



## SECTION 4

***SaskPower***



**REQUIREMENTS FOR  
CONSUMER-OWNED  
SUBSTATIONS  
GREATER THAN 5 kV**



**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

**Table of Contents**

<b>4.1</b>	<b><u>JURISDICTION</u></b> .....	403
4.1.1	SaskPower Electrical Inspections Division .....	403
4.1.2	SaskPower Transmission & Distribution.....	403
4.1.3	SaskPower Customer Services.....	403
<b>4.2</b>	<b><u>GENERAL REQUIREMENTS</u></b> .....	405
4.2.1	Voltages .....	405
4.2.2	SaskPower Required Drawings .....	405
<b>4.3</b>	<b><u>SERVICE REQUIREMENTS</u></b> .....	407
4.3.1	Extending Supply Service from 15 kV or 25 kV System .....	407
4.3.1.1	Aerial Supply .....	407
4.3.1.2	Buried Supply .....	407
4.3.2	Extending Supply Service from 72 kV, 138 kV or 230 kV Aerial System .....	407
4.3.2.1	Aerial Supply .....	407
4.3.3	Metering.....	407
4.3.3.1	General.....	407
4.3.3.1.1	15 kV or 25 kV – Aerial Supply – Metering Options.....	408
4.3.3.1.2	15 kV or 25 kV – Buried Supply – Metering Options.....	408
4.3.3.1.3	72 kV, 138 kV or 230 kV – Aerial Supply – Metering Options.....	408
4.3.3.2	Meter Mounting .....	409
4.3.3.2.1	General.....	409
4.3.3.2.2	Switchgear .....	410
4.3.3.3	Instrument Transformers, Enclosures & Supports.....	410
4.3.3.3.1	General.....	410
4.3.3.3.2	Instrument Transformers.....	410
4.3.3.3.3	Instrument Transformer Enclosures.....	411
4.3.3.3.4	Instrument Transformer Supports .....	411
4.3.3.4	Conduit and Secondary Wiring Requirements .....	412
4.3.3.4.1	15 kV or 25 kV Supply Voltages.....	412
4.3.3.4.2	72 kV, 138 kV or 230 kV Supply Voltages.....	413
4.3.3.5	Meter Signals .....	413
4.3.3.5.1	General.....	413
4.3.3.6	Communications .....	413
4.3.3.6.1	15 kV or 25 kV Supply Voltages.....	413
4.3.3.6.2	72 kV, 138 kV or 230 kV Supply Voltages.....	413

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

**Table of Contents (continued)**

<b>4.4</b>	<b><u>SPECIFICATIONS</u></b> .....	415
4.4.1	Aerial Supply Conductors.....	415
4.4.1.1	Phase Spacing .....	415
4.4.1.2	Lightning Protection (Shield) Wires .....	415
4.4.1.3	Deadend Tensions.....	415
4.4.1.4	Deadend Heights.....	416
4.4.1.5	Deadend Insulation Levels.....	416
4.4.2	Electrical Clearances Within Substations - External Clearances in Air.....	416
4.4.2.1	Phase Conductors (Outdoor).....	416
4.4.2.2	Other Clearances (Outdoor).....	417
4.4.3	Protection of Substation Equipment .....	417
4.4.3.1	Surge Arresters .....	417
4.4.3.2	Equipment Insulation Levels .....	417
4.4.4	Protection Coordination .....	418
4.4.5	Consumer Equipment Co-ordination .....	418
4.4.6	Disconnection of Substation from Transmission Line.....	418
4.4.7	Phase Rotation .....	419
4.4.8	Ambient Conditions .....	419
	Figures.....	421

## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.1 JURISDICTION

#### 4.1.1 SaskPower Electrical Inspections Division

All Consumer-owned substation requirements and regulations shall be as per the Code.

Drawings, and any subsequent revisions, of electrical single line, site plan, electrical arrangements, and pertinent equipment specifications shall be submitted before construction to the SaskPower Electrical Inspections Division, for review.

All Consumer owned high voltage substations shall be inspected by the SaskPower Electrical Inspections Division prior to being energized.

#### 4.1.2 SaskPower Transmission & Distribution

SaskPower Transmission and Distribution involvement within the Consumer substation shall be limited to the following areas:

- Connections at point of delivery.
- Electrical Clearances (Point of delivery to load side of protection equipment).
- Protection Co-ordination.
- Insulation Co-ordination.

Where the design of the proposed substation related to the connections, clearances, protection co-ordination and insulation co-ordination is of concern, SaskPower Transmission and Distribution shall indicate the recommended modifications.

#### 4.1.3 SaskPower Customer Services

SaskPower Customer Services, Metering Services involvement within the Consumer substation shall be limited to revenue metering.

Where the design of the proposed substation related to revenue metering is of concern, SaskPower Customer Services, Metering Services shall indicate the recommended modifications.

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

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## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.2 GENERAL REQUIREMENTS

#### 4.2.1 Voltages

All voltages quoted herein are nominal phase to phase voltages, unless otherwise specified.

#### 4.2.2 SaskPower Required Drawings

In addition to the requirements of the SaskPower Electrical Inspections Division, the Consumer shall submit **three copies** of the following drawings to the appropriate SaskPower Business Manager. These drawings will in turn be distributed to Transmission and Distribution and Customer Services - Metering Services. Dimensions are to be shown in metric.

- Substation plot plan showing the location of the substation in relation to the provincial survey system.
- Layout plan indicating the location of all existing and proposed roads, civil structures, site improvements, communication towers, and electrical equipment.
- Single line and three line diagrams of complete electrical system including Consumer's apparatus designations and phasing orientation.
- Substation layout plan indicating the ground grid and fence grounding systems.
- Substation structure drawings indicating:
  - Center Phase of Termination structure Geo-referenced to UTM NAD83 Zone 13 Extended
  - Structure details for conductor and shield wire termination and isolating switch.
  - Location of revenue metering units and conduit to these units. If revenue metering is to be installed in switchgear, a drawing indicating the proposed revenue metering installation, including the instrument transformer compartment, is required.
  - Transformer, circuit breaker, surge arresters, etc.

After reviewing the supplied drawings, SaskPower will advise the Consumer of any necessary corrections required to comply with SaskPower's requirements. The Consumer shall submit revised drawings to SaskPower Customer Services, to confirm corrections requested by SaskPower.

However, SaskPower Transmission and Distribution and Customer Services will not approve substations designed by the Consumer or his agent. Approval for the substation must be obtained from the SaskPower Electrical Inspections Division.

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

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## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.3 SERVICE REQUIREMENTS

#### 4.3.1 Extending Supply Service from 15 kV or 25 kV System

##### 4.3.1.1 Aerial Supply

SaskPower will extend an aerial supply service to the Consumer owned deadend insulators located within the Consumer's substation. The deadend insulators will be the point of delivery. The ownership of facilities to the point of delivery shall remain with SaskPower.

