Choosing a Surge Tank and Determining Pressure Rise

DADCO Surge Tanks are used with open-flow systems to increase the volume in the system thereby reducing the pressure rise when cylinders are stroked. Operating with a lower pressure rise will decrease the wear on the nitrogen gas spring components and reduce the load on the press. To determine the appropriate Surge Tank size for your system please consider the design information provided. Note: All calculations are based on isothermal conditions.

In addition, DADCO offers a Force Calculator at www.dadco.net that calculates pressure rise, initial force and final force during operation for linked systems with or without Surge Tanks.

Solving for Pressure Rise when Nitrogen Gas Springs and Surge Tank is known:

To calculate the pressure rise of a Nitrogen Gas Spring and Surge Tank system, first calculate the internal volume of the gas springs, where \( V_{\text{G.S.}} = \text{Internal Volume of Gas Springs} \), \( V_{\text{internal}} = \text{Internal Volume Adder} \), \( S = \text{Stroke} \), \( V_i = \text{Initial Volume} \) and \( N = \text{Number of Gas Springs per Surge Tank} \).

\[
V_{\text{G.S.}} = (V_{\text{internal}} \times S + V_i) \times N
\]

Next, calculate the volume of the Surge Tank, where \( V_{\text{ST}} = \text{Volume of the Surge Tank} \).

\[
V_{\text{ST}} = V_{\text{Displaced}}
\]

Solving for the Surge Tank Size when the Gas Springs and Pressure Rise is known:

To calculate the appropriate Surge Tank when the gas springs and pressure rise is known, first calculate the volume that the gas spring rods will displace when retracted, where \( V_{\text{Displaced}} = \text{Displaced Volume} \), \( V_{\text{rod}} = \text{Rod Volume Adder} \), \( T = \text{Travel} \) and \( N = \text{Number of Gas Springs per Surge Tank} \).

\[
V_{\text{Displaced}} = V_{\text{rod}} \times T \times N
\]

Calculate the pressure rise where \( P.R. = \text{Pressure Rise} \), \( V_{\text{Displaced}} = \text{Displaced Volume} \) and \( V_s = \text{System Volume} \).

\[
P.R. = \left( \frac{V_s}{V_{\text{Displaced}}} \right) - 1
\]

Application Example

Quantity 4, U6600.100 TO Nitrogen Gas Springs with a 75 mm travel are linked in a system with a ST.75.250 Surge Tank. What is the Pressure Rise?

Given: \( S = 100 \), \( T = 75 \), From the Tables: \( V_{\text{rod}} = 0.0099, V_i = 0.0464 \), \( V_{\text{Displaced}} = 4.146 \) L

\[
V_{\text{Displaced}} = V_{\text{rod}} \times T \times N
\]

\[
P.R. = \left( \frac{V_s}{V_{\text{Displaced}}} \right) - 1 = 19 \text{ or } 19\%
\]

Solving for the Surge Tank Size when the Gas Springs and Pressure Rise is known:

To calculate the appropriate surge tank when the gas springs and pressure rise is known, first calculate the volume that the gas spring rods will displace when retracted. Where \( V_{\text{Displaced}} = \text{Displaced Volume} \), \( V_{\text{rod}} = \text{Rod Volume Adder} \), \( T = \text{Travel} \) and \( N = \text{Number of Gas Springs per Surge Tank} \).

\[
V_{\text{ST}} = V_{\text{Displaced}}
\]

Next, calculate the internal volume of the gas springs, where \( V_{\text{G.S.}} = \text{Internal Volume of Gas Springs} \), \( V_{\text{internal}} = \text{Internal Volume Adder} \), \( S = \text{Stroke} \), \( V_i = \text{Initial Volume} \) and \( N = \text{Number of Gas Springs per Surge Tank} \).

\[
V_{\text{G.S.}} = (V_{\text{internal}} \times S + V_i) \times N
\]

After the volume of the gas spring is known, calculate the volume of the Surge Tank where \( V_s = \text{Volume of the Surge Tank} \), \( V_{\text{Displaced}} = \text{Displaced Volume} \), \( P.R. = \text{Pressure Rise} \) and \( V_{\text{rod}} = \text{Internal Volume of Gas Springs} \).

\[
V_{\text{ST}} = \sqrt[3]{\frac{V_{\text{displaced}}}{P.R. + V_{\text{rod}}}}
\]

Application Example

Quantity 4, U6600.100 TO Nitrogen Gas Springs with a 75 mm travel are linked in a system with a ST.75.250 Surge Tank. What is the Pressure Rise?

Given: \( S = 100 \), \( T = 75 \), From the Tables: \( V_{\text{rod}} = 0.0099, V_i = 0.0464 \), \( V_{\text{Displaced}} = 4.146 \) L

\[
V_{\text{Displaced}} = V_{\text{rod}} \times T \times N
\]

\[
V_{\text{st}} = \sqrt[3]{\frac{V_{\text{displaced}}}{P.R. + V_{\text{rod}}}}
\]

Surge Tank Product Specifications

The Surge Tank is offered in two Models: F – Free Flow Model has multiple open ports supplied as standard for maximum flexibility when piping; M1 – SMS-i® Model has a bottom port for attachment to a base plate. Gauges and shut-off ball valves are available upon request.

For assistance in determining the appropriate Surge Tank size for your system, refer to the instructions provided or contact DADCO with the cylinder size, length of stroke being used and amount of pressure rise desired. DADCO 90.710 / Y-7070 / 90.705 (Y-7075) hose is generally not recommended for use with Surge Tanks due to restricted flow capability.

