

RIT MSD P14474 Maintenance Manual

"Automated Hydrostatic Test Apparatus"

-Overview: The purpose of this document is to provide guidance in the event of a system or sub-component failure. This document should be the starting point for product trouble shooting and the guide for component replacement, if needed.

-Overall System Schematic:

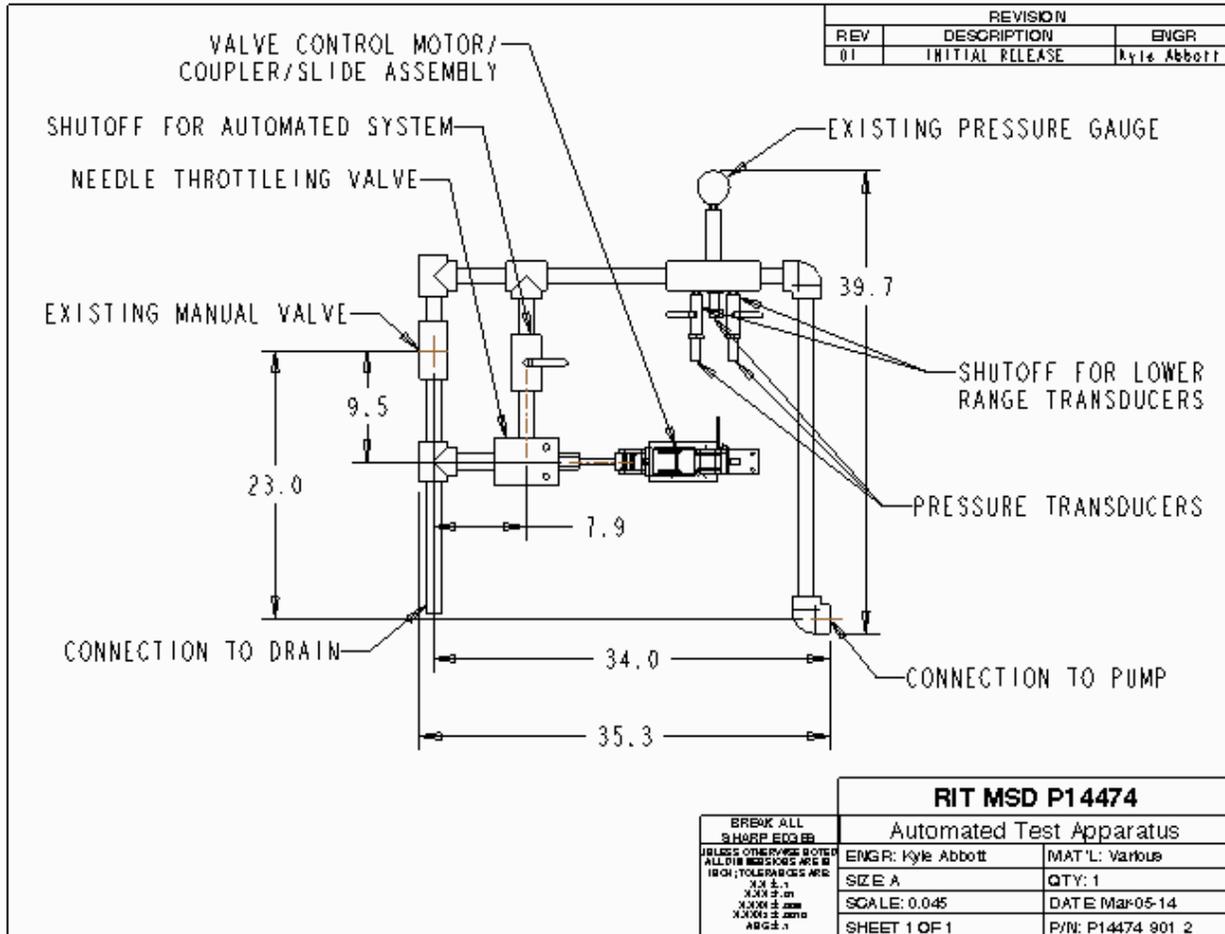


Figure 1: Complete system assembly

Figure 1 shows the complete system assembly, which includes the following subsystems:

- Piping and connections
- Pressure transducer manifold
- Needle throttling valve and shutoff valve
- Valve control motor and coupling

These subsystems will be covered in greater detail in the subsequent pages.

