assembly 013162: With 1 H30 Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 1); [A-C2]

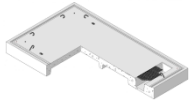
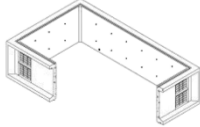
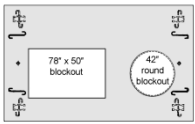
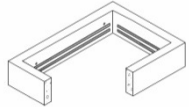
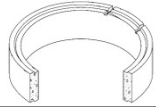
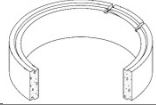
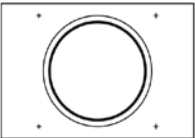
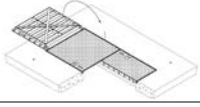
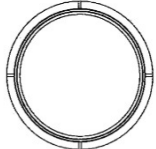

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	48 in	B2	013132	2	
Top Section	814 with rectangular and 42-inch round blackout, Type 1, offset to left	C3	013134	1	
Rectangular Riser	18 in	D2	013106		
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H30 Hatch		E2	013153	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9p. 8-ft Vault Assembly 013163: With 1 H30Equip. (72 in x 36 in) and 1 Personnel (42-in Round Hatch) (Type 2); [A-C3]

Component	Description	Label	Stock No.	Quantity	Figure
Base		A	013130	1	
Mid-Section Riser	48 in	B2	013132	2	
Top Section	814 with rectangular and 42-inch round blackout, Type 2, offset to right	C3	013135	1	
Rectangular Riser	18 in	D2	013106	1	
42-in Round Riser	4 in	D4	013197	1	
42-in Round Riser	12 in	D6	013109	1	
42-in Round Blockout		E1	013110	1	
Cover Slab with H30 Hatch		E3	013153	1	
42-in H20 Frame			012753	1	
42-in Solid			720466	1	

Table 9q. Vault Assembly Components and Overall Heights and Weight

Vault Assembly (ft)	Inside Height, Nominal	Outside Height^a, Nominal	814 – 30R Risers	814 – 48R Risers	Vault Weight^a, Nominal (lb)
8	8 ft-0 in	10 ft-5 in	-	2	51,700 lb
9	9 ft-0 in	11 ft-5 in	2	1	55,400 lb
10	10 ft-0 in	12 ft-5 in	4	-	59,100 lb

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

Stock No. Components		Manufacturer and Catalog No.
		Old Castle/ Utility Vault
013130	Standard vault base [A]	814 – SB
013131	30-in center section [B1]	814-30R w/ GRD
013132	48-in center section [B2]	814-48R w/ GRD
013133	Vault top section with two 76-in x 50-in blockouts [C1]	814-TEE-CLX
013134	Vault top section with one 76-in x 50-in and one 42-in round blockout, offset to left, Type 1 [C2]	814 Type 1 Top
013135	Vault top section with one 76-in x 50-in and one 42-in round blockout, offset to right, Type 2 [C3]	814 Type 2 Top
Assemblies		
013136	8-ft high vault with one H-20 72-in x 36-in and one 42-in round entry access	814-8 CLX vault w/ GRD
013137	8-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to left (Type 1)	814-8 CLX Type 1 vault w/ GRD
013138	8-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to right (Type 2)	814-8 CLX Type 2 vault w/ GRD
013139	9-ft high vault with one 72-in x 36-in and one 42-in round entry access	814-9 CLX vault w/ GRD
013140	9-ft high vault with two 42-in round entry accesses	814-9 vault w/ 814-TEE-CLX Top w/ (2) 42-in access hole w/ GRD
013141	9-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to left (Type 1)	814-9 CLX Type 1 vault w/ GRD
013142	9-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to right (Type 2)	814-9 CLX Type 2 vault w/ GRD
013143	10-ft high vault with one 72-in x 36-in and one 42-in round entry access	814-10 CLX vault w/ GRD
013144	10-ft high vault with two 42-in round entry accesses	814-10 vault w/ 814-TEE-CLX Top w/ (2) 42" access hole w/ GRD
013145	10-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to left (Type 1)	814-10 CLX Type 1 vault w/ GRD
013146	10-ft high vault with one 72-in x 36-in and one 42-in round entry access, offset to right (Type 2)	814-10 CLX Type 2 vault w/ GRD
013161	8-ft high vault with H-30 LW 2-door hatch and one 42-in round entry access	814-8 CLX vault w/ GRD w/ LW Hatch
013162	8-ft high vault with H-30 LW 2-door hatch and one 42-in round entry access, offset to left (Type 1)	814-8 CLX Type 1 vault w/ GRD w/ LW Hatch
013163	8-ft high vault with H-30 LW 2-door hatch and one 42-in round entry access, offset to right (Type 2)	814-8 CLX Type 2 vault w/ GRD w/ LW Hatch

