



Primary Underground Cable Injection

Standard
Operating
Procedure

Table of Contents

TABLE OF CONTENTS	1
1.0 PERSONS AFFECTED	2
2.0 PURPOSE	2
3.0 RATIONALE	2
4.0 SCOPE	2
5.0 POLICIES AND REGULATORY REQUIREMENTS	2
6.0 ROLES, RESPONSIBILITIES AND PREREQUISITES	3
7.0 TOOLS AND EQUIPMENT	3
8.0 PLANNING AND PREPARATION CHECKLIST	3
9.0 PROCEDURE	4
10.0 ACRONYMS, DEFINITIONS AND SYMBOLS	6
11.0 COMPONENTS	6
12.0 OWNER	6
13.0 REFERENCES	7



Primary Underground Cable Injection

Standard
Operating
Procedure

1.0 Persons Affected

This Standard Operating Procedure (SOP) affects:

All SaskPower personnel/contractor(s) within Distribution Services that work on primary underground cable injection.

2.0 Purpose

This SOP provides:

This SOP is intended to provide SaskPower personnel/contractor(s) with a safe procedure and direction for work on primary underground cable injection.

3.0 Rationale

This SOP ensures the following:

- To reduce the risk of serious injury from the hazard of working on primary underground cable injection.

4.0 Scope

In-the-Scope of the Procedure

- The procedure includes the following:
 - Explanation of the primary underground cable injection process
 - The step by step procedure for primary underground cable injection

Out-of-the-Scope of the Procedure

- The procedure does not include the following:
 - The identification of cables
 - The instructions for the operation of tools and equipment

5.0 Policies and Regulatory Requirements

This SOP is a result of the following policies, regulations, industry standards, and corporate directives and standards:

Policies:

- Personal Protective Equipment Policy
- Job Hazard Assessment Policy

Regulatory Requirement(s)

Saskatchewan Occupational Health & Safety Act and Regulations

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Other

- SaskPower Safety Rulebook
- SaskPower Standard Protection Code



Primary Underground Cable Injection

Standard Operating Procedure

6.0 Roles, Responsibilities and Prerequisites

In-the-Scope of the Procedure Role(s)	Quantity Required	Responsibilities	Prerequisites
SaskPower personnel/ contractor(s)	1 or more	<ol style="list-style-type: none">1. Inspect tools and equipment prior to use2. Obtain required permits	<ol style="list-style-type: none">1. Standard Protection Code Distribution Course

7.0 Tools and Equipment

Tools and Equipment and Quantity Required:

- TDR cable
- Splices
- A variety of injection terminators/adaptors
- Injection Fluids
- Vacuum Pump
- Soak Bottle
- Flow Test Assembly
- Injection and vacuum bottles
- Soapy water spray bottle

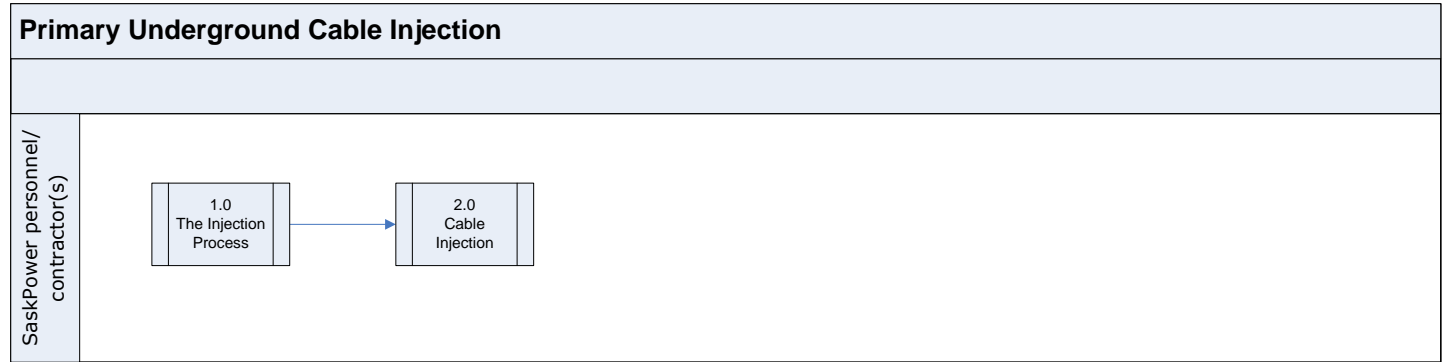
8.0 Planning and Preparation Checklist

Things to Check Before Starting the Procedure:

- Complete Hazard and Risk Assessment
- Applicable Personal Protective Equipment (PPE) is available and in good condition.