-Piping and Connections: All piping and elbow connections are constructed from 1" double extra heavy (XXS) piping. This piping matches the previous system at Cooper Crouse Hinds (CCH) test facility. This pipe is rated for operation at 10,000 psi internal pressure at room temperature. DO NOT exceed 10,000 PSI internal system pressure.

- Maintenance Recommendations:

- Periodically check for leaks during system use and tighten any joints that leak.
- If corrosion forms on any of the piping, remove corrosion with sandpaper, clean pipe with solvent and paint exposed pipe to prevent further corrosion.
- Once installed and tightened, minimal maintenance should be required.

-Pressure Transducers and Manifold:



Figure 2: Assembled Pressure Transducer Manifold

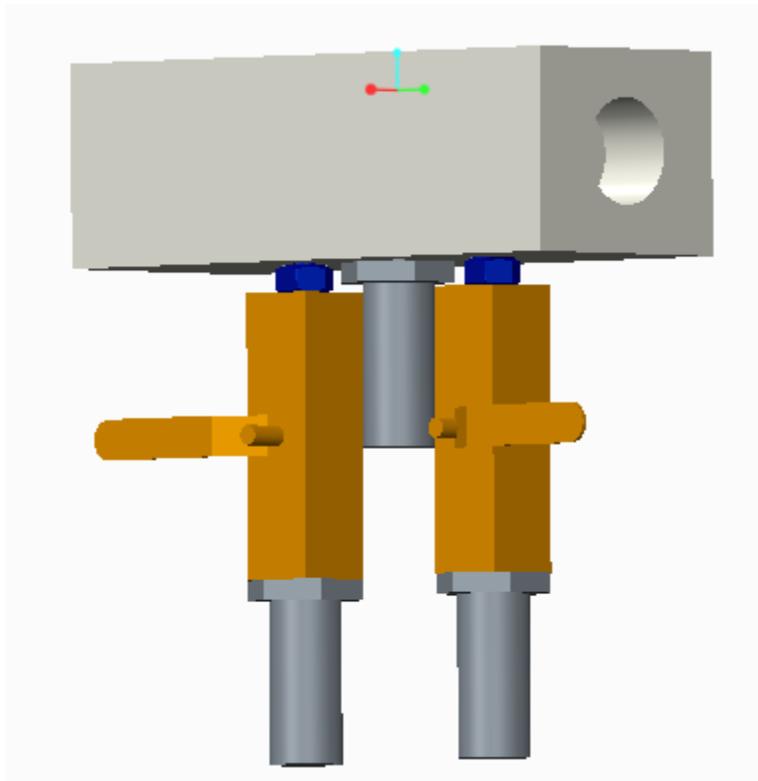


Figure 3: CAD image of Transducer Manifold

The pressure transducer manifold consists of 4 different component types:

1. Manifold (Beige in figure 3)
2. Male to Male NPT Unions (2) (Blue in figure 3)
3. 1/4" shutoff ball valves (2) (Orange in figure 3)
4. Omega pressure transducers (3) (Grey in figure 3)

-Manifold: This component was custom designed for the application and machined in-house at RIT. The manifold is constructed from 7075-T6 aluminum, as the materials high yield strength was required the stresses involved with 10,000 PSI operation.

-Maintenance Recommendations:

- 7075 is more susceptible to oxidation than other aluminums. Therefore, periodically remove surface oxidation with fine sandpaper or a scrub (scotchbrite) pad.
- Verify all plumbing connections are tight and leak-free

Shown below is the drawing for the manifold.

