



DocumentID:NTGuidelines-002	Title: Nozzle Tester Guidelines (Single/Solid End Cap Multi/ Split Cap Multi Nozzle Tester Designs)	Risk Ranking Code: 0
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## Nozzle Tester Guidelines

### PURPOSE

The purpose of this Guideline is to detail the necessary steps to perform a hydrostatic nozzle test utilizing the Vital Nozzle Test Tool. Full training is provided in the Vital orientation / recurring training programs.

### SCOPE

Vital Nozzle Testing Tools have either single or multi bolt configurations. Multi bolt configurations can either have a solid end cap or a split end cap depending on the available manway access. The Vital Nozzle Test Tools are specifically designed and built for each application to hydrostatic test nozzles on pressure vessels. There are exceptions; however, engineering continues to research and develop solutions to customer special requirements.

### Safety Considerations

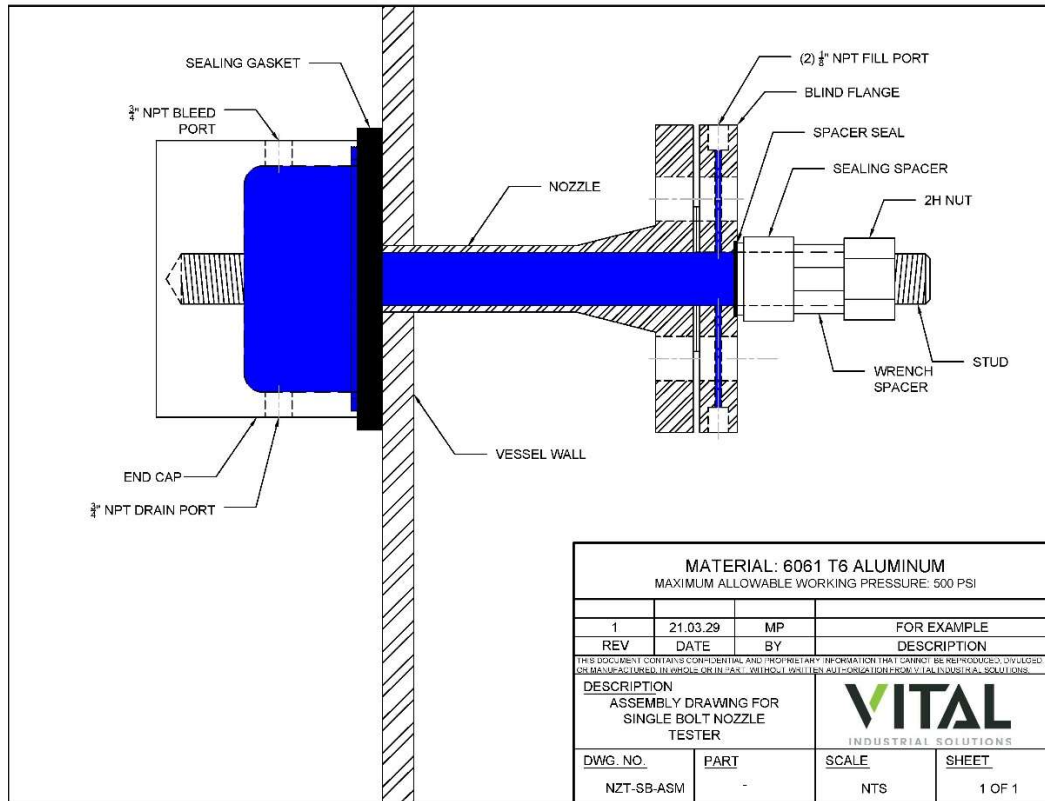
- Read the Confined Space Entry Program.
- Obtain the necessary vessel entry permit from the Customer.
- Know and understand the Customer's confined space program.
- Request a gas test prior to work commencing in the vessel area and ensure that proper protective equipment and monitoring systems are available and in use and that the Standby person is available.

### INSTALLATION and TEST GUIDELINES

The following shall identify the basic steps required to accomplish a hydrostatic nozzle test using the Vital Nozzle Tester Tool.

## Single Bolt Installation

### Single Bolt Configuration (Figure #1)



(Figure #1)

- Install 'Blind Flange' with gasket (supplied by installer) to nozzle.
- Thread 'Stud' into 'End Cap'.
- Install 'Sealing Gasket' on 'End Cap'.
- Enter vessel and fit 'End Cap' with 'Stud' into nozzle assembly/'Blind Flange' and position 'End Cap' onto vessel wall.
- Ensure that 'End Cap' and 'Sealing Gasket' is centered over the nozzle area and the end cap lines up with the contour of the interior wall of the vessel. (Centerlines can be drawn at 3, 6, 9, and 12 o'clock to help ensure center and/or 'Sealing Gasket can be glued to vessel wall)
- Insert 'Spacer Seal', 'Sealing Spacer', and then 'Wrench Spacer' onto the 'Stud' in front of the 'Blind Flange', install the '2H Nut' and tighten to calculated torque values.
- Block off 6 o'clock '1/4" NPT Drain Port' (supplied by installer).
- To introduce test medium into the cavity of the nozzle testing system, connect hose to the lower fitting and fill until medium begins to seep out of the '1/8" NPT Gauge Port', then attach hoses. Also, use the '1/4" NPT Bleed Port' (supplied by installer) on the 'End Cap' to ensure all trapped air is removed.
- Install gauge on '1/8" NPT Gauge Port' and ready for pressure application.