##### 4.3.1.2 Buried Supply

SaskPower will extend a buried supply service to the Consumer's equipment. The ownership of facilities to the point of delivery shall remain with SaskPower. Options are:

- Consumer supplied switchgear. The point of delivery shall be the cable termination in the switchgear.
- Consumer supplied padmounted switch, as per Code.
  - For a dead-front switch, the point of delivery shall be the high voltage load-break bushings. The bushings shall consist of a short load-break bushing insert with integral partial vacuum flashover solution, Elastimold Cat. No. 2701A4A, Cooper Cat. LBI225, or a SaskPower approved equivalent. SaskPower will terminate the supply conductors with separable insulated connectors (elbows).
  - For a live-front switch, the point of delivery shall be the high voltage cable terminations.
- The Consumer shall ensure that the switchgear cable termination compartment and the padmounted switch have adequate phase barriers and grounding means. Where working space (3m) or electrical clearance is insufficient to safely install grounds, a ground switch is required.

#### 4.3.2 Extending Supply Service from 72 kV, 138 kV or 230 kV Aerial System

##### 4.3.2.1 Aerial Supply

SaskPower will extend an aerial supply service to the Consumer owned termination structure located within the Consumer's substation. The SaskPower supplied riser conductor will be the point of delivery as per Figure 4-5. The ownership of facilities to the point of delivery shall remain with SaskPower.

### 4.3.3 Metering

#### 4.3.3.1 General

Three element metering shall be used for all new installations. The Consumer shall provide adequate space for installation of three voltage transformers and three current transformers.

Due to the numerous options for metering the Consumer, such as pole-mount, padmount, switchgear, etc., the Consumer shall contact the appropriate SaskPower Business Manager to determine details for the specific application.

## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.3.3.1.1 15 kV or 25 kV - Aerial Supply - Metering Options

- Consumer owned overhead facilities, similar to Figure 4-1. SaskPower will utilize pole mounted instrument transformers, which shall be installed immediately on the load side of the Consumer's supply isolating switches. The Consumer is responsible for connection of the Consumer supplied conductors to the SaskPower supplied bypass switch.
- Consumer supplied padmounted metering cabinet <sup>(1)</sup>, as per Code, with Consumer supplied primary cable to the metering cabinet. The metering cabinet shall include a separate compartment for SaskPower's instrument transformers.
- Consumer supplied switchgear, similar to Figure 4-2 <sup>(1)</sup>. The Consumer shall provide a separate compartment for SaskPower's instrument transformers. This compartment shall be located immediately on the load side of the Consumer's point of isolation in the switchgear.

Note (1): The Consumer shall ensure that the switchgear or padmounted metering cabinet have adequate phase barriers and grounding means. Where working space (3m) or electrical clearance is insufficient to safely install grounds, a ground switch is required.

### 4.3.3.1.2 15 kV or 25 kV - Buried Supply – Metering Options

- Consumer supplied padmounted metering cabinet <sup>(2)</sup>, as per Code. The padmounted metering cabinet shall include a separate compartment for SaskPower's instrument transformers.
- Consumer supplied switchgear, similar to Figure 4-2 <sup>(2)</sup>. The Consumer shall provide a separate compartment for SaskPower's instrument transformers. This compartment shall be located immediately on the load side of the Consumer's point of isolation in the switchgear.

Note (2): The Consumer shall ensure that the switchgear or padmounted metering cabinet have adequate phase barriers and grounding means. Where working space (3m) or electrical clearance is insufficient to safely install grounds, a ground switch is required.

### 4.3.3.1.3 72 kV, 138 kV or 230 kV – Aerial Supply – Metering Options

- Consumer owned overhead facilities. Instrument transformers required for SaskPower's revenue metering shall normally be installed immediately on the load side of the Consumer's gang operated supply switch. For individual instrument transformers, voltage transformers shall normally be installed on the line side of the current transformers. The Consumer is responsible for connection of the Consumer supplied conductor to the SaskPower supplied connectors on the instrument transformers.
- As a consumer preferred alternative to instrument transformers installed on the line side of the service, SaskPower will allow metering on the secondary side of the Consumer's power transformer provided there are no technical or operational impediments. The Consumer shall contact the appropriate SaskPower Account Manager to determine details for the specific application. The Consumer will provide the required technical data to allow the metering instrumentation to be compensated.

## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.3.3.2 Meter Mounting

#### 4.3.3.2.1 General

- 15 kV or 25 kV Service
  - SaskPower shall supply and install:
    - a meter and associated equipment.
  - The Consumer shall supply and install:
    - For services with a connected load of less than 5 MVA either:
      - a 36" x 36" x 18" weatherproof meter cabinet, complete with backing plate, proper grounding and window (if the Consumer wishes to read the meter), or
      - a minimum space of 1.2 x 1.2 x 1.2 m, located in a consumer owned facility. This space shall be backed with a piece of 19 mm thick plywood, with its centre line not more than 1.7 m or less than 1.2 m above floor level. The Consumer shall supply and install onto the 1.2 m x 1.2 m plywood a 30" x 30" x 12" meter cabinet complete with backing plate and proper grounding.
    - For services with a connected load of equal to or greater than 5 MVA:
      - a minimum space of 1.2 x 1.2 x 1.2 m., located in an environmentally controlled building. This space shall be backed with a piece of 19 mm thick plywood, with its centre line not more than 1.7 m. or less than 1.2 m. above floor level. The Consumer shall supply and install onto the 1.2 m. x 1.2 m. plywood a 30" x 30" x 12" meter cabinet complete with backing plate and proper grounding. The Consumer shall supply and install a 120 VAC power supply in the meter cabinet.
    - a 13-jaw combination meter socket (meter socket with sufficient space for a 10-pole test switch). This meter socket shall be mounted with the centre line of the socket 1.5 m to 1.8 m above finished grade or floor level:
      - inside the 36" x 36" x 18" meter cabinet, or
      - onto the 1.2 m x 1.2 m plywood, adjacent to the 30" x 30" x 12" meter cabinet. In no case shall the top of the meter socket extend beyond the plywood.
    - a ground connection in the meter socket.
- 72 kV, 138 kV or 230 kV Service
  - SaskPower shall supply and install:
    - a meter and associated equipment.
  - The Consumer shall:
    - provide a minimum space of 1.2 x 1.2 x 1.2 m, located in an environmentally controlled building. This space shall be backed with a piece of 19 mm thick plywood, with its centre line not more than 1.7 m or less than 1.2 m above floor level.
    - supply and install onto the 1.2 m x 1.2 m plywood a 30" x 30" x 12" meter cabinet complete with backing plate and proper grounding.
    - supply and install a 13-jaw combination meter socket (meter socket with sufficient space for a 10-pole test switch). This meter socket shall be mounted onto the 1.2 m x 1.2 m plywood, adjacent to the 30" x 30" x 12" meter cabinet, and with the centre line of the

## Section 4

### Requirements for Consumer-Owned Substations Greater Than 5 kV

socket 1.5 m to 1.8 m above the floor. In no cases shall the top of the meter socket extend beyond the plywood.

