Instructions - User Guide

309239

Rev. A

This manual contains important warnings and information.
READ AND KEEP FOR REFERENCE.

INSTRUCTIONS

GRACO

First choice when quality counts™

Air Powered, Falcon™

Variable Ratio Mini-Cat Proportioner

50 psi (0.345 MPa, 3.5 bar) Maximum Air Inlet Pressure

Model 965660, 1:1 to 4:1 Ratio Range

550 psi (3.8 MPa, 37.0 bar) Maximum Fluid Working Pressure

Model 965661, 2:1 to 8:1 Ratio Range

625 psi (4.3 MPa, 42.0 bar) Maximum Fluid Working Pressure

U.S. Patent No. 5,158,438
U.S. Patent No. 5,209,152

Graco Inc. P.O. Box 1441 Minneapolis, MN 55440-1441

Graco Inc. is registered to I.S. EN ISO 9001

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Symbols

Warning Symbol

⚠ WARNING

This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol

⚠ CAUTION

This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the instructions.

Terms

Variable Ratio Mini-Cat Pump: This pump automatically proportions and mixes two or three fluids in a prescribed ratio, which is variable within the ranges listed on the cover.

Base: One of two reactive chemicals used in a plural component system. Also called polyol or resin.

Reducer: Used to thin base. Also called true solvent or dilutent.

Catalyst: The fluid which reacts with the base fluid. Also called hardener.

Part: An undefined unit of measurement. When you determine the size of the unit (ounce, pint, gallon), use that measurement consistently in setting up your system.

Spray Gun: This term refers to any type of spray gun or dispensing valve used to spray or dispense the fluid being pumped.

Ratio: Ratio refers to the simultaneous output of a certain volume of fluid by the primary and secondary pumps.

Primary Pump: The pump directly under the air motor. It usually pumps the base fluid.

Secondary Pump: The pump located along the pivot beam. It usually pumps the catalyst.

⚠ WARNING

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are not sure, call your Graco distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure stated on the equipment or in the **Technical Data** for your equipment. Do not exceed the maximum working pressure of the lowest rated component in your system.
- Use fluids and solvents which are compatible with the equipment wetted parts. Refer to the **Technical Data** section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Handle hoses carefully. Do not pull on hoses to move equipment.
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 66° C (150° F) or below -40° C (-40° F).
- Wear hearing protection when operating this equipment.
- Do not move or lift pressurized equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

⚠ WARNING

PRESSURIZED EQUIPMENT HAZARD

Fluid dispensed from the spray gun, leaks or ruptured components can splash in the eyes or on the skin and cause serious injury.

- Do not point the valve at anyone or at any part of the body.
- Do not put your hand or fingers over the spray nozzle.
- Do not stop or deflect leaks with your hand, body, glove or rag.
- Always have the tip guard and the trigger guard on the gun/valve when dispensing.
- Be sure the valve trigger safety operates before dispensing.
- Lock the valve trigger safety when you stop dispensing.
- Follow the “Pressure Relief Procedure” on page 13 if the nozzle clogs and before cleaning, checking or servicing the equipment.
- Tighten all fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.

MOVING PARTS HAZARD

Moving parts can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Before checking or servicing the equipment, follow the “Pressure Relief Procedure” on page 13 to prevent the equipment from starting unexpectedly.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Ground the equipment and the object being dispensed to. Refer to “Ground the System” on page 10.
- If there is any static sparking or you feel an electric shock while using this equipment, **stop dispensing immediately. Do not use the equipment until you identify and correct the problem.**
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvents or the fluid being dispensed.
- Keep the dispense area free of debris, including solvent, rags, and gasoline.
- Do not smoke in the dispense area.
- Do not turn on or off any light switch in the dispense area while dispensing or while operating if fumes are present.

TOXIC FLUID HAZARD

Hazardous fluid or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, inhaled, or swallowed.

- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- The air motor exhausts any fluids added to the input air, such as oil or antifreeze.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

PLURAL COMPONENT MATERIAL HAZARD

Graco does not manufacture or supply any of the reactive chemical components that are used in this equipment and is not responsible for their effects. Because of the vast number of chemicals that could be used and their varying chemical reactions, the buyer and user of this equipment should determine all facts relating to the materials used, including any of the potential hazards involved. Particular inquiry and investigation should be made into potential dangers relating to toxic fumes, fires, explosions, reaction times and exposure of human beings to the individual components or their resultant mixtures. Graco assumes no responsibility for loss, damage, expense or claims for bodily injury or property damage, direct or consequential, arising from use of such chemical components.

Specifications

The following chart gives specifications for the Mini-Cat pumps, using No. 10 weight oil. The volumetric ratio is expressed as the proportion of the volume of fluid of the primary pump compared to the volume of fluid of the secondary pump.

For example, Model 965660 has a minimum volumetric ratio of 1:1. At this setting the primary and secondary pumps combined will deliver an output of 1.1 GPM (4.2 liter/min). The minimum volumetric ratio for Model 965660 is 1:1 and the combined output at that setting is 0.7 GPM (2.6 liters/min).

Model	Pump		Volumetric Ratio		Output Volume GPM (liter/min.) at 40 CPM		Stall Pressure at 50 psi (0.34 MPa, 3.4 bar) inbound	
Number	Primary	Secondary	Min.	Max.	Min.	Max.	Min.	Max.
965660	222015	222012	1:1	4:1	0.62 (2.3)	1.0 (3.8)	350 (2.4, 24)	550 (3.8, 38)
965661	222015	222019	2:1	8:1	0.56 (2.1)	0.75 (2.8)	420 (2.9, 29)	625 (4.2, 43)

Installation

The Typical Installation drawings (Figure 1 and Figure 2) are only guides to setting up the complete Variable Ratio Mini-Cat system. For assistance in designing a system to suit your particular needs, contact your nearest Graco representative.

NOTE: The reference numbers and letters in the text correspond to the numbers and letters in the drawings.

Location

Install the proportioner on a flat floor surface.

Connect the Fluid Supply Lines

Connect grounded fluid hoses to the 3/4 npt(f) pump inlet fittings. If the unit will be pressure fed from separate supply units, install a fluid pressure gauge at each inlet.

NOTE: The pressurized fluid supplies must not exceed 1/4 of the operating fluid pressure of the pump. Pressure above that level will feed right through the pump and improper rationing will result.

Connect the Static Mixer

Connect a static mixer to the 1/2 npt(m) manifold outlet. Connect a grounded fluid hose and spray gun to the end of the static mixer. Tighten all the fittings.

Key for Figure 1 and Figure 2

A Atomizing Air Regulator
B Self Relieving Air Valve
C Catalyst Supply Shut-off Valve
D Grounded Fluid Hose
E Sampling Valve (resin)
F Mix Manifold
G Mini-Cat Proportioner
H Air Oiler
I Air Filter
J Main Self Relieving Air Valve
K Resin Supply Pail
L Solvent Supply
M Air Spray Gun
N Air Supply
O Static Mixer
P Fluid Regulator
R Solvent Shut-off Valve
S Color Selector Manifold
T Pressure Relief Valve

