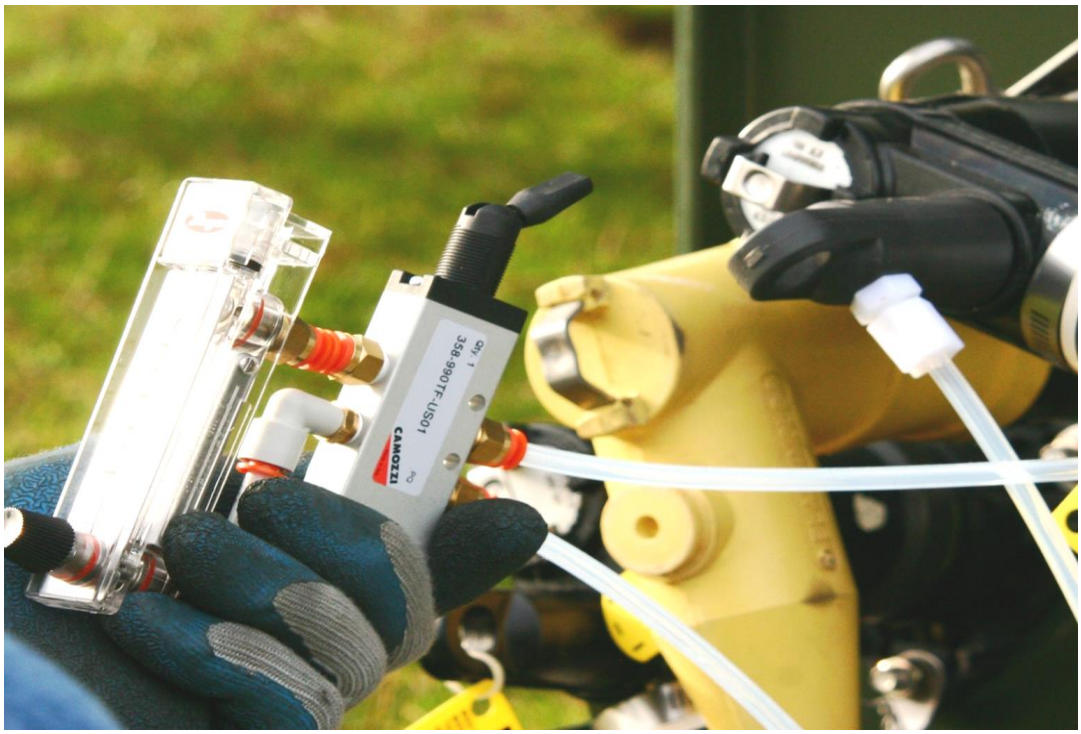
Rejuvenation Instructions

#281 – Flow & Pressure Tests – UPR



This NRI covers the following:

- How to testing cable systems for flow and pressure prior to injection.
- What to do should a cable system fail a flow or pressure test.
- How to determine the approximate location of a flow restriction or blockage.

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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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Table of Contents

Termination Test

The termination test is an in-process test performed immediately after installing an injection adapter to confirm adequate flow and pressure. The timing of the test allows the technician to easily take corrective actions should a leak or flow restriction be detected.

1. Procedures.

a. Set the compressed CO_2 supply to the test pressure. Use the pressure test pressure from **NRI 351**.

b. Connect the flow meter assembly (11357-1) to the injection adapter.

c. Start with the flow test valve in the exhaust position.

d. Switch the flow meter assembly to the pressurize position for ten seconds and watch and listen.

e. If the flow drops to 0 cc/min in less than five seconds, the termination is blocked.

f. If the flow stays above 50 cc/min for ten seconds with no leaks, the termination is flowing correctly.

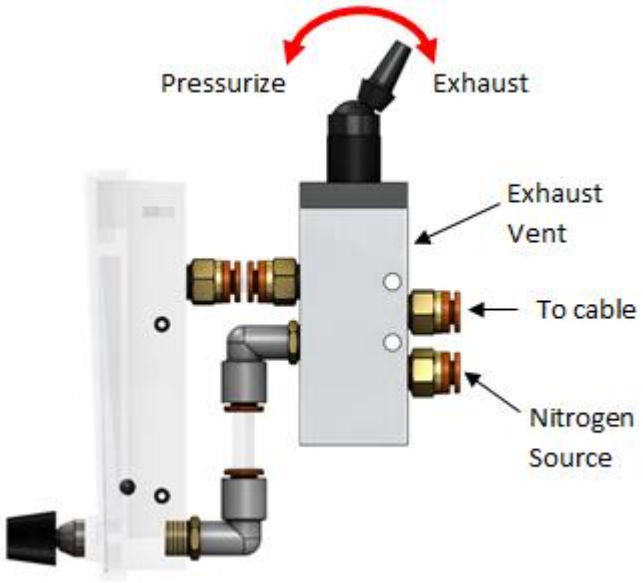

Figure 1: Flow meter operation.

g. If a leak is heard, determine the location of the leak and repair it.

- Use leak detection fluid or soapy water to help aid in the search.

h. Switch the flow test valve back to the exhaust position and allow it to vent.