- supply and install 120 VAC power supply in the meter cabinet.
- supply and install a ground connection in the meter socket.

#### 4.3.3.2.2 Switchgear

When the Consumer installs switchgear, and the meter is located in the same switchgear assembly as the instrument transformers, the meter shall be located in a separate compartment. The meter compartment shall conform to the following dimensions:

- Depth - 380 mm (15") minimum to 450 mm (18") maximum
- Height - 850 mm (34") minimum
- Width - 600 mm (24") minimum

The meter compartment shall be equipped with a hinged door, flush with the front of the switchgear, with provisions for sealing by SaskPower. A window shall be provided if the Consumer wishes to read the meter. The meter compartment shall be located so that the meter can be mounted with its centre line at a height of 1.5 m to 1.8 m above floor level.

When the meter socket is separate from the switchgear, it may be wall-mounted adjacent to the switchgear, with approval from SaskPower Customer Services, Metering Services.

#### 4.3.3.3 Instrument Transformers, Enclosures & Supports

##### 4.3.3.3.1 General

Revenue metering instrument transformers and other associated equipment supplied by SaskPower shall be used exclusively for the purpose of SaskPower revenue metering.

##### 4.3.3.3.2 Instrument Transformers

SaskPower shall:

- supply and maintain all revenue metering instrument transformers.
- for aerial supply voltages of 25 kV or less, supply and install bypass switches and a cluster bracket, complete with instrument transformers, on a Consumer owned pole. SaskPower shall supply and install a ground grid at the base of the pole.
- install all 72 kV, 138 kV and 230 kV instrument transformers on facilities provided by the Consumer.

The Consumer shall:

- when the supply voltage is 25 kV or less, install the SaskPower supplied instrument transformers in the switchgear or padmounted metering cabinet..
- contact SaskPower Customer Services, Metering Services for instrument transformer details.

Instrument transformers will not be shipped out of the province for installing in switchgear or in padmounted metering cabinets.

Voltage transformers, 15 kV or 25 kV class, may be equipped with one fuse per transformer centrally mounted for 3-phase, 4-wire wye circuits.

## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.3.3.3.3 Instrument Transformer Enclosures

15 kV and 25 kV Buried Supply

When switchgear or padmounted metering cabinet is utilized, the Consumer shall:

- provide a separate and completely barriered compartment for mounting the voltage transformers and current transformers. The compartment shall be located immediately after the isolation switch.
- ensure that the instrument transformer compartment is of sufficient size to enable maintenance and replacement of instrument transformers.
- provide a means for padlocking and sealing (by SaskPower) the instrument transformer compartment.
- install the instrument transformer enclosure a minimum of 300 mm (12") above the floor or final grade.
- in addition to the electrical clearances specified in the applicable CSA standard, provide for a minimum physical separation of 50 mm to be maintained between instrument transformers and between the instrument transformer and the surrounding switchgear to provide adequate working clearances.
- contact SaskPower Customer Services, Metering Services for instrument transformer installation details.

The instrument transformer compartment shall be required to be equipped with a draw out type or swing out type carriage with disconnect provisions for de-energizing and grounding the primary of each transformer upon withdrawal.

### 4.3.3.3.4 Instrument Transformer Supports

- For 15 kV or 25 kV Aerial Supply:
  - The Consumer shall:
    - provide and install a class 4 / 35' (minimum) pole for mounting the SaskPower supplied and installed bypass switches and cluster bracket / instrument transformer assembly as per Figure 4-1.
- For 72 kV Aerial Supply:
  - The Consumer shall:
    - provide and install a platform or pedestals for mounting of SaskPower instrument transformers.
    - ensure proper grounding of the platform or pedestals.
- For 138 kV or 230 kV Aerial Supply
  - The Consumer shall:
    - provide and install pedestals for mounting of SaskPower instrument transformers.
    - ensure proper grounding of the pedestals.

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

**4.3.3.4 Conduit and Secondary Wiring Requirements**

**4.3.3.4.1 15 kV or 25 kV Supply Voltages**

When the instrument transformers are located indoors:

- The Consumer shall supply and install:
  - a continuous run of conduit (minimum 35 mm (1¼") diameter) for the exclusive use of SaskPower between the instrument transformer enclosure and the meter enclosure, to a maximum length of 11 m.
  - sealable LB fittings or similar conduit fittings, if required.
  - the bond on the meter socket when PVC conduit is used.
- SaskPower shall supply and install:
  - a continuous run of secondary conductors in the Consumer supplied conduit between the instrument transformers and the meter test switch (such that there are no splices or interruptions).
  - a test switch.

When the instrument transformers are located outdoors:

- The Consumer shall:
  - supply and install buried 78 mm (3") PVC water tight conduit from the pole mounted instrument transformer structure, or from the padmounted metering cabinet, to the meter. When a pole mounted instrument transformer structure is used, the conduit shall extend 1200 mm up the instrument transformer structure, and be complete with a 78 mm (3") PVC expansion joint.
  - obtain approval from SaskPower Customer Services, Metering Services, if the length of the 78 mm (3") PVC conduit requirement exceeds 75 metres.
  - limit the number of 90 degree PVC conduit bends to four (4).
- SaskPower shall supply and install:
  - a continuous run of secondary conductors in the Consumer supplied conduit between the instrument transformers and the meter test switch (such that there are no splices or interruptions).
  - a test switch.

## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.3.3.4.2 72 kV, 138 kV or 230 kV Supply Voltages

The Consumer shall:

- supply and install buried 103 mm (4") PVC water tight conduit from the instrument transformer structure to the indoor metering cabinet space provided. The conduit shall extend 1200 mm up the instrument transformer structure and be terminated on a Consumer supplied junction box located on the instrument transformer structure.
- obtain approval from SaskPower Customer Services, Metering Services, if the length of the 103 mm (4") PVC conduit requirement exceeds 75 metres.
- limit the number of 90 degree PVC conduit bends to four (4).
- for 72 kV supply voltage, supply and install conduit, pull boxes, and junction box as per Figure 4-3.
- for 138 kV or 230 kV supply voltage, supply and install conduit, pull boxes, and junction box as per Figure 4-4.
- supply and install a pull box located inside the building, and adjacent to the revenue meter.

SaskPower shall supply and install:

- a continuous run of secondary conductors in the Consumer supplied conduit between the instrument transformers and the meter test switch (such that there are no splices or interruptions).
- a test switch.
- flexible conduit between the instrument transformers and the Consumer supplied pull box.

### 4.3.3.5 Metering Signals

#### 4.3.3.5.1 General

Any Consumer requiring output signals from the SaskPower revenue meter shall contact the appropriate SaskPower Business Manager for applicability, availability, details, and costs.