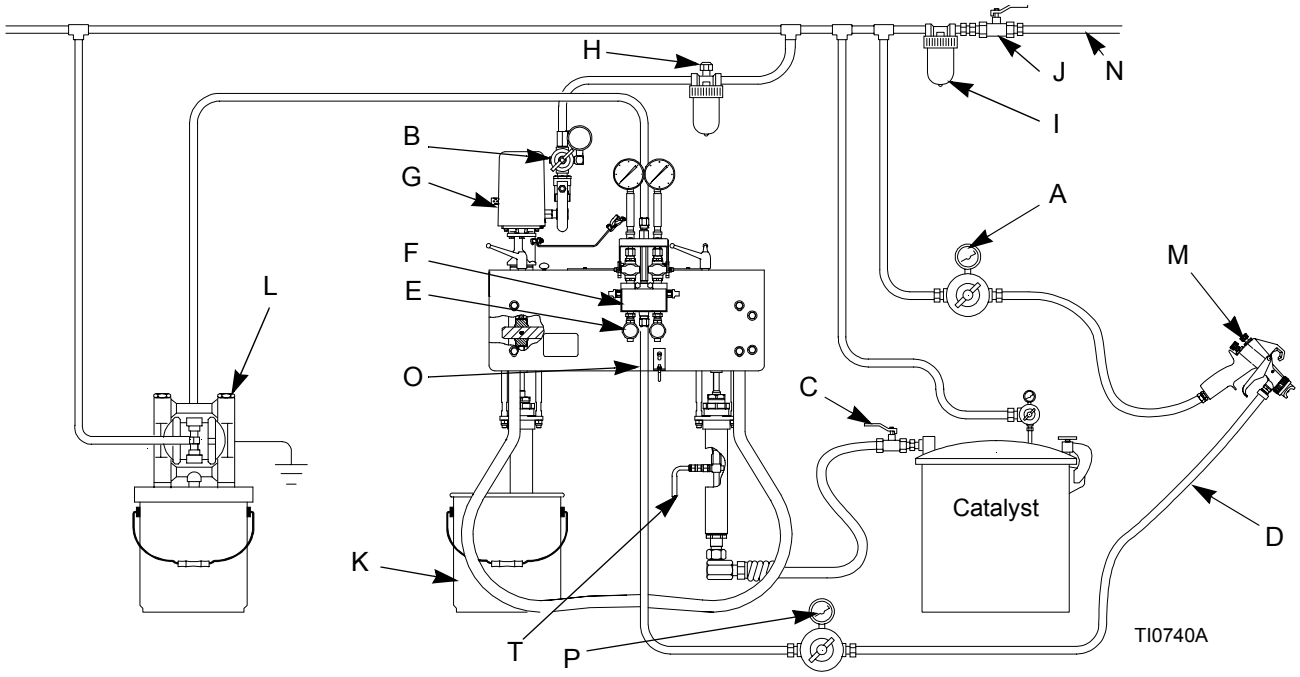


Figure 1 - Typical Installation for One Color System

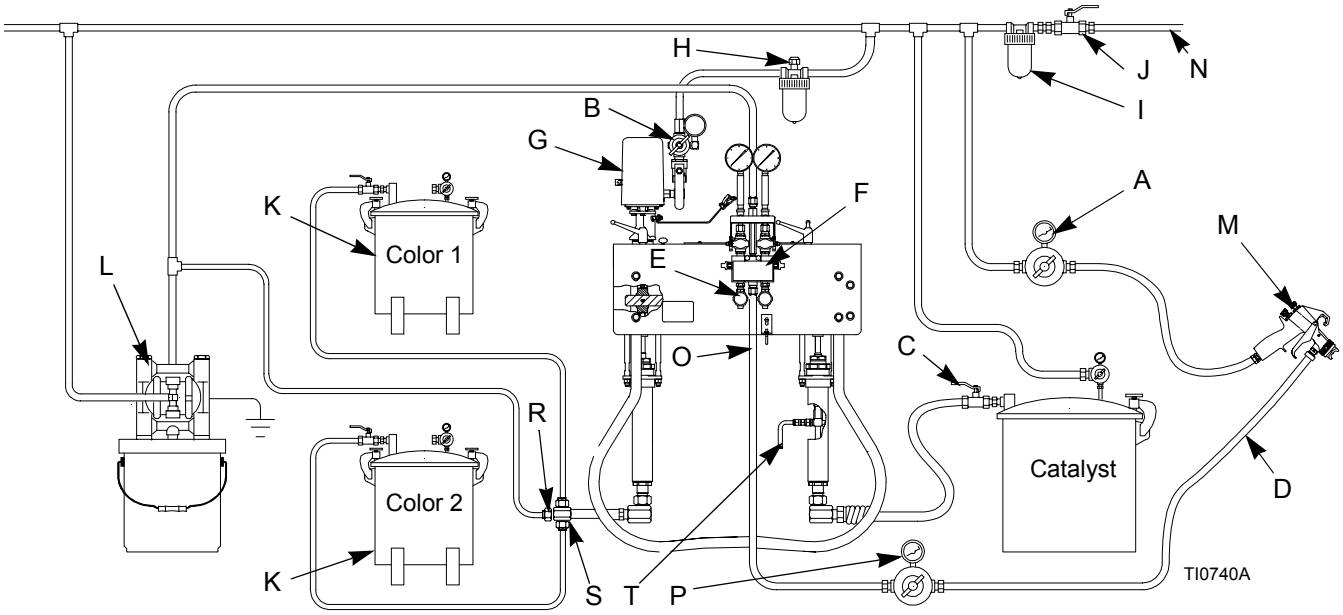


Figure 2 - Typical Installation for Two Color System

Connect the Air Supply Line

NOTE: To ensure the maximum pump performance, be sure that all the accessories used are properly sized to meet your system requirements. Use only genuine Graco parts and accessories.

In the air line, install an air filter to remove harmful dirt and moisture from the compressed air supply. Install an air line lubricator downstream from the air filter, the supplied air regulator, and the bleed-type master air valve. The lubricator provides automatic lubrication to the air motor.

⚠ WARNING

The supplied bleed-type master air valve is required in your system to relieve the air trapped between the valve and the pump after the pump is shut off. Trapped air can cause the pump to cycle unexpectedly, which can result in serious injury.

Connect a 1/2” minimum ID grounded air supply hose to the 1/2 npt(f) port of the air regulator. Open the bleed-type master air valve and set the air regulator to the desired pressure, using the pressure gauge.

Connect the Solvent Supply Line

Remove the coupling from the solvent inlet on the mix manifold and install a grounded fluid supply from the solvent pump.

Ground the System

⚠ WARNING

Fire and Explosion Hazard

Before operating the system, ground it as explained below. Also read the **Fire or Explosion Hazard** section on page 7.

Ground all of this equipment:

- **Pump:** Use a ground wire and clamp as shown in Figure 3. Loosen the grounding lug locknut and washer (X). Insert one end of a 12 ga. (1.5 mm²) minimum ground wire (Y) into the slot in lug (Z) and tighten the locknut securely. Connect the other end of the wire to a true earth ground. Order part number 222011 Grounding Clamp and Wire.