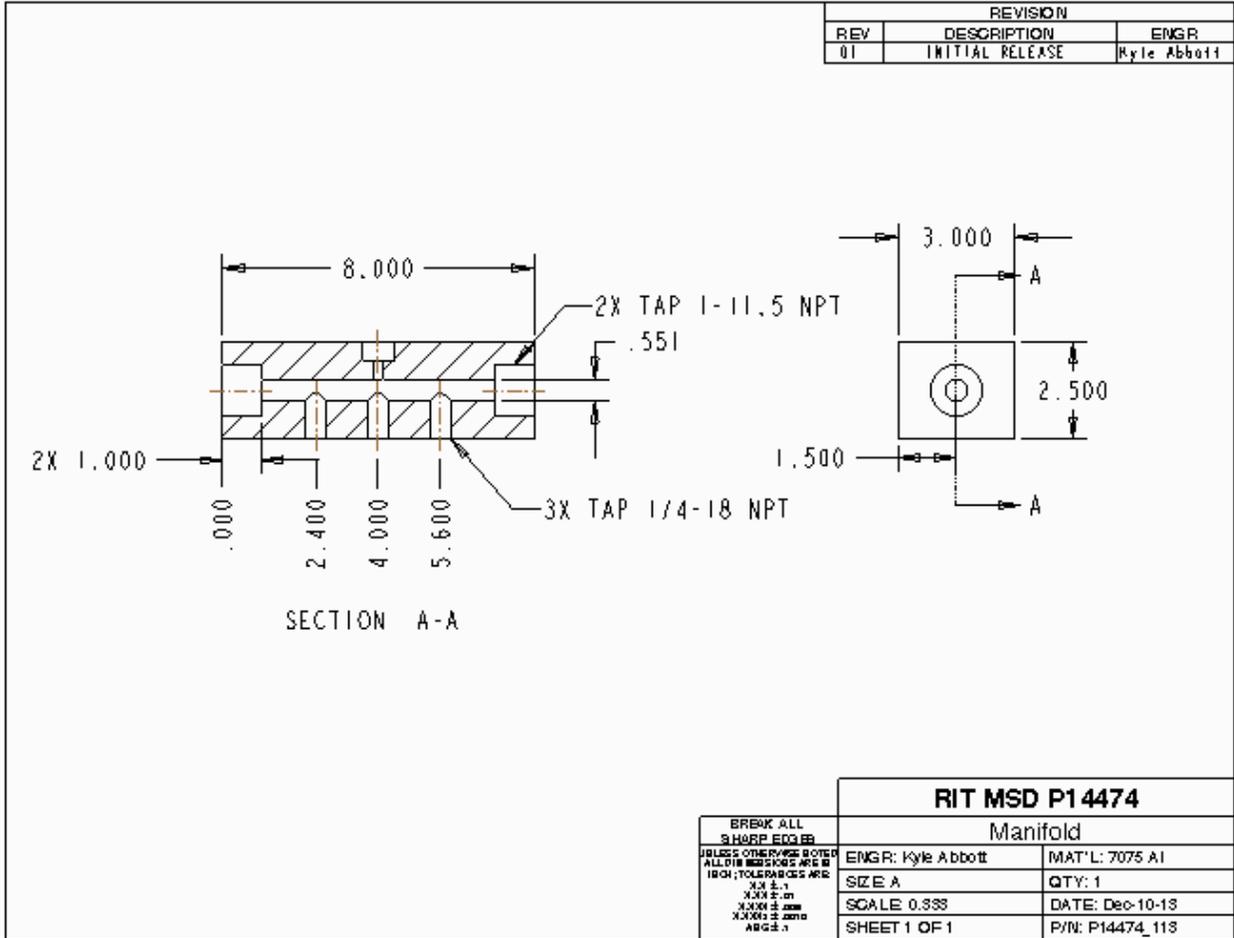


Figure 4: Engineering Drawing for Manifold

-Male to Male NPT Unions: Two 1/4 NPT male-to-male unions were used to join the shut-off ball valves to the manifold. The components are manufactured by Swagelok, part # SS-4-HN-10K.

-Maintenance Recommendations:

- None. Once installed, these components should not require adjustment or other maintenance.

- 1/4" Shutoff Ball Valves: Two shutoff ball valves are used to isolate two pressure transducers from damage at high pressures. These valves were purchased from McMaster-Carr, part # 3553K21. These valves are pressure rated for 10,000 psi operation.

-Maintenance Recommendations:

- Periodically cycle all ball valves from full open to full close. This will prevent increased seal friction by periodically "wetting" the seals.
- If any leaks begin to form at the handle stem, replacement is recommended.

Shown below is the product description for the ball valve.

 Need help? Call (609) 259-8900, e-mail, or text 58926.

3553K21 [FIND](#) [CONTACT US](#)

Extreme-Pressure Type 316 Stainless Steel Ball Valve

1/4" NPT Female



With 1/4"-3/4" Pipe Size

Each In stock
\$171.95 Each
[ADD TO ORDER](#) 3553K21

Pipe Size	1/4"
End-to-End Length	3 1/2"
Maximum Pressure for Water, Oil, and Inert Gas	10,000 psi @ 266° F
Maximum Pressure for Steam	10,000 psi @ 266° F
Temperature Range	-40° to +446° F
Vacuum Rating	Not rated

Ideal for high-pressure hydraulic oil and water applications, these valves withstand up to 10,000 psi. Connections are NPT female. Body and ball are Type 316 stainless steel. Seats and seals are PEEK, PTFE, and RTFE. Valves have restricted flow (reduced port).