In the event that output signals are provided to the Consumer, SaskPower will not accept any liabilities with respect to the use or loss of the output signals.

### 4.3.3.6 Communications

#### 4.3.3.6.1 15 kV or 25 kV Supply Voltages

The Consumer is responsible for the supply and installation of SaskPower pre-approved communication devices to the revenue meter, for the exclusive use of SaskPower. Due to numerous options available, SaskPower, Metering Services may be contacted to discuss such options.

The communication service will be in SaskPower's name, and payment of all monthly charges will be the responsibility of SaskPower.

#### 4.3.3.6.2 72 kV, 138 kV or 230 kV Supply Voltages

The Consumer is responsible for the supply and installation of a dedicated PSTN communication line to the revenue meter, for the exclusive use of SaskPower.

The communication service will be in SaskPower's name, and payment of all monthly charges will be the responsibility of SaskPower.

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

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## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.4 SPECIFICATIONS

#### 4.4.1 Aerial Supply Conductors

##### 4.4.1.1 Phase Spacing

A slack span is required from SaskPower line terminal to the Consumer-supplied termination structure as per Fig 4-5. Phase spacing shall be sufficient in order to prevent phase-to-phase faults under severe wind conditions.

Minimum slack span phase spacing on SaskPower substations is:

- 1.2 m for 15 kV
- 1.2 m for 25 kV
- 3.5 m for 72 kV
- 4.0 m for 138 kV
- 6.0 m for 230 kV

These separations are required for the mounting tabs for the SaskPower-supplied deadend insulators located on the Consumer's termination structure.

##### 4.4.1.2 Lightning Protection (Shield) Wires

At voltages above 25 kV, lightning protection may be provided on the transmission lines by one or two shield wires, depending on the type of construction. The shield wire(s) will be insulated from the Consumer's termination structure and ground grid.

##### 4.4.1.3 Deadend Tensions

Consumer-owned termination structure(s) as per Fig 4-5 shall be designed to withstand the following mechanical loads:

- Maximum tension per phase conductor - 6672 N (1500 lb.)
- Maximum tension per shield wire - 4450 N (1000 lb.)

The above tensions are required to permit sufficient ground clearance for phase conductors and sufficient shield wire to phase conductor clearance for the slack spans. Safety factors are not included in these values. This information shall be indicated on drawings of the proposed Consumer substation.

The insulator mounting tab on the Consumer-supplied termination structure shall accommodate a 110kN (25000 lb) shackle with dimensions as shown on Figure 4-6.

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

**4.4.1.4 Deadend Heights**

	<u>15 kV</u>	<u>25 kV</u>	<u>72 kV</u>	<u>138 kV</u>	<u>230 kV</u>
Minimum phase conductor deadend height above ground level	8 m	8 m	11 m	11 m	11 m
Minimum shield wire deadend height above phase conductor level	N/A	N/A	2.1 m	2.1 m	3.0 m

The above requirements are minimum in order to provide the necessary ground clearance in the slack span.

Higher deadend heights permit greater flexibility in line terminal location and slack span length.

**4.4.1.5 Deadend Insulation Levels**

	Number of Deadend Porcelain Insulators in String	
	ANSI Class	
	52-1	
	<u>15 kV</u>	<u>25 kV</u>
Normal Conditions	3	3
Contamination Areas	5	5

Deadend composite insulators shall meet or exceed the equivalent values of the deadend porcelain insulators above.

**4.4.2 Electrical Clearances Within Substations – External Clearances in Air**

The following SaskPower clearances are minimum metal to metal for electrical components ahead of Consumer's protective device within Consumer substations. SaskPower recommends these clearances be maintained throughout the Consumer's substation to ensure reliability of supply to other consumers is not affected.

**4.4.2.1 Phase Conductors (Outdoor)**

<u>System Nominal Voltage</u>	<u>15 kV</u>	<u>25 kV</u>	<u>72 kV</u>	<u>138 kV</u>	<u>230 kV</u>
<u>BIL</u>	110 kV	150 kV	350 kV	650 kV	1050 kV
Minimum Clearances for Rigid Bus,					
line-to-ground	300 mm	300 mm	740 mm	1 480 mm	2 150 mm
line-to-line	380 mm	380 mm	840 mm	2 140 mm	2 680 mm

Flexible Strain Bus to follow same minimum clearances as Rigid Bus with allowance for maximum deflection of conductor.

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

**4.4.2.2 Other Clearances (Outdoor)**

Clearances shall be per the Code as well as any other applicable CSA standards including C22.3 No.1, but shall not be less than the following:

	<u>15 kV</u>	<u>25 kV</u>	<u>72 kV</u>	<u>138 kV</u>	<u>230 kV</u>
Over Grade	3.4 m	3.4 m	3.7 m	4.3 m	4.9 m
Over Roads	5.78 m	5.78 m	7.7 m	8.3 m	8.9 m
Grade to Lowest Exposed Insulator	2.5 m	2.5 m	2.5 m	2.5 m	2.5 m

**4.4.3 Protection of Substation Equipment**

**4.4.3.1 Surge Arresters**

In order to minimize disturbances caused by insulation failures in Consumer apparatus, the Consumer shall provide surge protection via surge arresters. The Consumer is responsible to determine adequate protective margins for their equipment. The Canadian Standards Association Guides CAN/CSA C71-1-99 and C71-2-98 set out the principles and practice for insulation coordination on three phase AC power systems having a nominal voltage above 1000 volts. The surge arresters shall be capable of withstanding the power frequency voltages specified in Section 3.2.

**4.4.3.2 Equipment Insulation Levels**

Equipment (i.e. transformers, breakers, switch gear, switches, etc.) connected to SaskPower's system shall comply to the following insulation levels:

<u>System Voltages-kV</u>	<u>Insulation Class-kV</u>	<u>Basic Insulation Level or Lightning Impulse Level-kV</u>
15	15	110
25	25	125
72	72.5	350
138	145	650
230	245	1050

These insulation levels are **required** for equipment ahead of Consumer's protective device. SaskPower recommends these insulation levels be adopted throughout the Consumer's equipment to ensure reliability of supply to other Consumers is not affected.

## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.4.4 Protection Coordination

SaskPower's objective is to limit the impact of Consumer faults on its own facilities and adjacent Consumer facilities. If the Consumer's facilities are supplied via SaskPower facilities with a primary voltage of 72 kV or higher, high speed clearing of the fault (removal of the fault within 100 milliseconds of inception of the fault) may be a requirement. The requirement will normally be based upon the drop in the positive sequence voltage that occurs during the fault. If the positive sequence voltage at the point of common coupling drops to less than 85% of nominal during the fault, high speed clearing may be required. The need for high speed clearing **must be assessed** in conjunction with SaskPower.

It should be noted that the coordination of protection is for the protection of SaskPower equipment and the maintenance of services to other Consumers. SaskPower cannot assume responsibility for the protection of Consumer-owned equipment.