9.0 Procedure

High Level Flowchart



The Procedure

1.0 The Injection Process

1.1 Explanation of the injection process

1.1.1 All SaskPower personnel/contractor(s) required to perform URD cable injection shall review the following information:

- *Circuits are de-energized and grounded. A high-performance time domain reflectometer (TDR) is attached to the cable end. A very narrow pulse is transmitted down the cable length. This pulse is partially reflected at every change in impedance along the cable. This approach allows for accurate locating of all sleeves (or splices) along with any other impedance anomalies*
- *For cable with conductors larger than 3/0 it is generally necessary to replace each splice with a special purpose injectable splice. These splices are available in a variety of designs from major global manufacturers in heat-shrink, cold-shrink, or molded varieties. For conductors smaller than 3/0, molded splices will generally flow without modification. Fluid flows around the compression sleeve or through a drilled water stop. Injecting at high pressure requires special injection adaptors and sealing technology.*
- *After the injection terminations are installed, an air flow test is done. This consists of air under pressure being forced into the cable on one end, and a vacuum being utilized at the other end of the subject cable. This verifies continuous flow through the strands and the sleeves if there are any. If there are more than 2 sleeves in one segment, do not attempt injection. While the cable under test is still in the de-energized state, a small amount of desiccant is injected into the strands, followed by the primary silicone product. The desiccant will flush the cable of impurities,*

and once the primary fluid is injecting, the cable can be re-energized if required.

- *Finally, the silicone fluid is injected at a pressure between 1 and 7 bar behind the strand desiccant. For cables with conductors greater than 3/0 the process is complete as there is sufficient volume in the interstitial spaces within the strands to sufficiently treat the insulation.*
- *For cables smaller than 3/0, a small reservoir of fluid referred to as a "soak bottle" is left attached to the termination for 60 to 120 days depending on the thickness of the insulation and the conductor temperature. The soak bottle supplies replacement fluid to the strands at less than 1 bar as the fluid in the strands slowly diffuses into the insulation. The soak bottle design permits its connection to an energized cable. The bottle may be removed with a suitable insulating stick without an addition circuit outage where work rule permit.*

2.0 Cable Injection

2.1 URD cable injection

2.1.1 All SaskPower personnel/contractor(s) required to perform URD cable injection shall follow these steps:

- *De-energize the ground cable*
- *Tdr cable*
- *Change elbows or terminations*
- *Remove permanent caps and install injections adapters on the elbows*
- *Set the pressure at 15 psi with, or at 28 psi without splice*
- *Connect the flow test assembly to the injection adapter of the elbow in the exhaust position*
- *Switch the flow test valve to the pressurized position, if the flow drops to 0 cc/m in less than 5 seconds, the termination is blocked or there is restriction in the cable*
- *At the other end of the cable, connect a pressure gauge and monitor time it takes before having any movement*
- *Check for any leaks by spraying soapy water*
- *Monitor the flow until it stabilizes to zero, then the pressure test is done and the cable is ready to be injected*
- *Switch the flow test valve to the exhaust position to bleed the air from the cable, wait for the ball to drop to zero and start vacuum at the receiving end*
- *Install injection and vacuum bottles at each ends*
- *Remove ground*



Primary Underground Cable Injection

Standard
Operating
Procedure

- *Re-energize cable*

2.2 Trade names of injection fluids

2.2.1 All SaskPower personnel/contractor(s) required to perform URD cable injection shall review the following information as required:

- *CableCURER/XL*
- *CableCURE/DMDB*
- *CableCURE/CB*
- *CableCURE/SD*

NOTE: Cables are injected with CableCURE/XL, or CableCURE/DMDB, or CableCURE/CB, or a mixture of the XL and CB.

10.0 Acronyms, Definitions and Symbols

Acronyms and Abbreviations

TDR- A high-performance time domain reflectometer

Definitions

N/A

Symbols

N/A

11.0 Components

The following is a list of components for this SOP which can be accessed through the SOP System:

Component Name	Component Type	Component Description	Location of Component
Primary underground cable injection Flowchart	Flowchart	High level flowchart for the procedure	SOP Online - Primary underground cable injection

12.0 Owner

Owner



Primary Underground Cable Injection

Standard
Operating
Procedure

Operations and Maintenance Director - Kevin Schwing

13.0 References

References	Location of Resource