Figure 5: Retailers spec. sheet for shutoff valves

-Omega Pressure Transducers: 3 pressure transducers were selected for pressure feedback to the system. Three pressure ranges were selected: 10,000 PSI, 5,000 PSI, 1,000 PSI. The lower pressure range transducers (1,000 psi and 5,000 psi) are to be used when the test is not to exceed the limit pressure and provide greater accuracy over the 10,000 psi transducer. When tests are to exceed the pressure limits of the respective transducers they should be isolated from the test by shutting off the corresponding shutoff ball valve.

-Maintenance Recommendations:

- The pressure transducers are NIST certified from the factory. When certification runs out, the instrument should be recalibrated as is recommended by NIST.

-Needle Throttling Valve and Shutoff Valve:

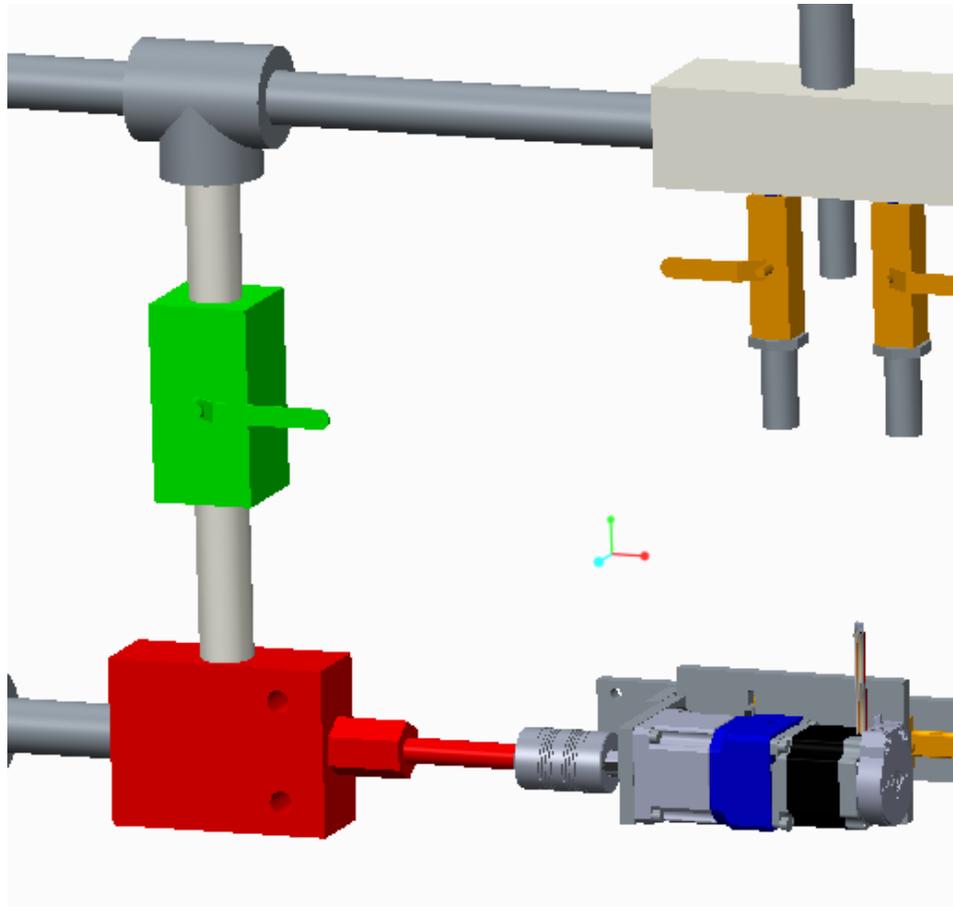


Figure 6: CAD Image showing Needle Throttlin Valve (Red) and Shutoff Valve (Green)

-Needle Throttling Valve: The main pressure control valve used for the system is manufactured by Swagelok, part # NV16N2RD10. This is a high flow, 10,000 PSI rated, needle valve suitable for flow throttling. Shown below is the manufacturer's drawing for the valve.