- Pressurize Vital Tool to specified values that should be applied using a step method.

Example Only: Test Pressure to be 500 PSI. Step method

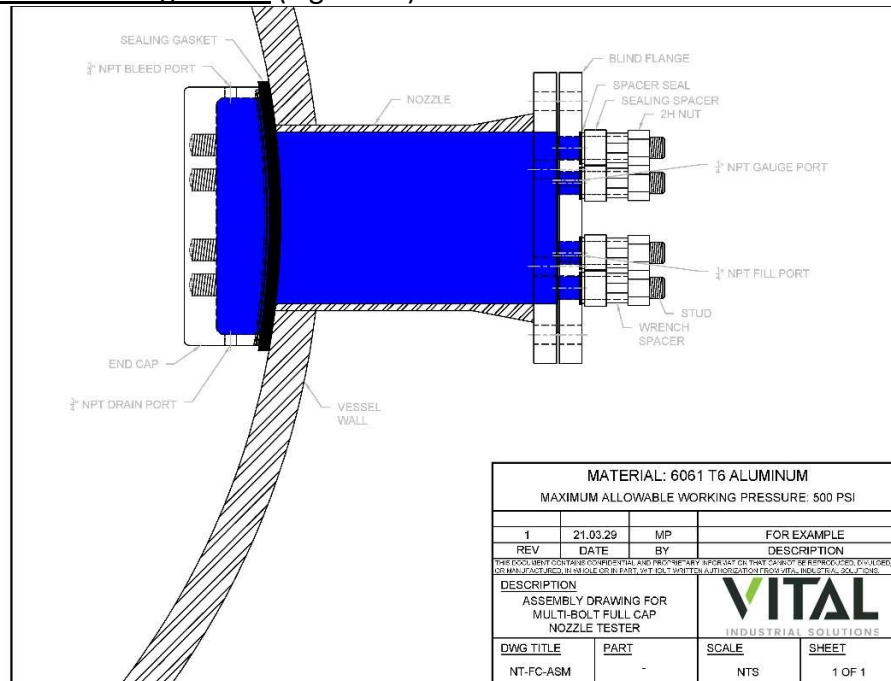
Initial Pressure	25% or 100 PSI	Hold 60 seconds
Second Pressure	50% or 250 PSI	Hold 60 seconds
Third Pressure	75% or 350 PSI	Hold 60 seconds
Final Pressure	100% or 500 PSI	Hold – do not exceed 110%

**Note: The greater the pressure, the greater the number of steps to be used.**

- During pressurization, visually inspect for leakage around the Vital Nozzle Tester Tool and assembly.
- Hold the specified pressure for ten (10) minutes (minimum) or as required by the Customer/Inspector and visually inspect for leakage.
- Release pressure and recover all test medium following approval by the Customer/Inspector.
- Disconnect gauge and pump hose assemblies.
- Loosen '2H Nut' until Vital Nozzle Tester Tool is movable within the test area.
- Disassemble and remove Vital Nozzle Tester Tool and clean test area. Testing is finished once all inspection forms and sign-off sheets have been completed.

## Solid End Cap Multi Bolt Installation

Solid End Cap Multi Bolt Configuration (Figure #2)



(Figure #2)

- Thread 'Studs' into 'End Cap'.
- Install 'Sealing Gasket' on 'End Cap'.
- Enter vessel and fit 'End Cap' with 'Studs' into nozzle assembly/'Blind Flange' and position 'End Cap' onto vessel wall.
- Install 'Blind Flange' with gasket (supplied by installer) to nozzle.
- Ensure that 'End Cap' and 'Sealing Gasket' is centered over the nozzle area and the end cap lines up with the contour of the interior wall of the vessel. (Centerlines can be drawn at 3, 6, 9, and 12 o'clock to help ensure center and/or 'Sealing Gasket can be glued to vessel wall)
- Insert 'Spacer Seals', 'Sealing Spacers', and then 'Wrench Spacers' onto the 'Stud' in front of the 'Blind Flange', install the '2H Nut' and tighten to calculated torque values. **(Follow Torque Pattern Exhibit A)**
- To introduce test medium into the cavity of the nozzle testing system, connect hose to the lower fitting and fill until medium begins to seep out of the '1/4" NPT Gauge Port', then attach hoses. Also, use the '1/4" NPT Bleed Port' (supplied by installer) on the 'End Cap' to ensure all trapped air is removed.
- Install gauge on '1/4" NPT Gauge Port' and ready for pressure application.
- Pressurize system to specified values using a step method.