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"

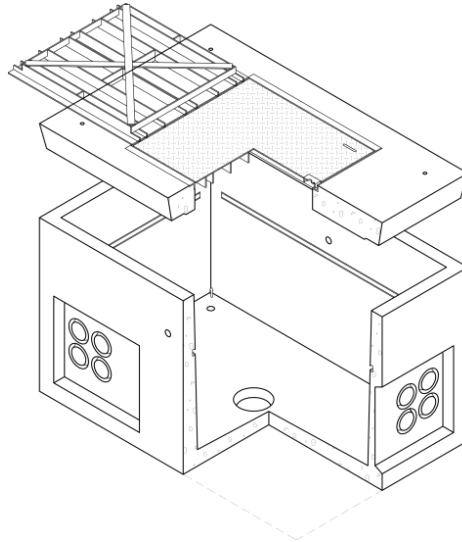
14. Sources

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)

644 Electric Vault, Primary Service



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:

Stock No	Description
013731	Base , standard 644
013732	Cover , with hatch
013733	Assembly ; base and cover with hatch

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.

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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

	Size, Nominal (in)	Location	Per Location	Total #
Knockouts				
Round	4-3/4 dia	All 4 walls, on bottom	8 ea side	32
Ground rod	1 dia	2 corners of floor	1 ea corner	2
Channels				
Galvanized "C" channel, horizontal, embedded in walls	36 long	End walls, above all knockouts	1 ea side	2
	60 long	Side walls, above all knockouts	1 ea side	2
Sump	8 dia	Floor, center	1, to one side	1
Pulling irons	1/2 dia	As request per project; 2 corners of floor (typical)	1 ea corner	4
Lift holes	1-1/2 dia	2 opposite walls, center wall, horizontal	1 ea side	2
Ground inserts, bronze	1/2 dia	2 opposite walls, internal and external	2 ea side	4
Ladder	–	Not required	–	

Base shall have dimensions as shown in Tables 4.2b and 4.2c, and Figure 4.2.

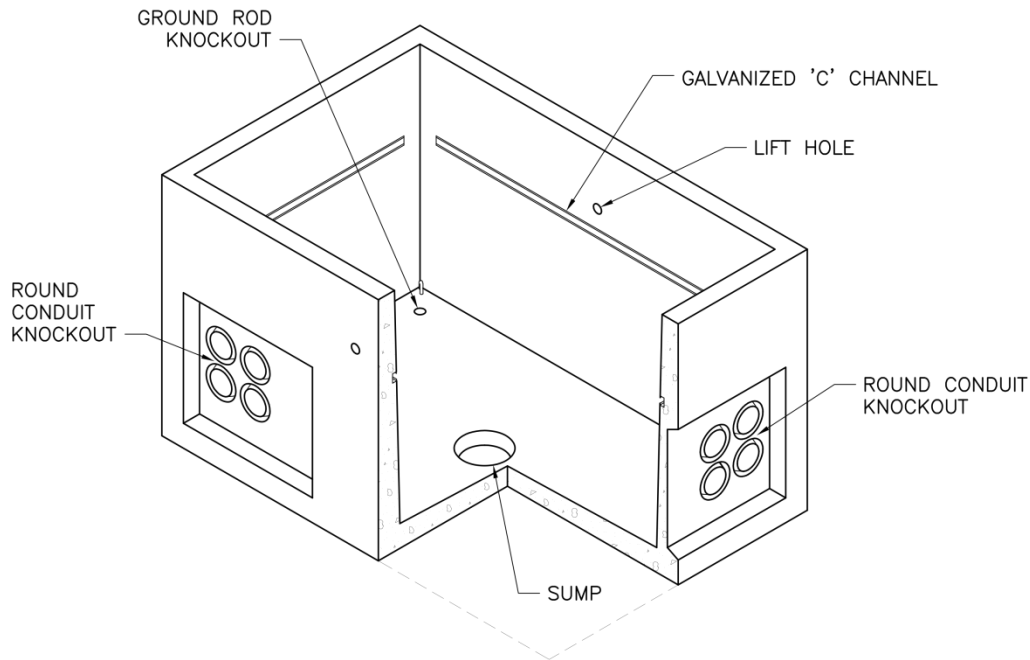
Table 4.2b. Base Dimensions, Inside, Nominal (ft-in)

Length	Width	Height
5-6	3-6	3-2

Table 4.2c. Base Dimensions, Outside, Nominal (ft-in)

Length	Width	Height
6-0	4-0	3-6

Figure 4.2. Base



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.