The Consumer is advised that under- and over-voltage and under- and over-frequency conditions can occur. SaskPower powerlines may be equipped with high-speed automatic reclose equipment which can be either single-phase or three-phase in operation. Refer to Section 3.2 for a further discussion of the characteristics of the SaskPower system. The Consumer shall take suitable precautions for the protection of his equipment. Refer to Section 3 for further details.

At voltages above 72kV, SaskPower Transmission & Distribution requires the use of a circuit breaker or circuit switcher as the automatic circuit interrupting device on the high voltage side of a Consumer owned substation. Breakers and circuit switchers provide superior protection when compared to fuses. They are superior in that they eliminate single-phasing, increase flexibility for coordination, and eliminate the nuisance of "sneak-outs" (i.e. fuse blowing due to long-term deterioration of the fuse element).

At voltages of 72 kV or higher, SaskPower Transmission & Distribution requires that the Consumer's transformer use a delta connected or ungrounded wye connected high voltage winding. If the Consumer has, or anticipates that they may have on-site generation which operates synchronously with SaskPower's system, they should refer to the requirements set out in the following SaskPower documents:

Generation Interconnection Requirements at Voltages 34.5 kV and Below, or  
Non-Utility Generation Interconnection Requirements at Voltages 72 kV and Above

The Consumer shall confirm settings of protection relays or size of fusing with SaskPower Transmission & Distribution to insure coordination with SaskPower owned equipment and that service to other consumers will be safe and reliable.

### 4.4.5 Consumer Equipment Coordination

The characteristics of the Consumer's facilities and load can affect SaskPower's system. Consumers are required to insure that their facilities comply with the power quality requirements set out in Section 3. In order to insure coordination of their facilities, the Consumer will be required to provide SaskPower with the characteristics of their facility. These data requirements will be identified by SaskPower Customer Services at the time the Consumer applies for service. The type of data required will depend on the service voltage and the nature of the Consumer's load.

### 4.4.6 Disconnection of Substation from Transmission Line

Maintenance, safety, and SaskPower system operation considerations require a disconnect switch (either motorized or manual) to disconnect the Consumer substation from the transmission line. The disconnect device shall be located on the line side of metering transformers and any consumer equipment including surge arrestors. It is recommended that the Consumer consider a 3-phase manually operated ground switch to be used on the load side of the disconnect device.

## Section 4 Requirements for Consumer-Owned Substations Greater Than 5 kV

### 4.4.7 Phase Rotation

..... Phases on SaskPower's system are designated by the colors Red, Yellow, and Blue, with the phase rotation being POSITIVE R-Y-B (A-B-C) counter-clockwise direction.

In general, the connection of the primary supply line to the Consumer's substation shall be such that Red phase is to the H1 transformer bushing, Yellow phase is to the H2 bushing, and Blue phase is to the H3 bushing or maintain positive sequence of YBR or BRY.

...In cases where it may be necessary or desirable to have the phases connected in a manner different from the above standard, the phasing will be established by mutual agreement between the Consumer and SaskPower.

### 4.4.8 Ambient Conditions

All consumer equipment must be capable of withstanding the required voltages, conducting the required current, and interrupting the required fault current in the required time within an ambient temperature range of -50 degrees C. to + 45 degrees C.

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**

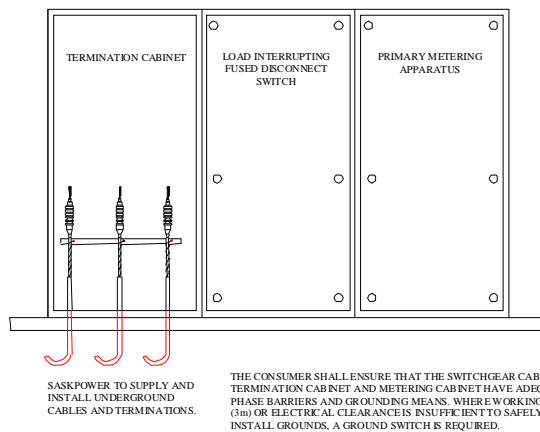
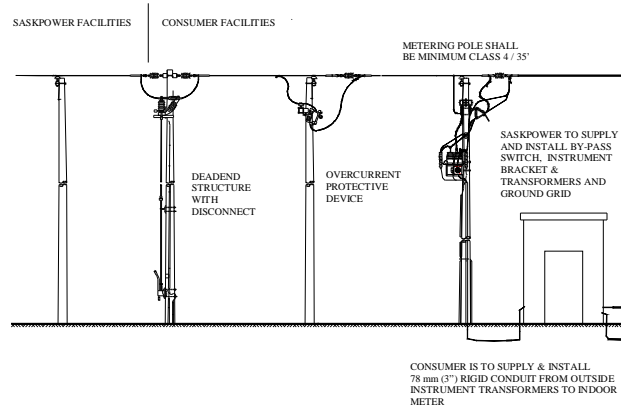
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**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**  
**FIGURES**



**Section 4**  
**FIGURES**

**SaskPower**



**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**  
**FIGURES**

(This page intentionally left blank)

