Rejuvenation Instructions

#623 – EPR Insulated Cables – iUPR & SPR

This NRI covers the following:

- How to determine the fluid used during injection.
- How to determine the injection pressures used for SPR.
- Special preparation instructions for EPR insulation.
- Special injection instructions for the SPR process.

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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.

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Selecting Fluids

There are limitations of the types of fluid that can be used with ethylene propylene rubber (EPR) insulation.

- Cablecure 733 is prohibited with EPR insulation.
- Cablecure iXL (formerly known as Perficio) is prohibited for cables with high interstitial volume to insulation volume ratios. Call Engineering for assistance.
    - Example: Large conductors with a thin insulation.
- Small diameter (4/0 and smaller) EPR cables of any color should be injected using Cablecure 732-80 fluid only.

Call Engineering for further details or assistance.

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.

Always contact Engineering to verify the injection pressure.

1. Find the tailored injection pressure (TIP).

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 column of the cable.

Cable Number	Design voltage & insulation level	Stranding	Actual Insulation Thickness (mils)	Conductor AWG, kcm, or mm²	Conductor Size (mm²)	Number of Strands	Strand Diameter (mils)	Strand Diameter	Nominal Conductor OD (mils)	Conductor shield OD (mils)	Typical Insulation OD (mils)	Typical Shield OD (mils)	tailored injection pressure (psig)
AEIC Cables													
1	15kV; 100%	Concentric	180	**2**	33.6	7	97.4	2.47	292	332	692	772	[illegible]
2			180	[illegible]	42.4	19	66.4	1.69	332	374	734	814	[illegible]
3			180	**1/0**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	219
4			180	[illegible]	67.4	19	83.7	2.13	418	464	824	904	[illegible]
5			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			180	**350**	177.5	37	97.3	2.47	681	731	1091	1191	120
9			180	**500**	253.1	37	116.2	2.95	813	863	1223	1323	101
10			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			180	**750**	380.1	61	110.9	2.82	998	1052	1412	1512	100
13			180	**800**	405.2	61	114.5	2.91	1031	1087	1447	1547	100
14			180	**900**	456.3	61	121.5	3.09	1094	1152	1512	1612	100
15			180	**1000**	506.4	61	128.0	3.25	1152	1212	1572	1702	100

Figure 1: Find the XLPE TIP.

2. Reduce the ATIP for EPR insulation.

In the event of rubber insulation, the ATIP must be reduced.

- Take the ATIP, found above in step 1, and divide the value by 4.
- Rubber insulation is not able to take the same pressures as XLPE.

3. Reduce the ATIP 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.
- For those working in meters, reduce the ATIP by 7psi for every 5 meters of change.

Preparing Cables

1. Strip the insulation.

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

Figure 2: The EPR blade compared to one style of XLPE blade.

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

a. Remove the wingnut from the top of the insulation stripper. Be careful not to lose both the wingnut and washer.
b. Remove the XLPE blade from the insulation stripper. Be careful as the blade is sharp.
c. Place the EPR blade onto the insulation stripper and tighten the washer and wingnut down.
d. Set the blade depth to the appropriate position to prevent damaging the conductor.
e. Use the insulation stripper as normal.

2. Reinforce the insulation.

EPR insulation cannot be pressurized the same way XLPE insulation can. To treat the insulation effectively, it is required to reinforce the insulation.

Using 3M Super 20 white restricting tape can be an effective way of reinforcing weak or thin insulation. The restricting tape helps mitigate the pressure felt near the termination and translates it towards the middle of the cable.

a. Contact Engineering for specific directions related to the application and instructions for installation.
b. Prepare the cable to the cutback dimensions described on the template used. In cases of no template, prepare the cable to the dimensions determined.
c. Install IAs and connectors according to normal procedure for the application.
d. To apply the 3M 130C tape, start at the semi-con and smoothly apply one lap up the length of the insulation to the IA.
    - The component body must make contact with the semi-con. Do not cover the semi-con.
e. To apply the 3M Super 20 white restricting tape, smoothly cover the 3M 130C layer starting at the semi-con with 1½ laps up the length of the insulation to the IA.
    - Cut the Super 20 tape so that it does not stretch.
    - The component body must make contact with the semi-con. Do not cover the semi-con in this location.

SPR Injection Procedures

Follow standard injection procedures for the application, according to **NRI 603** or **NRI 613**, through fluid arrival at the outlet end of the cable.

- **EPR insulated cables cannot be pressurized as it can continuously balloon until it ruptures.**

- **EPR insulated cables cannot be left unattended during injection.**

After the cable's outlet end is pinned, the following procedures override standard injection procedures for pressurizing URD and Feeder cables.

1. 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. Verify that the fluid injected into the cable is between the floor and target fluid amounts.
b. Find the current millimeters of fluid injected.
c. 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).
d. Compare the current amount of supplied fluid to the floor and target.
e. Continue injection until the fluid floor amount has been reached.

2. Pin the inlet.

a. Close the ball valve to the injection tool to prevent fluid spray.
b. Use the injection tool to insert the plug pin into the injection adaptor (IA); then remove the injection tool from the IA.
c. Check the plug pin hole for leaks and tap the pin in if it is not flush.
d. Wrap the saddle chain around a rag to protect and keep debris out of the injection tool.

3. Resume standard injection procedures.

After completing injection on EPR insulated cables, resume normal procedures for the application according to **NRI 603 Small Diameter Cables (URD) - SPR** and **NRI 613 Large Diameter Cables (Feeder) - SPR**.