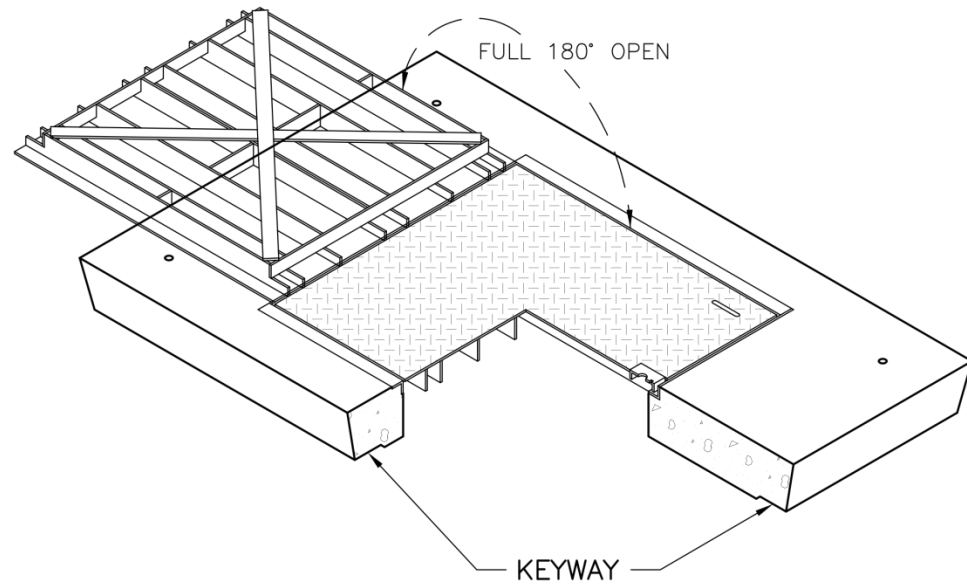
Table 4.3. Cover Dimensions, Nominal

Concrete Collar			
Length (ft-in)	Width (ft-in)	Thickness (in)	Opening (ft)
6-0	4-0	6	3 x 3

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

Stock No.	Description	Oldcastle/Utility Vault Catalog Number
130731	Base , standard 644	644-BL
130732	Cover , with hatch	64-332P
013733	Assembly , base and cover with hatch	644-LA

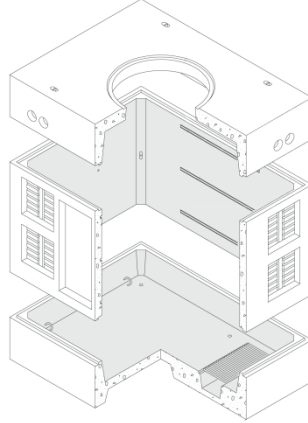
7. References

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:

Stock No.	Description
013734	Base , standard 687
013735	Mid-section
013736	Cover with round access
013737	Assembly (base, mid-section, and cover with round access)

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.

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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."