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**  
**FIGURES**

**TABLE OF CONTENTS**

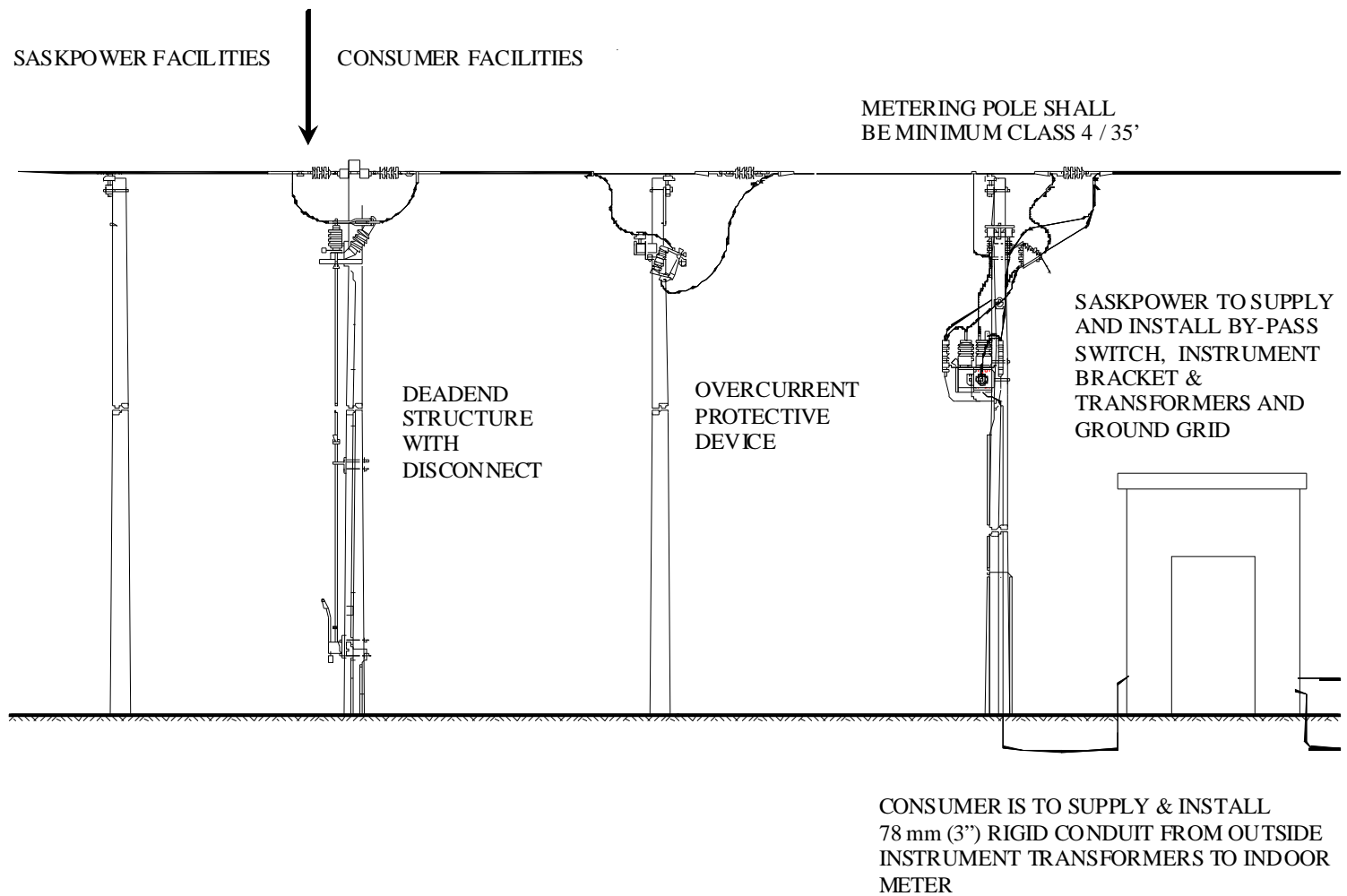
**FIGURES**

Figure 4-1	Consumer Owned Overhead 15 or 25 kV Facilities (Typical) .....	425
Figure 4-2	Consumer Owned 15 or 25 kV Switchgear (Typical).....	426
Figure 4-3	Conduit, Pull Boxes, and Junction Box 72 kV Outdoor Instrument Transformer Secondary .....	427
Figure 4-4	Conduit, Pull Boxes, and Junction Box 138 or 230 kV Outdoor Instrument Transformer Secondary 428	
Figure 4-5	72, 138 and 230 kV Termination Structure (Typical).....	429
Figure 4-6	72, 138 and 230 kV Insulator Mounting Tab Dimensions.....	430

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**  
**FIGURES**

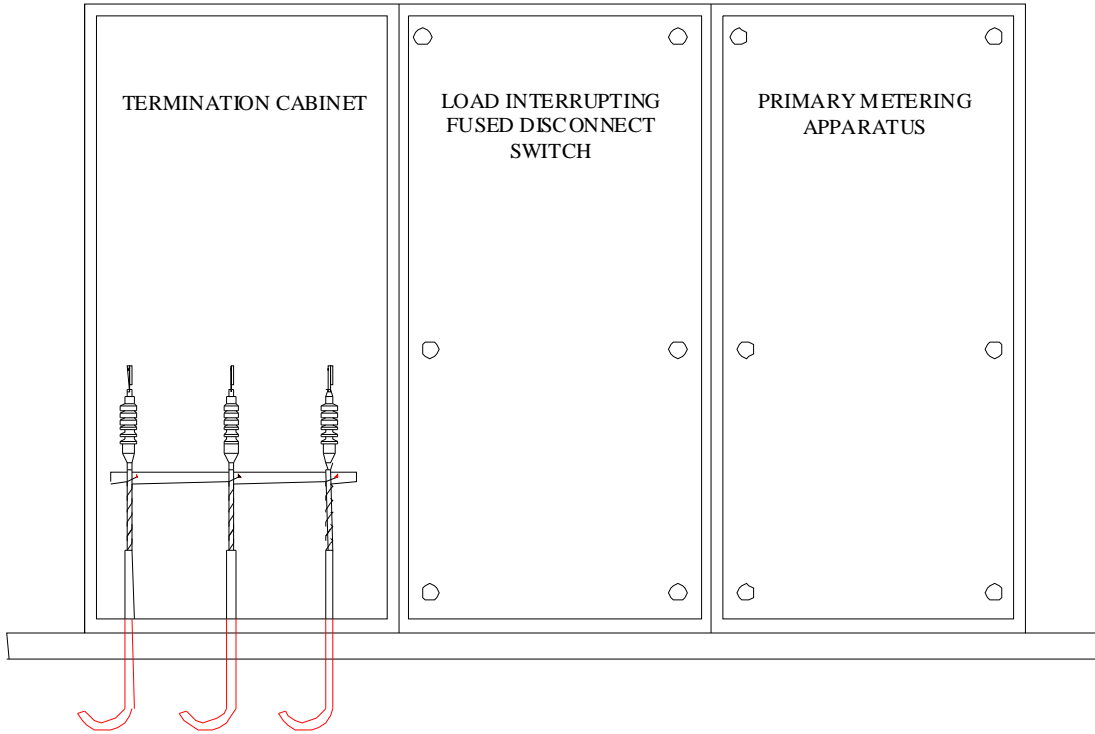
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**Section 4**  
**Requirements for Consumer-Owned Substations Greater than 5 kV**  
**FIGURES**