- **Fluid hoses:** Use only grounded fluid hoses.
- **Air hoses:** Use only grounded air hoses.
- **Spray Guns:** Obtain grounding through connection to a properly grounded fluid hose and pump.
- **Fluid supply container:** Follow your local code.
- **Air compressor:** Follow your local code.
- **To maintain grounding continuity when flushing or relieving pressure:** Hold a metal part of the spray gun firmly to the side of a grounded metal pail, then trigger the gun.
- **All solvent pails used when flushing:** Follow your local code. Use only metal pails, which are conductive, placed on a grounded surface. Do not place the pail on a non-conductive surface, such as paper or cardboard, which interrupts the grounding continuity.

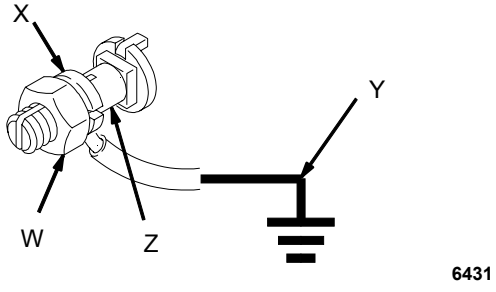


Figure 3 - Pump Grounding Lug

Ratio Adjustment

Understanding the terms used with the Variable Ratio Mini-Cat proportioner, how it functions, and how to find and set the correct ratios for your application is the key to easier, more versatile operation of your proportioning system.

Be sure to read and understand the terms on page 4 and the following information before operating the equipment.

There are three main points when applying the use of ratios:

1. Determine the ratio that is required.
2. Calculate the scale setting.
3. Set the ratio on the Variable Ratio Mini-Cat proportioner.

Determining the Ratio

Set the ratio based on the following:

- **If the fluids are supplied at a ready-to-spray viscosity,** simply set the ratio as explained under **Setting the Ratio** on page 12.
- **If the fluids are NOT supplied at ready-to-spray viscosity and you must pre-reduce the base,** the ratio must be determined after the reducer is added to the base, as instructed at right.