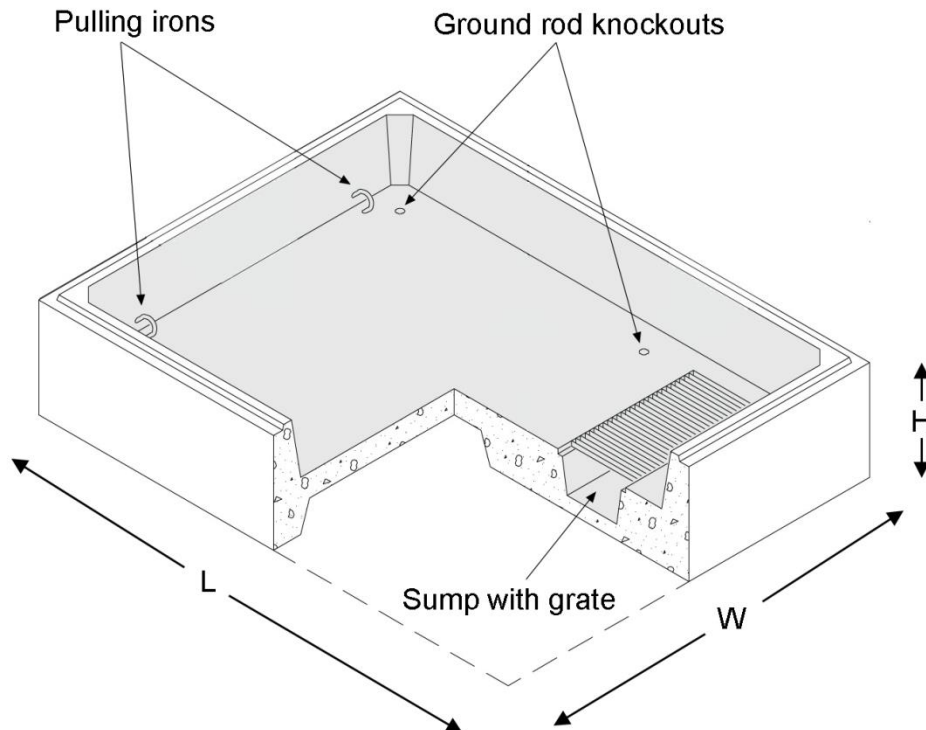
4. Base Requirements

The vault base shall be constructed according to the dimensions and details shown in Table 4 and Figure 4.

Table 4. Base Dimensions (Nominal)

Stock No.	Outside			Inside		
	Length	Width	Height	Length	Width	Height
013734	8' 8"	6' 8"	1' 10"	8' 0"	6' 0"	1' 0"

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.

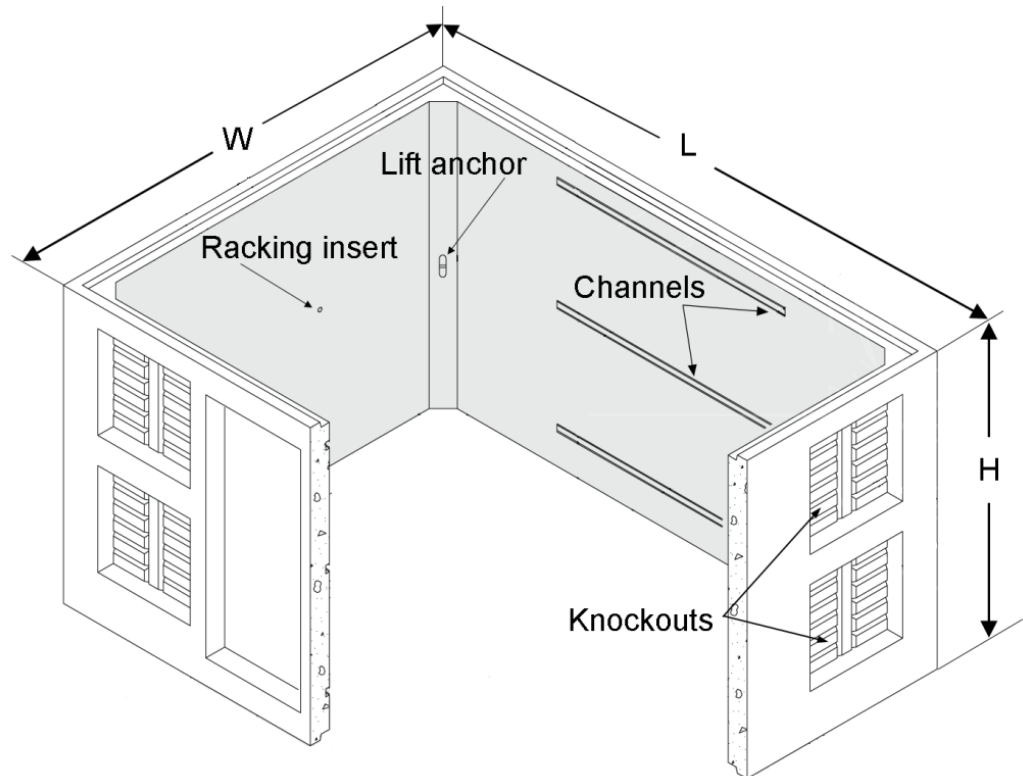
5. Mid-Section Requirements

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)

Stock No.	Outside			Inside		
	Length	Width	Height	Length	Width	Height
013735	8' 8"	6' 8"	4' 10"	8' 0"	6' 0"	4' 9"

Figure 5. Mid-Section



5.1 Knockouts, Waffle

Knockouts shall be of the waffle type.

Knockouts shall measure 18 in by 18 in.