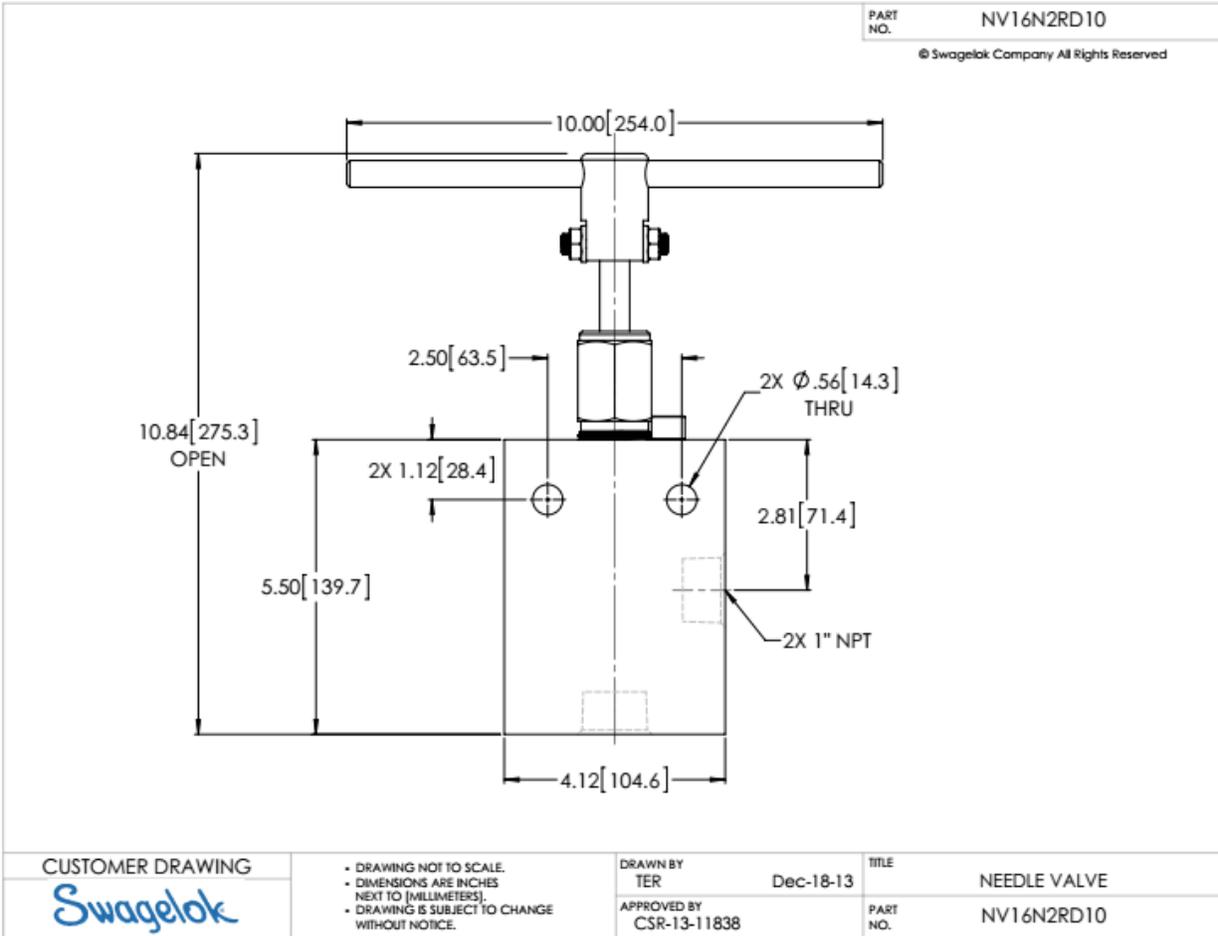


Figure 7: Manufacturers Drawing for Needle Throttling Valve

-Maintenance Recommendations:

- Periodically check for leaks at the stem-to-body interface. If leaks/wetting occurs, it is likely that factory service is needed. Consult Swagelok to arrange repair/rebuild.

-Shutoff Valve: In the event that the automated valve becomes inoperable, the system can be shut down so that manual control can be resumed.

-Ball Screw: Controls the linear motion of the needle valve.

-Maintenance Recommendations:

- Check for wear and rust lubricate with oil as needed