Example Only: Test Pressure to be 500 PSI. Step method

Initial Pressure

25% or 100 PSI

Hold 60 seconds

Second Pressure	50% or 250 PSI	Hold 60 seconds
Third Pressure	75% or 350 PSI	Hold 60 seconds
Final Pressure	100% or 500 PSI	Hold – do not exceed 110%

**Note: The greater the pressure, the greater the number of steps to be used.**

- During pressurization, visually inspect for leakage around Vital Nozzle Test Tool and assembly.
- Hold the specified pressure for ten (10) minutes (minimum duration) or as required by the Customer/Inspector and visually inspect for leakage.
- Release pressure and recover all test medium following approval by the Customer/Inspector.
- Disconnect gauge and pump hose assemblies.
- Loosen '2H Nuts' until Vital Nozzle Tester Tool is movable within the test area.
- Disassemble and remove Vital Nozzle Test Tool. Clean test area.
- Testing is finished once all inspection forms and sign-off sheets have been completed and area is as you found it.

### Torque Pattern Exhibit A

Utilization of torque patterns and tightening sequences improve the accuracy of the load by controlling / reducing loading 'Cross-talk'. If the proper bolt-tightening sequence is maintained, the bolt loads will remain relatively equal throughout the torque process.

**Goal:** To obtain a torque rate per fastener on a Vital nozzle test tool. Assumes tool has been located on the vessel wall and the tool has fasteners (stud & nut) identified by numbers (torque) as per the torque values provided by Vital for each Nozzle Tester application.

**Step 1** Begin by first ratcheting and snugging up all nut(s) on the tool system assembly.

**Step 2** Using a torque wrench apply 1 third of the total torque value to each nut starting with the #1 nut and continue through to the other nuts, at all times employing the sequence pattern. Complete the torque pass as many times as it takes to reach an equal pressure to all the nuts.

**Step 3** After completing the second torque pass, adjust the torque wrench to 2/3 of the total torque value and begin another pass utilizing the recommended torque pattern provided by Vital until the desired torque has been applied to and obtained with nut.

**Step 4** Apply the final torque pass to the nuts until the total torque value is obtained on each nut.

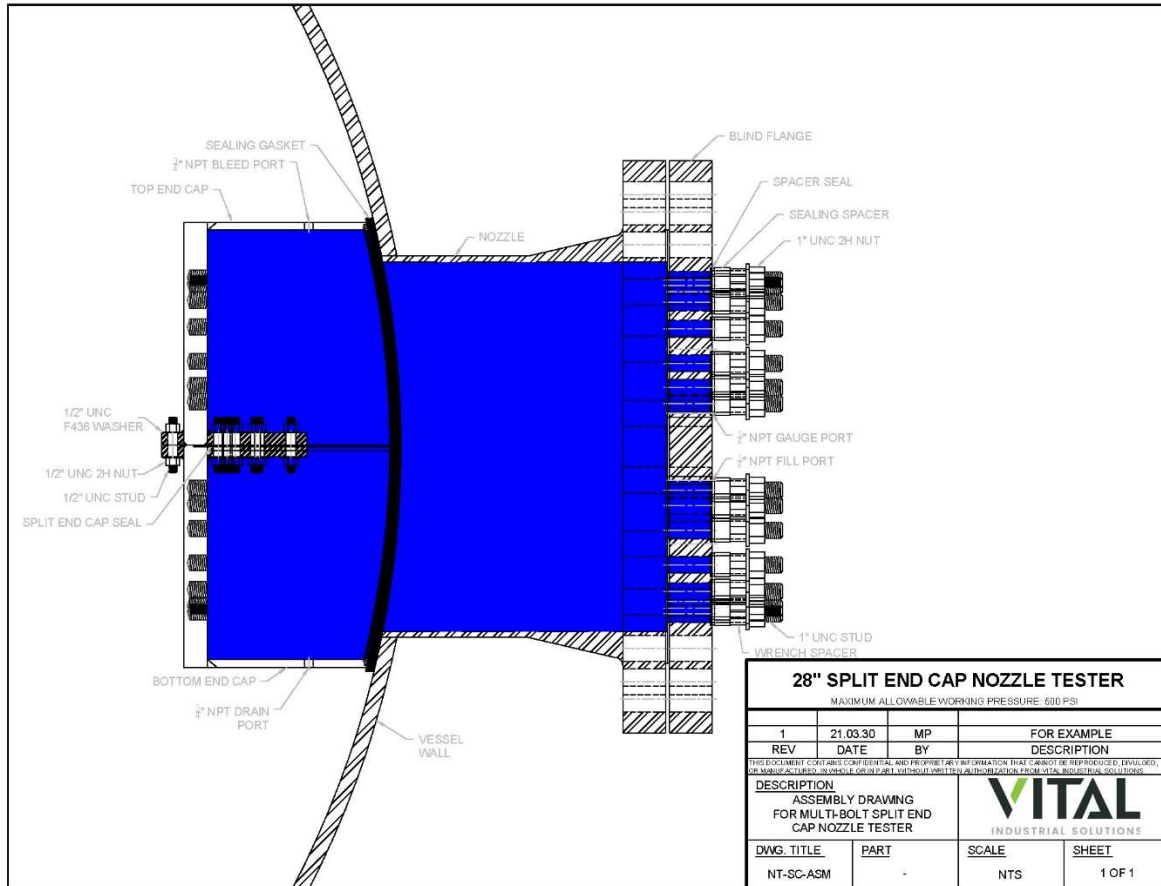
This step will be accomplished after two or three passes due to 'cross-talk'.