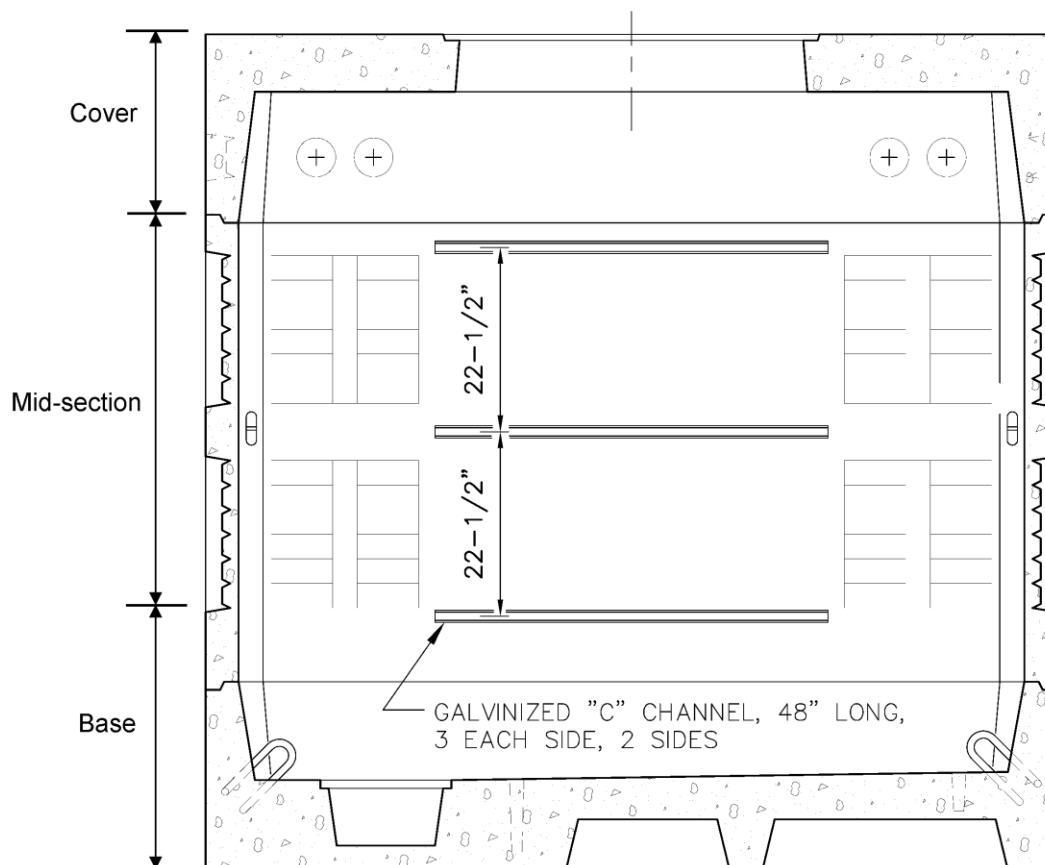
Four knockouts shall be located on the outer edge of each wall for a total of 16 knockouts.

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

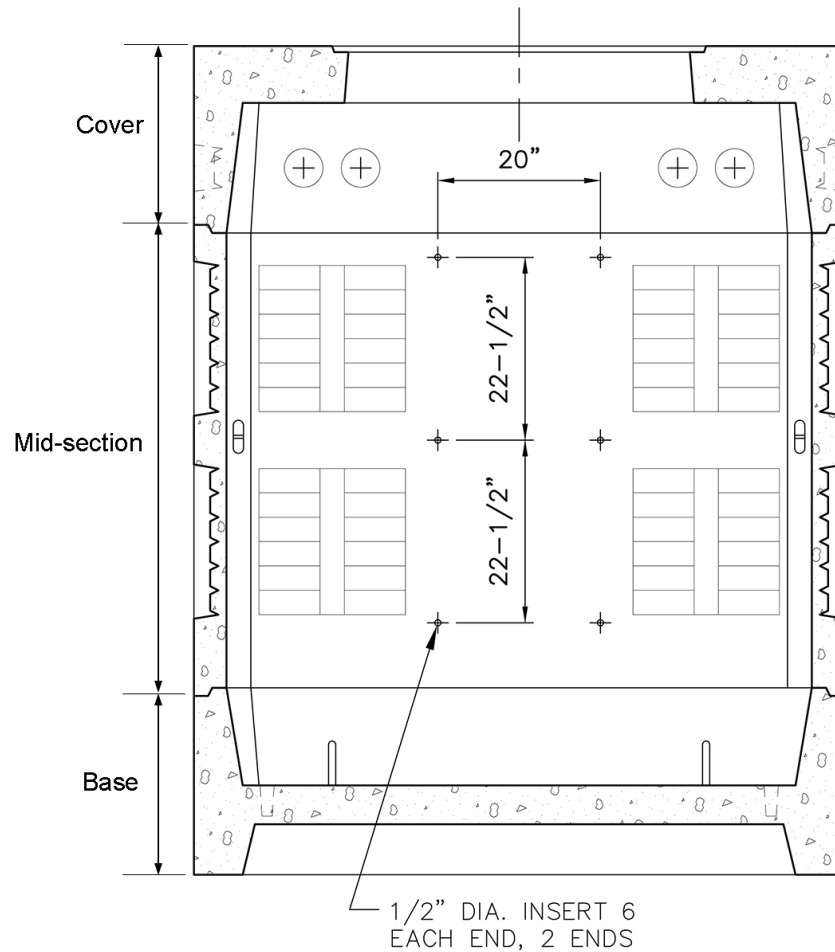


5.3 Racking Inserts

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.

