

Rejuvenation Instructions #623 – EPR Insulated Cables



This NRI covers the following:

- How to determine the fluid compatibility and type.
- How to determine the injection pressures.
- Special preparation instructions for rubber insulation.
- More injection instructions for the SPR process.

Trademarks: http://www.novinium.com/trademarks/

Patents: http://www.novinium.com/patents/



WARNING: It is dangerous working around energized high-voltage systems, pressurized systems, and chemicals. Always work in accordance to the Novinium Field Operations Safety Handbook (FOSH) or other local governing safety standards.

©Novinium, Inc. 2023, all rights reserved. <u>engineering@novinium.com</u> Revised: February 21, 2023 Novinium, Inc. 22820 Russell Rd Kent, WA 98032 (253) 395-0200



Table of Contents

Introd	uction	. 2			
Fluid (Compatibility	. 2			
Fluid 1	Гуре	. 2			
Deter	mining iUPR Injection Pressure	. 2			
Deter	mining SPR Injection Pressure	. 2			
1.	Find the adjusted tailored injection pressure (ATIP) for rubber insulation.	. 2			
2.	Reduce the ATIP further for large elevation changes.	. 3			
Preparing Cables					
1.	Strip the insulation	. 3			
Injecti	on Procedures	.4			
1.	SPR Injection	.4			
2.	Compare fluid supplied to the target	.4			



Introduction

There is a wide variety of rubber insulated cables with different colors and chemistries. While EPR (Ethylene Propylene Rubber) is a common type of rubber insulation for medium voltage cables, it should not be confused with other types of rubber insulation.

When rubber insulation (including EPR) is encountered in the field, the first step is to confirm it is compatible with the fluid. Only then can the cable be injected with adjusted procedures described below.

Fluid Compatibility

Not all rubber insulation is compatible with injection. If you encounter any type of rubber insulation you have not previously injected with the approval of Engineering, contact <u>Engineering@novinium.com</u> for further guidance.

For some types of EPR, Engineering may give approval without requiring a sample. Otherwise, a small sample of the insulation may be required for compatibility testing. This may take 2-4 weeks to complete from the time of shipment.

Note: rubber insulations can easily be confused with common types of EPR. Always try to confirm using cable markings or cable specifications from the customer.

Fluid Type

Rubber insulated cable approved for injection **should only be injected with 732/80. Do not dilute any rubber insulated feeder cable with 212.**

Determining iUPR Injection Pressure

Due to the low pressures used in iUPR injection, the normal procedure for determining the iUPR injection pressure is sufficient.

Determining SPR Injection Pressure

The moderate pressures used for SPR injection must be lowered to accommodate for the EPR insulation's inability to withstand the forces of moderate pressure injection.

The following steps can be used to calculate the injection pressure required for SPR. You can always contact Engineering to verify the adjusted injection pressure.

1. Find the adjusted tailored injection pressure (ATIP) for rubber insulation.

The tailored injection pressure is the base amount of pressure calculated for injection. TIP is determined by the conductor's geometry and insulation thickness.

a. Refer to NRI 302 The Cable Table.



- b. Find the cable to be injected.
- c. Find the value for the XLPE tailored injection pressure (TIP) column of the cable
 - o (219psi in the example below)
- d. Next, divide the TIP by 4 to get the ATIP for rubber insulated cables
- e. For the example below \rightarrow 219 / 4 = 55psi

	Design voltage &		Actual Insulation	Conductor AWG,	Conductor		Strand		Nominal	Conductor	Typical	Typical	tailored injection	
Cable	insulation		Thickness	kcm, or	Size	Number of	Diameter	Strand	Conductor	shield OD	Insulation	Shield OD	pressure	
Number	level	Stranding	(mils)	mm ²	(mm ²)	Strands	(mils)	Diameter	OD (mils)	(mils)	OD (mils)	(mils)	(psig)	
AEIC Cables														
1			180	2	33.6	7	97.4	2.47	292	332	692	772	2 5	
2		0	180		42.4	19	66.4	1.69	332	374	734	814	240	
3		\square	180	1/0		1.5	11.0	1.00	0.0				219	
4	<u> </u>		180		67.4	19	83.7	2.13	418	464	824	904	130	
5		L L	180	3/0	85.1	19	94.0	2.39	470	518	878	958	173	
6			180	4/0	107.2	19	105.5	2.68	528	578	938	1018	155	
7			180	250	126.7	37	82.2	2.09	575	625	985	1065	142	
8	1 -	U U	180	350	177.5	37	97.3	2.47	681	731	1091	1191	120	
9		\circ	180	500	253.1	37	116.2	2.95	813	863	1223	1323	101	
10		Ē	180	600	304.2	61	99.2	2.52	893	943	1303	1403	100	
11			180	700	354.5	61	107.1	2.72	964	1016	1376	1476	100	
12	LΩ		180	750	380.1	61	110.9	2.82	998	1052	1412	1512	100	
13		15	180	800	405.2	61	114.5	2.91	1031	1087	1447	1547	100	
14	1		180	900	456.3	61	121.5	3.09	1094	1152	1512	1612	100	
15	1		180	1000	506.4	61	128.0	3.25	1152	1212	1572	1702	100	

Figure 1: Find the XLPE TIP.

2. Reduce the ATIP further for large elevation changes.

- If the elevation between the two terminations or ends of the sub-segment is greater than 33ft (10 meters), the ATIP must be reduced further. For extreme elevation changes, call Engineering.
- Reduce the ATIP by 2psi for every 5ft of elevation change or by 7psi for every 5 meters.

Preparing Cables

1. Strip the insulation.

When preparing rubber insulated cables, the Speed System insulation stripper blade **MUST** be changed from the standard XLPE blade to the EPR blade.

The EPR blade cuts through the rubber insulation without hindering movement. This leads to a clean cut that does not damage the conductor.

Use the insulation stripper as normal, setting the blade depth to the appropriate position to prevent damaging the conductor.





Figure 2: The EPR blade

Injection Procedures

1. SPR Injection

There are two important differences between SPR injection of XLPE and of rubber insulated cables:

1. Rubber insulated cables cannot be pressurized as it can continuously balloon until it ruptures.

2. Rubber insulated cables cannot be left unattended during injection.

In some cases, it also may be recommended to reinforce the bare insulation that is left unsupported by the cable's concentric neutrals or jacket.

Using 3M Super 20 white restricting tape can be an effective way of reinforcing rubber insulated cables for some installations. Contact Engineering to see for guidance and if a template is needed detailing how to apply Super 20 for the specific installation.

2. Compare fluid supplied to the target.

The fluid target is the ideal injected amount of fluid in the cable. During normal injection, the fluid floor and target amounts will typically be reached or exceeded.

- a. Find the floor and target millimeters of fluid the cable will take (the same way to find the target when estimating the time for fluid arrival).
- b. Compare the current amount of supplied fluid to the floor and target.
- c. Since rubber insulated cables cannot be pressurized, contact Engineering if the fluid floor isn't reached when fluid arrives at the receiving end.

Other than the exceptions noted above, follow standard injection procedures for the application, according to <u>NRI 603 Small Diameter Cables (URD) - SPR</u> and <u>NRI 613 Large Diameter Cables (Feeder) - SPR</u>.