The threaded rods may have to be cut in order to use a standard depth socket or use an extra deep socket.

For example, if the nozzle is installed tangentially at a 45-degree angle, the longer bolts may be 3 times longer than the short bolts therefore may require more turns to equalize the loads on the fasteners. The longer bolts will stretch more based on the elasticity of the threaded rod. To finish the torquing, complete a backward and a forward pass at 115% of the total torquing values.

## Spilt End Cap Multi Bolt Installation

### Spilt End Cap Multi Bolt Configuration (Figure #3)



(Figure #3)

- Enter vessel with end cap separated.
- Once inside, install the 'Split End Cap Seal' on the seal groove, that is along the end cap split line. (Make sure about 1/8" of O-ring is sticking past the top of the end cap for it make a tight seal against the 'Sealing Gasket').
- Install '1/2" UNC Studs, Nuts, Washers' along the end cap split line. Tighten nuts to squeeze O-ring and eliminate leak path in split end.
- Thread '1" UNC Studs' into 'Split End Cap'.
- Install 'Sealing Gasket' on 'Split End Cap'. (Make sure 'Split End Cap Seal' comes in contact with 'Sealing Gasket')
- Fit assembled 'Split End Cap' with '1" UNC Studs' into nozzle assembly/Blind Flange' and position assembled 'Split End Cap' onto vessel wall.
- Install 'Blind Flange' with gasket (supplied by installer) to nozzle.
- Ensure that the assembled 'Split End Cap' and 'Sealing Gasket' are centered over the nozzle area and the end cap lines up with the contour of the interior wall of the vessel. (Centerlines can be drawn at 3, 6, 9, and 12 o'clock to help ensure center and/or 'Sealing Gasket can be glued to vessel wall)

- Insert 'Spacer Seals', 'Sealing Spacers', and then 'Wrench Spacers' onto the 'Stud' in front of the 'Blind Flange', install the '2H Nut' and tighten to calculated torque values. **(Follow Torque Pattern Exhibit A)**
- To introduce test medium into the cavity of the nozzle testing system, connect hose to the lower fitting and fill until medium begins to seep out of the '1/4" NPT Gauge Port', then attach hoses. Also, use the '1/4" NPT Bleed Port' (supplied by installer) on the 'End Cap' to ensure all trapped air is removed.
- Install gauge on '1/4" NPT Gauge Port' and ready for pressure application.
- Pressurize system to specified values using a step method.

Example Only: Test Pressure to be 500 PSI. Step method

Initial Pressure	25% or 100 PSI	Hold 60 seconds
Second Pressure	50% or 250 PSI	Hold 60 seconds
Third Pressure	75% or 350 PSI	Hold 60 seconds
Final Pressure	100% or 500 PSI	Hold – do not exceed 110%

**Note: The greater the pressure, the greater the number of steps to be used.**

- During pressurization, visually inspect for leakage around Vital Nozzle Test Tool and assembly.
- Hold the specified pressure for ten (10) minutes (minimum duration) or as required by the Customer/Inspector and visually inspect for leakage.
- Release pressure and recover all test medium following approval by the Customer/Inspector.
- Disconnect gauge and pump hose assemblies.
- Loosen '2H Nuts' until Vital Nozzle Tester Tool is movable within the test area.
- Disassemble and remove Vital Nozzle Test Tool. Clean test area.
- Testing is finished once all inspection forms and sign-off sheets have been completed and area is as you found it.

### Torque Pattern Exhibit A

Utilization of torque patterns and tightening sequences improve the accuracy of the load by controlling / reducing loading 'Cross-talk'. If the proper bolt-tightening sequence is maintained, the bolt loads will remain relatively equal throughout the torque process.

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