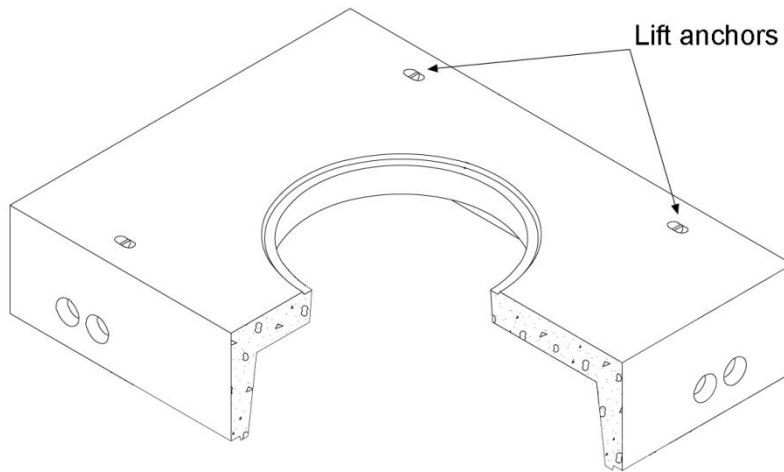
6. Cover Requirements

Covers shall be constructed according to the dimensions shown in Table 6 and Figure 6.

Table 6. Cover Dimensions (Nominal)

Stock No.	Outside			Inside			Access Configuration
	Length	Width	Height	Length	Width	Height	
013736	8' 8"	6' 8"	1' 10"	8' 0"	6' 0"	1' 3"	One 42" round

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

Stock No.	Components	Oldcastle/Utility Vault Catalog No.
130734	Base, standard 687	687-BL
130735	Mid-section with cable supports	687-ML
130736	Cover, with round access	687-TL-42C
130737	Assembly (base and cover with round access)	687-LA

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)

Precast Reinforced Concrete Transformer Pads



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:

Stock No	Description
013721	Single phase transformer pad
013722	Three phase transformer pad (75–300 kVA)
013723	Three phase transformer pad (500–1500 kVA)
013724	Three phase transformer pad (2000–2500 kVA)

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.

Standards Coordinator
Quan Wang

Standards Supervisor
John Shipek

Unit Director
Darnell Cola

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

Stock No.	Dimensions, nominal (ft-in)			Blockout Dimensions, nominal (in)		Blockout placement from edge of pad (in)
	Width W_p	Length L_p	Height H_p	Width W_b	Length L_b	
013721	4-0	4-8	0-6	22	14	8
013722	7-0	7-0	0-6	60	16	12
013723	8-0	7-9	0-6	60	16	12
013724	8-0	10-0	0-8	60	24	12