NOTE:

- Evaporation of the reducer in the base causes changes in the ratio. To prevent evaporation, store the base in a closed container.
- Some reducers have very little ability to lubricate and many cause seals to dry out. To prolong the seal life, be sure your pump seals are compatible with the base's reducer. Contact your Graco representative for the correct seals to use.

Base is Pre-reduced

To determine the ratio of the base/reducer mixture to the catalyst, follow the procedure in the example below.

Example:

The instructions on the can say "Mixer 5 parts base to 1 part catalyst. Then reduce 3 parts of this mixture to 1 part reducer."

1. Add the parts of the base and catalyst to find the parts mixture**.**

	5	parts base
+	1	parts catalyst
	6	parts mixture

2. The next statement on the can says, "Reduce 3 parts of the mixture." So divide the parts of the mixture by 3 parts to find the parts reducer.

	6	parts mixture
÷	3	parts to reduce
	2	parts reducer

3. To determine the ratio of the secondary pump, add the appropriate parts base and parts reducer to find the parts combined base/reducer.

	5	parts base
+	2	parts reducer
	7	parts combined base/reducer to 1 part catalyst

The ratio of the secondary pump is 7:1.

Calculating the Scale Setting

The scale setting is determined either from the appropriate chart or by using the formulas below.

NOTE: MR stands for Mix Ratio in the following formulas.

For Model 965660

$$\text{Scale Setting} = 16 \left[\frac{\text{MR-1}}{\text{MR}}\right]$$

For Model 965661

$$\text{Scale Setting} = 16 \left[\frac{\text{MR-2}}{\text{MR}}\right]$$

For example, for a 4:1 mix ratio with Model 965661 the catalyst scribe mark should be set on:

$$\text{Scale Setting} = 16 \left[\frac{\text{MR-2}}{\text{MR}}\right]$$

$$\text{Scale Setting} = 16 \left[\frac{\text{4--2}}{\text{MR}}\right] = 8$$

Setting the Ratio

⚠ WARNING

Pressurized Equipment Hazard

To reduce the risk of serious injury, always follow the **Pressure Relief Procedure** on page 13 before setting or changing the mix ratio.

To set or change the mix ratio, loosen the four adjusting knobs. Pull up on the knob to disengage the thread. Slide the catalyst to the desired scale setting and retighten the adjusting knobs.

Ratio Setting for Model 965660

Volumetric Ratio	Ratio Setting
1.00:1	0
1.25:1	3.20
1.50:1	5.33
1.75:1	6.86
2.00:1	8.00
2.25:1	8.89
2.50:1	9.60
2.75:1	10.18
3.00:1	10.67
3.25:1	11.08
3.50:1	11.43
3.75:1	11.73
4.00:1	12.00

Ratio Setting for Model 965660

Volumetric Ratio	Ratio Setting
2.00:1	0
2.50:1	3.20
3.00:1	5.33
3.50:1	6.86
4.00:1	8.00
4.50:1	8.89
5.00:1	9.60
5.50:1	10.18
6.00:1	10.67
6.50:1	11.08
7.00:1	11.43
7.50:1	11.73
8.00:1	12.00

Operation

Pressure Relief Procedure

⚠ WARNING

Pressurized Equipment Hazard

The system pressure must be manually relieved to prevent the system from starting or spraying accidentally. To reduce the risk of an injury from accidental spray from the gun, splashing fluid, or moving parts, follow the **Pressure Relief Procedure** whenever you:

- are instructed to relieve the pressure,
- stop spraying,
- check or service any of the system equipment,
- or install or clean the spray nozzle.

1. Lock the spray gun safety latch.
2. Shut off the power source to the pump.
3. Close the bleed-type master air valve (required in the system).
4. Unlock the spray gun safety latch.
5. Hold a metal part of the spray gun firmly to the side of a grounded metal pail, and trigger the gun to relieve fluid pressure.
6. Lock the spray gun safety latch.
7. Open the pressure relief valve, having a container ready to catch the drainage. Leave the valve open until you are ready to spray again.
8. If you suspect that the spray tip/nozzle or hose is completely clogged or that pressure has not been fully relieved after following the steps above, very slowly loosen the tip guard retaining nut or hose end coupling to relieve pressure gradually, then loosen completely. Now clear the tip/nozzle or hose.