- **NOTE:** Failing to fully bleed off the pressure trapped in the cable will interfere with the flow test that usually follows.

Flow test

The flow test is used to determine if an adequate flow path exists through the cable system prior to moving forward with injection. If the test finds the flow path to be blocked or restricted, then corrective actions must be taken to increase the success of injection.

1. Procedures.

a. Set the compressed CO_2 supply to the test pressure at the proposed injection end of the cable referencing **NRI 351**.

b. Connect the flow meter assemblies (11357-1) to both ends of the cable.

c. Set both flow meters to the exhaust position.

d. At the proposed injection end of the cable, switch the flow meter assembly to the pressurize position.

e. Monitor the flow at both ends of the cable until the flow stabilizes.

- **NOTE:** If the flow at the outlet end remains zero and the inlet flow slowly approaches zero, then the cable is blocked and needs to be retested from the opposite end.

f. Calculate the flow resistance (R) by following the procedures outlined in step 2 below.

g. If R is less than 1.0, the cable passes the flow test. Record the test pressure and outlet flow rate in Knomentous and continue to the pressure test.

h. If R is greater than 1.0, the cable is flow restricted and the test must be re-run from the opposite direction.

- **NOTE:** Before starting the flow test from the opposite end, bleed off the gas pressure that is trapped in the cable.

i. If the calculated flow resistance (R) from the second end is less than 1.0, use that termination as the injection side.

j. If the calculated R value from the opposite end is greater than 1.0, then one of the following two actions must be taken:

- If the cable system was identified with having at least one splice by TDR test, then perform the backflow test as outlined in step 3 below to identify the location of the restriction.
- If the cable system was identified as splice free by the TDR test, then use the procedures for flow testing flow-restricted cables outlined in step 4.

k. Record the flow test pressure and outlet flow rate in Knomentous.

2. Calculate the resistance (R).

Divide the flow test pressure (in psi) by the outlet flow (in cc/min).

- Resistance = Pressure / Flow (R = P/F)
- **Example:** Suppose the flow test pressure (P) is 15 psi and the outlet flow is 30 cc/min.

  R = P/F = 15/30 = 0.5
- Values less than 1.0 are good.
- Values greater than 1.0 may require remedial action.

3. Backflow test the blocked cables.

The backflow test locates the distance to a blockage or restriction and is especially useful for **cable systems with multiple splices.**

a. Connect flow meters (11357-1) to both ends of the cable and set the test pressure.
b. Use the pressure testing procedures to pressurize the entire cable until the flow is zero.
c. Switch the flow test valve to the exhaust position to let the gas pressure out of the cable.
d. Monitor and time the flow, and note the time when the flow drops below 30 cc/min. at both ends. The blockage or restriction is closest to the end where flow drops first. The faster the flow drops, the closer the blockage is to that end.

4. Procedures for flow-restricted cables.

The procedures for flow-restricted cables use the low-flow meter assembly (11357-2) to measure flow as little as 1cc/min (see Figure 2).

a. Ensure that all gas pressure has been bled off from the previous flow test before starting the low-flow test.
b. Set the compressed CO_2 supply to the test pressure at the proposed injection end of the cable. Reference **NRI 351**.
c. Connect the flow meter assembly (11357-1) to the proposed injection end of the cable.
d. Connect the low-flow meter assembly (11357-2) to the opposite end of the cable.
e. Set both flow meters to the exhaust position.
f. At the proposed injection end of the cable, switch the flow meter assembly to the pressurize position.
g. Monitor the flow at both ends of the cable until the flow stabilizes.

Figure 2: Low-flow meter operation.

- **NOTE:** If the flow at the outlet end remains zero and the inlet flow slowly approaches zero, then the cable is blocked and needs to be retested from the opposite end.

h. Calculate the flow resistance (R) by following the procedure outlined in step 2.
i. Switch both flow meters into the exhaust position and bleed off the pressure.
j. Repeat the test from the opposite end and calculate the flow resistance (R).

k. If an outlet flow was measured, choose the end with the lowest flow as the injection side and document the test pressure and outlet flow rate in Knomentous.

l. If the flow is zero in both directions, the cable is blocked and may not be injected until the blockage is cleared.

m. Record the flow test pressure and flow rates in Knomentous.

Pressure Test

The pressure test is used to determine if the cable system is leak-free prior to moving forward with injection.

1. Procedures

a. Set the compressed CO_2 supply to the test pressure at both ends of the cable referencing **NRI 351**.

b. Connect flow meters (11357-1) to both ends of the cable.

c. Switch both test valves to the pressurize position.

- To pressure test immediately after the flow test, you can switch the outlet end to the pressurize position without stopping flow into the inlet end.

d. Monitor the flow at both ends of the cable.

- If the flow at both ends drops to 0cc/min and holds steady, there are no leaks in the cable system and it is ready for injection.
- If the flow at one end or both ends of the cable stabilizes at anything above 0cc/min, there is a leak in the cable system. Leaks must be located and repaired.
- Use leak detection fluid or soapy water to help locate the leak.

e. Record the pressure test result in Knomentous.