Figure 4.2a. Transformer Pad

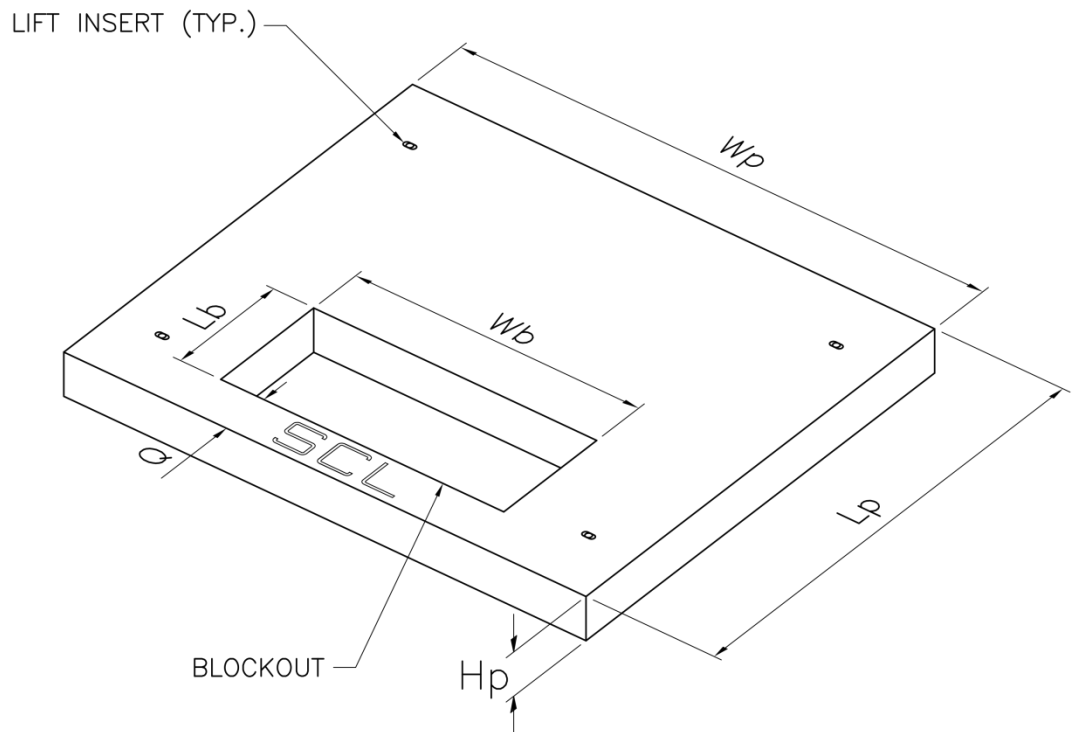
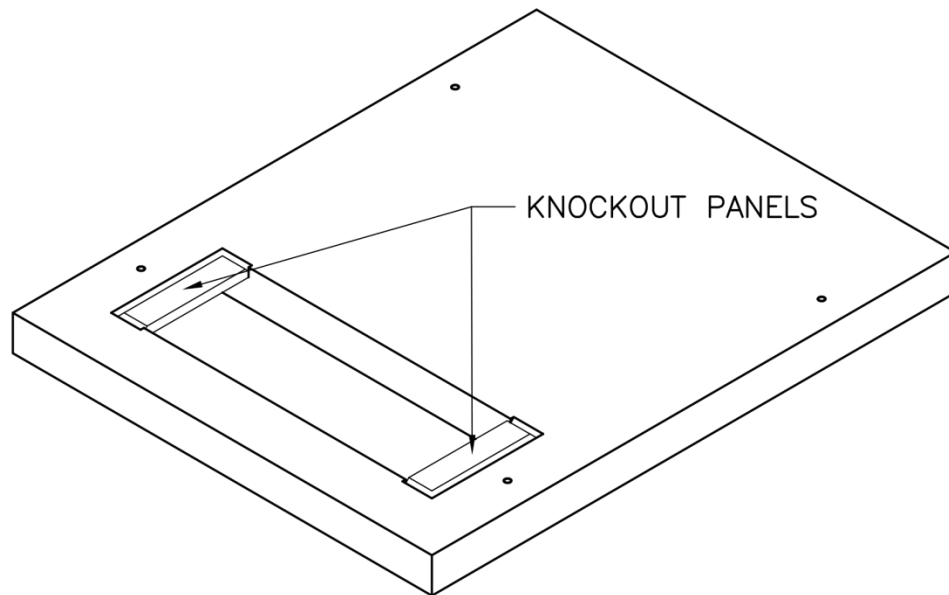


Figure 4.2b. Knockout Panel Detail



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

Stock No.	Description	Catalog No.
		Oldcastle/Utility Vault
013721	Single phase transformer pad	54-1422
013722	Three phase transformer pad (75–300 kVA)	77-1660
013723	Three phase transformer pad (500–1500 kVA)	88-1660
013724	Three phase transformer pad (2000–2500 kVA)	77-810-2460

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.

Stock No.	Conduit Trade Size (in)
013294	3/4
013295	1
013296	1-1/4
013297	1-1/2
013298	2
013299	2-1/2
013300	3
013301	3-1/2
013302	4
013303	5
013304	6

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.

Standards Coordinator
Brett Hanson

A handwritten signature in black ink, appearing to read "Brett Hanson".

Standards Supervisor
John Shipek

A handwritten signature in black ink, appearing to read "John Shipek".

Unit Director
Darnell Cola

A handwritten signature in black ink, appearing to read "Darnell Cola".