Bulletin No. B14102

Comprehensive Guide

This manual provides product specifications, and a step-by-step maintenance guide for DADCO Surge Tanks.

Note that proper repair requires careful examination of all component parts and replacement of any that are worn or damaged. All DADCO replacement parts are available from factory stock.

Typically, DADCO Surge Tanks can be rebuilt in less than five minutes by replacing only the o-rings.

After reviewing this guide, if you require any additional training or have any questions please contact DADCO for assistance.

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Surge Tank Design, Installation & Maintenance

DADCO Surge Tanks

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Surge Tank Repair Instructions

I. Exhausting System Pressure and Removing C-Ring

1. Exhaust nitrogen gas by opening the bleed valve on the control panel. Verify all pressure is exhausted by reading the control panel guage and removing the gas spring piston rod into the tube manually. If the rod will not fully retract, STOP and contact DADCO.

2A. Remove the Safety Tab from top of the Surge Tank using a hex key. ST.30 uses a 4 mm hex key. ST.100 uses a 10 mm hex key.

2B. Locates a Surge Tank from a SMS or SMS** plate to perform maintenance. A key is used to mount the bottom tapped holes.

3. Remove the Surge Tank Head Assembly by pushing down the Surge Tank Head Assembly using a Surge Tank Head Assembly O-ring and C-Style Retaining Ring Tool.

4. Tap the Surge Tank Head Assembly down into the Tube Assembly. The Head Assembly only needs to be tapped approximately 12 mm below the C-Ring. DO NOT force further into the Tube Assembly.

5. Using the Plastic Assembly Blade remove the O-ring from the Surge Tank and discard.

6. If damage to the Tube Assembly is present, remove the O-ring from the Surge Tank and discard.

7. Install a new C-Style Retaining Ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing. The O-ring will be seated next to the O-ring Backup Ring.

II. Replacing the O-rings

1. To remove the Head Assembly, thread the T-Handle (90.202) into the center port.

2. I m prove the Tube Assembly for any damage, especially around the mouth of the Tube Assembly. Polish out any scratches at the mouth of the Tube Assembly to avoid damaging the O-ring in the event of a replacement. If damage to the Tube Assembly is severe it must be replaced.

3. Install the C-Style Retaining Ring in the retaining ring groove using a DADCO C-Ring Installation Tool (90.352) or a standard bench tool. Tap C-Ring into position. The C-Style Retaining Ring is fully seated in the retaining ring groove.

4. Using the Plastic Assembly Blade, remove the O-ring Backup Ring from the Surge Tank and discard.

5. Install the new O-ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing.

6. Install all the port plugs at the top of the Surge Tank using the Port Servicing Tool (90.320.8). Do not twist when installing. To remove your Surge Tank to your control panel, making sure all connections are tight and that the system nitrogen gas spring rods are extended.

III. Reassembly

1. 1. Lubricate the inside wall of the Tube with the contents of the tube kit. Thread the T-Handle into the center port of the Surge Tank Head and installed the Head Assembly. The Head Assembly may need to be pushed down approximately 12 mm below the C-Ring. DO NOT force it further into the Tube Assembly.

2. Insert the C-Style Retaining Ring into the retaining ring groove using a DADCO C-Ring Installation Tool (90.352) or a standard bench tool. Tap C-Ring into position.

3. Facing bottom, install the new O-ring into the Tube Assembly.

4. Tap the Surge Tank Head Assembly down into the Tube Assembly using a key. ST.30 uses a 4 mm hex key. ST.100 uses a 10 mm hex key.

5. Using the Plastic Assembly Blade remove the O-ring from the Surge Tank and discard.

6. Install the new C-Style Retaining Ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing.

7. Install the new O-ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing.

IV. Charging

1. Attach Charging Assembly (90.201ST.05000 - 90.201ST.03000) to the quick disconnect nitrogen filter valve on the control panel.

2. Open the main valve on the nitrogen tank then set the desired charging pressure on the regulator.

3. Using the T-Handle, pull up on Surge Tank Head Assembly until it past the C-Ring and the top is flush with the Tube Assembly.

4. Install the new Dust Cover (90.246.5). Tap with a soft mallet until the top of the Dust Cover sits flush with the Tube Assembly.

5A. Install the Safety Tab at the top of the Surge Tank using a key. ST.30 uses a 4 mm hex key. ST.100 uses a 10 mm hex key.

6B. Attach the B29 Mount onto the Surge Tank with B29 Mount.

IV. Charging

1. Facing bottom, install the new O-ring into the Tube Assembly.

2. Install the new O-ring using a C-Style Retaining Ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing.

3. Install the new C-Style Retaining Ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing.

4. Install the new O-ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing.

5. Install the new O-ring using the Plastic Assembly Blade. Verify the O-ring does not leak when installing.

6. Install all the port plugs at the top of the Surge Tank using the Port Servicing Tool (90.320.8) do not twist when installing. To remove your Surge Tank to your control panel, making sure all connections are tight and that the system nitrogen gas spring rods are extended.

Parts List

- Included in the Repair Kit

Repair Tools

- T-Handle 90.202  - M9 thread
- Port Servicing Tool 90.352
- Plastic Assembly Blade 90.357
- C-Ring Removal Tool 90.356
- C-Ring Installation Tool 90.352 (91500 - 97500 Models)
- O-ring Backup Ring
- Dual Cover 90.246.5
- Safety Tab 90.250.10
- C-Style Retaining Ring 90.285
- Dust Cover 90.246.5
- Port Plug (97) 90.525.110
- O-ring 90.525.115

Repair Kits

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