**Consumer Owned Overhead 15 or 25 kV Facilities (Typical)**  
**Fig 4-1**

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**  
**FIGURES**

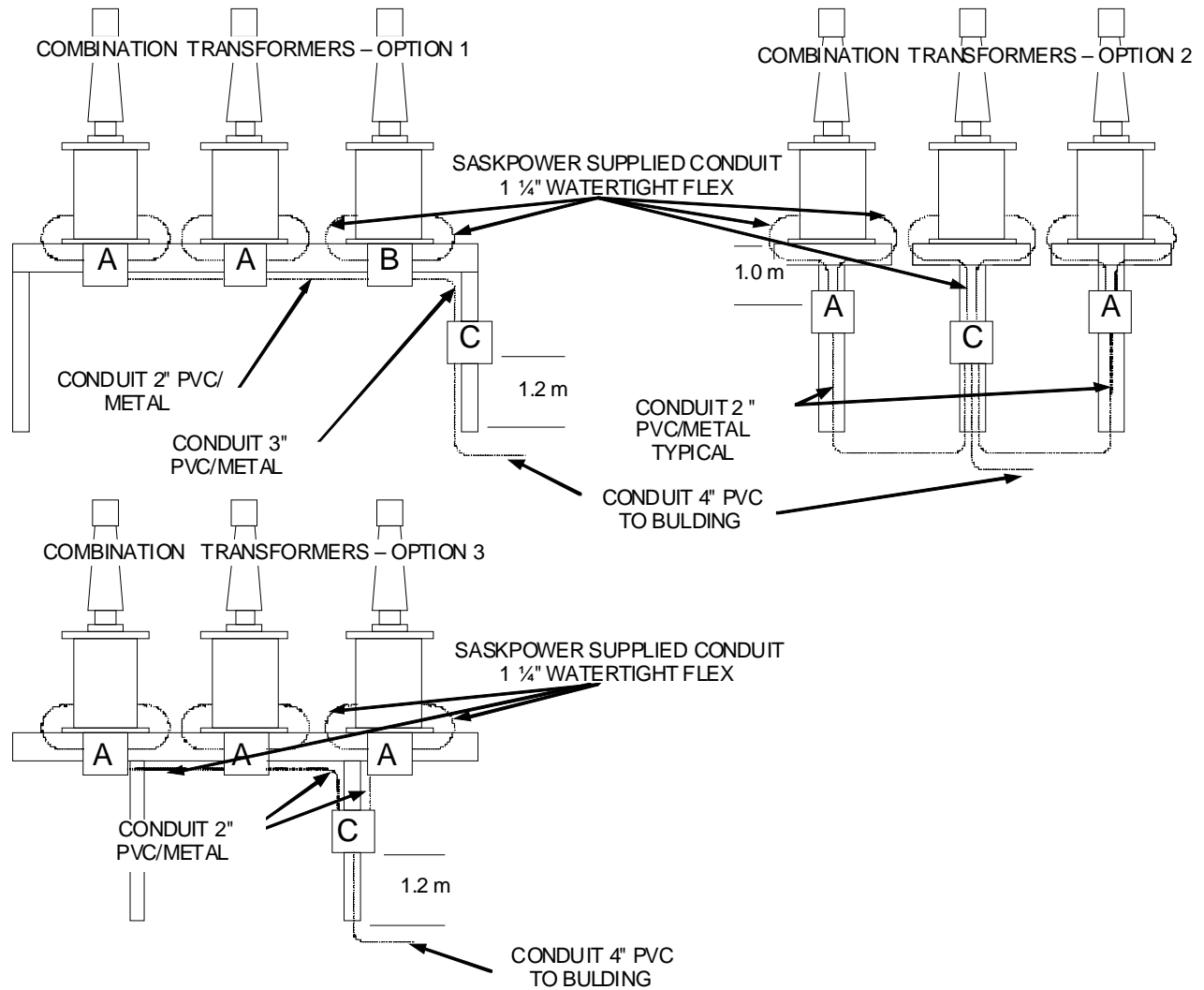


SASKPOWER TO SUPPLY AND INSTALL UNDERGROUND CABLES AND TERMINATIONS.

THE CONSUMER SHALL ENSURE THAT THE SWITCHGEAR CABLE TERMINATION CABINET AND METERING CABINET HAVE ADEQUATE PHASE BARRIERS AND GROUNDING MEANS. WHERE WORKING SPACE (3m) OR ELECTRICAL CLEARANCE IS INSUFFICIENT TO SAFELY INSTALL GROUNDS, A GROUND SWITCH IS REQUIRED.

**Consumer Owned 15 or 25 kV Switchgear (Typical)**  
**Fig 4-2**

**Section 4**  
**Requirements for Consumer-Owned Substations Greater than 5 kV**  
**FIGURES**

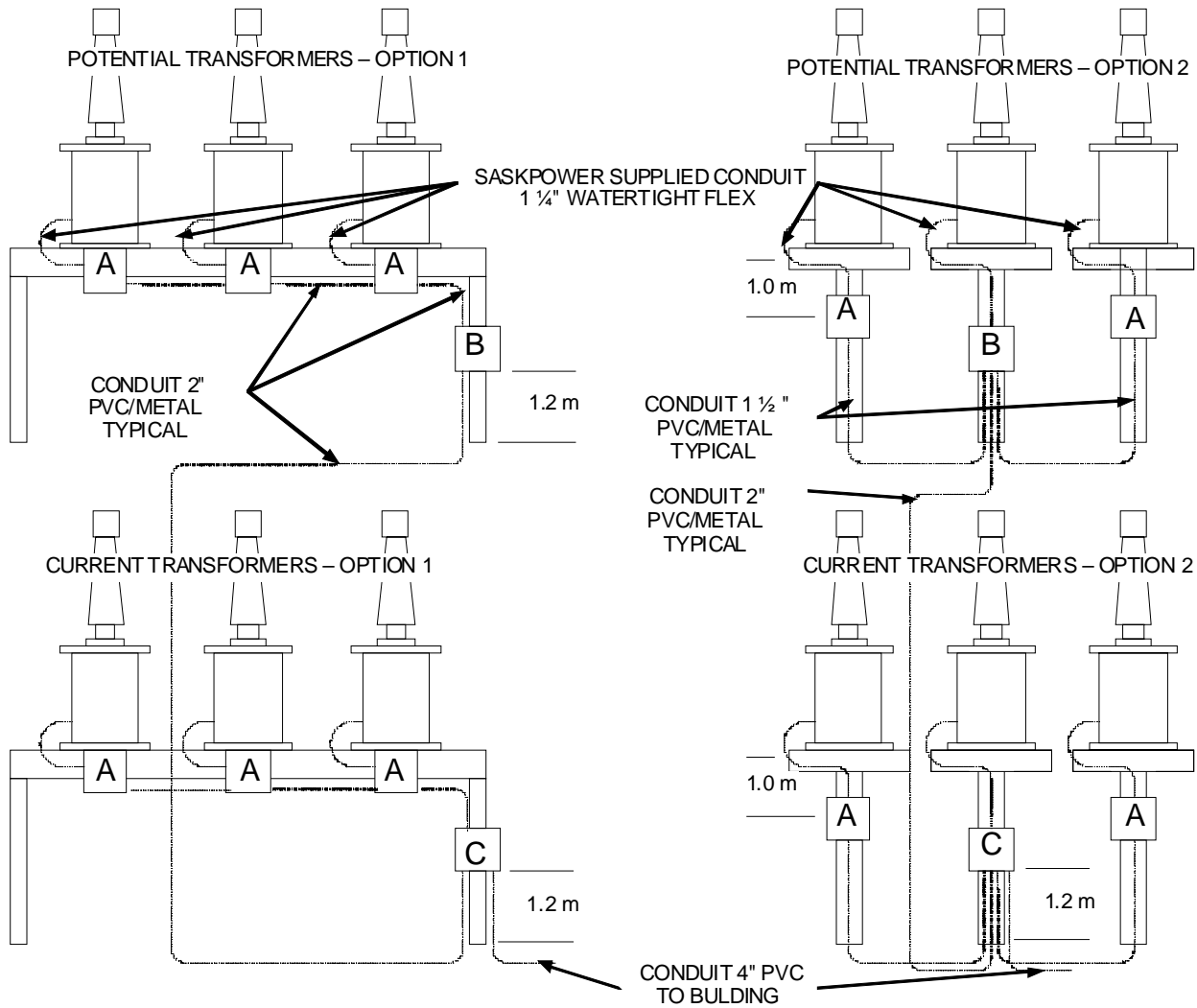


PULL BOXES	DIMENSIONS
A	8" X 8" X 6"
B	12" X 12" X 6"