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

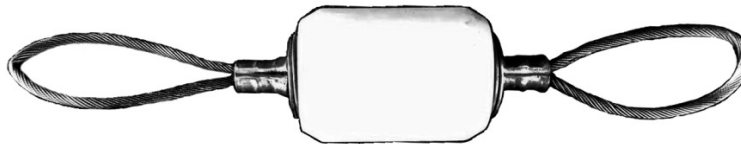


Figure 3.2. Mandrel

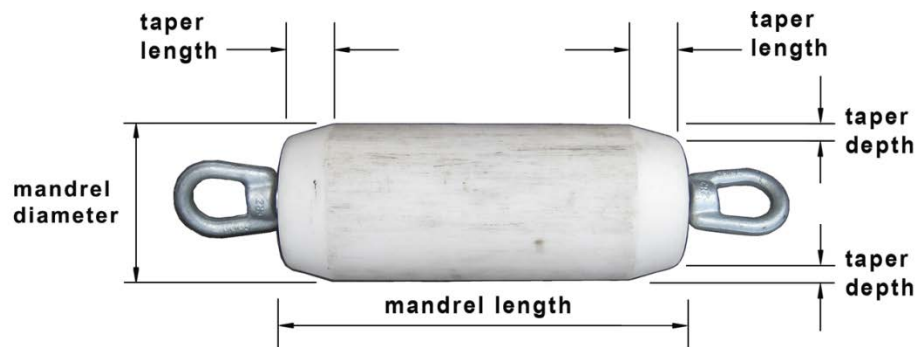


Table 3.1. Mandrel Dimensions

Stock No.	Conduit Trade Size (in)	Mandrel Diameter (in)	Mandrel Length (in)	Taper Length (in)	Taper Depth (in)	Material	Figure
013294	3/4	0.62	1.0	—	—	Delrin or nylon	3.1
013295	1	0.78	1.25	—	—	Delrin or nylon	3.1
013296	1-1/4	1.00	1.5	—	—	Delrin or nylon	3.1
013297	1-1/2	1.25	1.75	—	—	Delrin or nylon	3.1
013298	2	1.62	2.25	—	—	Delrin or nylon	3.1
013299	2-1/2	2.00	2.75	—	—	Delrin or nylon	3.1
013300	3	2.50	3.25	—	—	Delrin or nylon	3.1
013301	3-1/2	3.00	3.75	—	—	Delrin or nylon	3.1
013302	4	3.50	8.0	1.0	0.5	Delrin or nylon	3.2
013303	5	4.75	12.0	1.5	0.5	Delrin or nylon	3.2
013304	6	5.50	14.0	2.0	0.7	Delrin or nylon	3.2

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.

Standards Coordinator
Kathy Tilley

Standards Supervisor
John Shipek

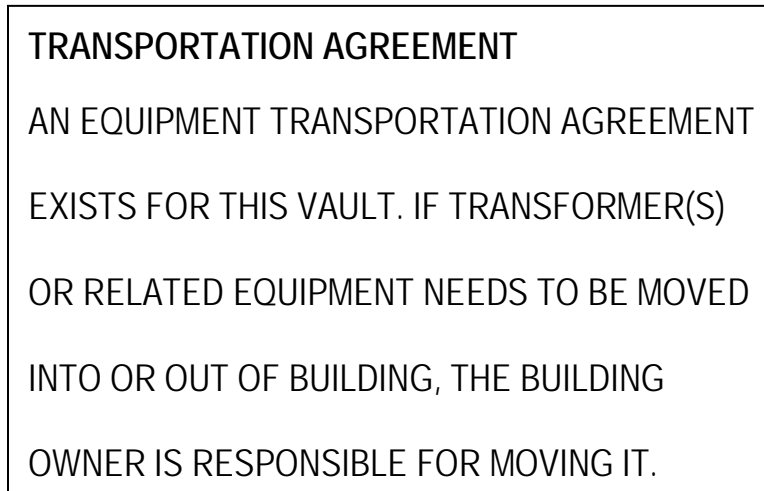
Unit Director
Darnell Cola



3. General Requirements

Material	Phenolic resin sheet
Dimensions	12 in x 12 in square, $\pm 1/16$ in
Color	
Sign	Red
Lettering	White
Lettering style and size	
Style	All caps, sans serif font, engraved
Size	Title text: 1-in high, nominal Body text: 1/2-in high, nominal
Thickness (in)	6 mils, nominal
Mounting	4 holes, 5/16-in diameter, $\pm 1/16$ -in, on corners

Figure 3. Text Sign Example



4. Suggested Manufacturer

Scott Machine Development Corporation, Walton, NY

5. Sources

Customer Electric Service Installation Process (CESIP) Section 12.30; "Equipment Transportation Agreement Procedure," SCL Energy Delivery Operations, June 2008

Scott Machine Development Corporation; www.scottmachinecorp.com

Tilley, Kathy; SCL Electrical Engineering Support Specialist, originator of 7651.25
(kathy.tilley@seattle.gov)