JUNCTION BOX	DIMENSIONS
C	24" X 16" X 6"

**Conduit, Pull Boxes and Junction Box 72 kV**  
**Outdoor Instrument Transformer Secondary**  
**Figure 4-3**

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**  
**FIGURES**



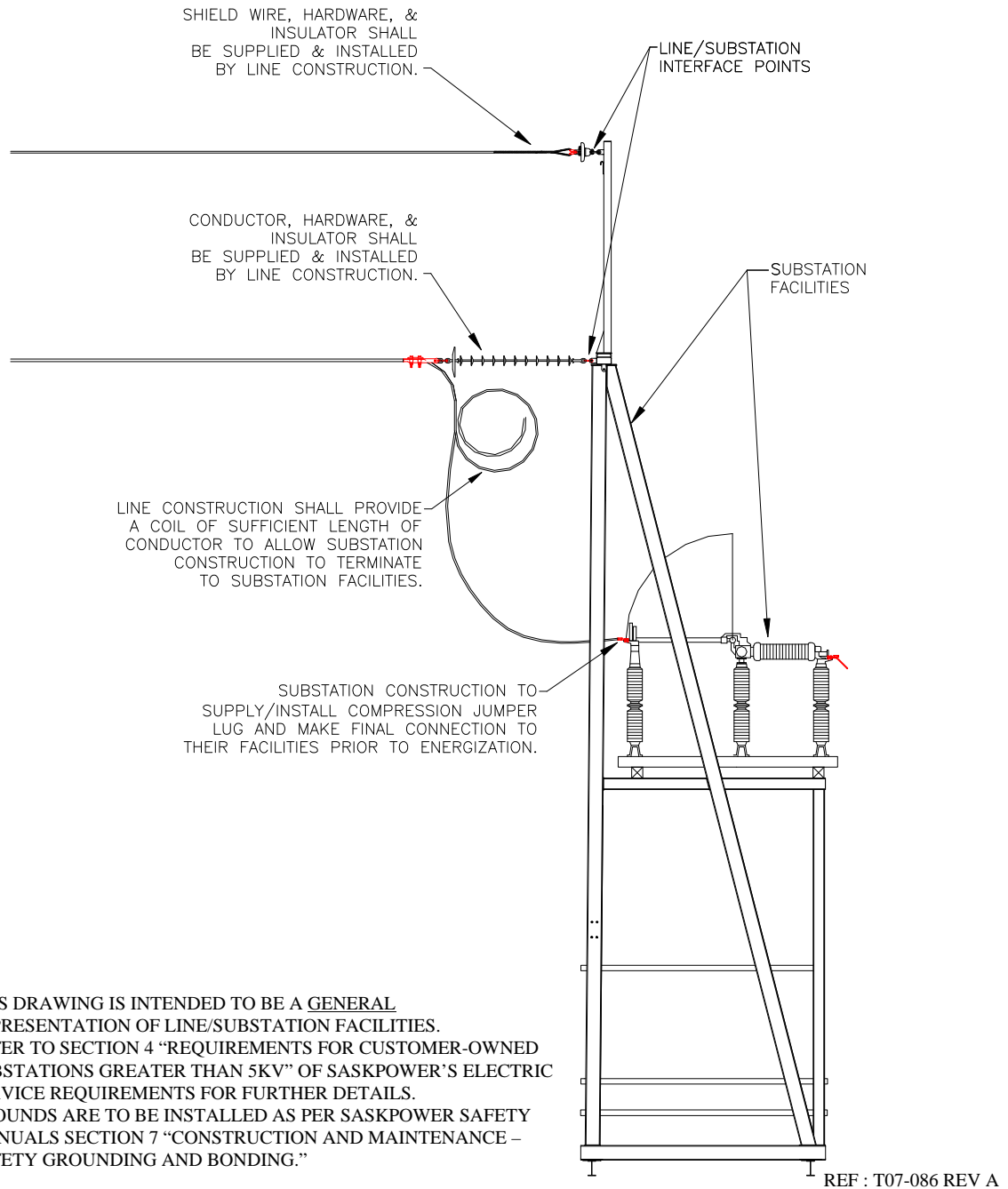
PULL BOXES	DIMENSIONS
A	8" X 8" X 6"
B	12" X 12" X 6"

JUNCTION BOX	DIMENSIONS
C	24" X 16" X 6"

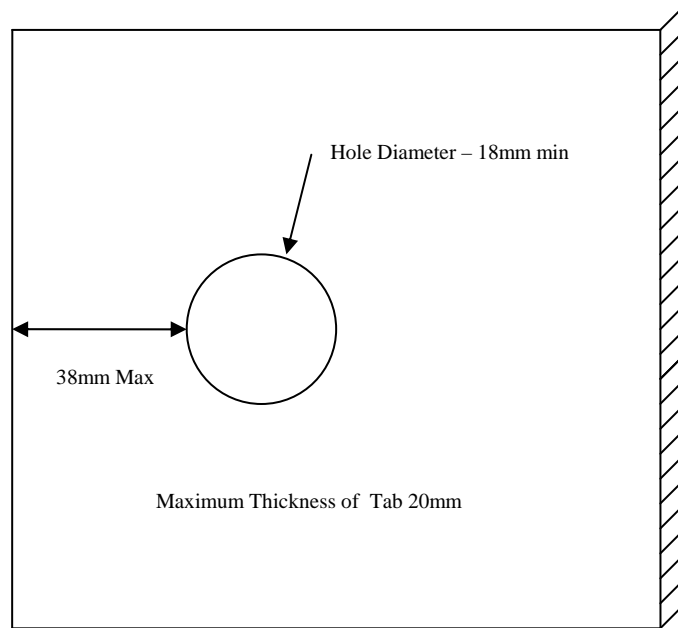
**Conduit, Pull Boxes and Junction Box 138 or 230 kV**  
**Outdoor Instrument Transformer Secondary**  
**Figure 4-4**

**Section 4**  
**Requirements for Consumer-Owned Substations Greater than 5 kV**  
**FIGURES**



**72, 138 and 230 kV Termination Structure (Typical)**  
**Fig 4-5**

**Section 4**  
**Requirements for Consumer-Owned Substations Greater Than 5 kV**  
**FIGURES**



**72, 138 and 230 kV Insulator Mounting Tab Dimensions**  
**Fig 4-6**