Flushing

⚠ WARNING

To reduce the risk of fire, explosion, and serious injury from static sparking and splashing, be sure to follow these precautions before and during system flushing:

- Be sure the entire system and flushing pails are properly grounded. Refer to **Ground the System** on page 10.
- Wear eye protection.
- Follow the “Pressure Relief Procedure” before flushing and before removing a spray tip.
- If a high pressure spray gun is being used, remove the spray tip before flushing.
- Use the lowest possible fluid pressure and maintain firm metal-to-metal contact between the spray gun and pail during flushing,

The pumps, mixer manifold and other components were tested with lightweight oil at the factory. Before operating the pump, thoroughly flush the Mini-Cat system to prevent contamination of your fluids. Follow the **Flushing the System** on page 14**.**

Flush the mixer, hose and gun often enough to prevent fluid from reacting or curing in them. Contact your fluid manufacturer for the effective pot life of the fluid you are using.

Flushing the System

1. Put the pump intake hoses into a 5 gallon (20 liter) container of a compatible solvent. Refer to the fluid manufacturer's recommendations.

2. Start the pump as instructed below.

3. Do not install a spray tip yet. Hold a metal part of the gun firmly to the side of a grounded metal pail. Using the lowest possible fluid pressure, trigger the gun into the pail.

4. When clean solvent comes from the spray gun, release the trigger and carefully check all connections in the system for leaks.

5. Take the hoses out of the solvent, and trigger the gun until all the solvent has been pumped out of the hoses.

Starting the Pump

1. Close the bleed-type master air valve, and turn the air regulator knob all the way out (counterclockwise).

2. Turn on the main air supply.

3. With the mixer manifold handle in the open (down) position (see Figure 4), trigger the gun, slowly open the bleed-type master air valve, and turn the air regulator knob clockwise until the pump starts to cycle.

4. Allow the pump to cycle slowly until all the air is pushed out of the lines. Release the trigger - the pump will stall against the pressure.

5. The manifold handle controls fluid flow. With the lever of the manifold in the open (down) position, base and catalyst are supplied to the gun. To stop the flow, move the handle to the closed (up) position.

Standard Operation Flushing

Use the solvent valves to flush contaminants and mixed fluids from the mixer manifold, hose and spray gun. Follow the procedure, below.

1. Start the solvent pump, and move the mixer manifold handle to the closed (up) position. See Figure 4.

2. Open one of the solvent valves and trigger the gun into the metal pail until thoroughly flushed. Release the trigger.

3. Close the opened solvent valve, and open the other solvent valve. Trigger the gun into the pail until thoroughly flushed. Release the trigger.

4. Open both solvent valves and continue flushing until all contaminants and fluids are removed. Release the trigger.

5. To flush the sampling valves, place a grounded metal pail under the sampling valves. Turn the valve handle to the open position. Flush until all contaminants and fluids are removed. Close the sampling and solvent valves. The solvent valves should be finger tight only, but must be tight enough to prevent solvent from mixing with the fluid during operation.

6. Trigger the gun to relieve the pressure.

Checking the Ratio

1. Open the mixer manifold by moving the handle to the down position. See Figure 4.

2. Set your operating pressure. After determining the operating pressure, release the spray gun trigger and lock the safety latch.

3. Close the mixer manifold by moving the handle to the up position. See Figure 4.

4. Open the sampling valve on the secondary pump side approximately three turns. Open the sampling valve on the primary pump side one turn. This will prevent the pressure from building up on the secondary pump, which would open the relief valve.

5. Place a grounded waste container under the sampling valve.

6. Open the mixer manifold (move the handle to the down position). Use the sampling valve to adjust the pressures to your normal operating pressure.

7. Close the mixer manifold (move the handle to the up position). Put the sampling containers under the sampling valves.

8. Open the mixer manifold. Check the ratio; make sure the pressure is within 20% of your normal operating pressure. Close the mixer manifold when enough fluid has been dispensed into the sampling containers.

NOTE: If the pressure readings are not within 20% of your normal operating pressure, follow the procedure **Standard Operation Flushing** on page 14, then take a sample again.

If your sample ratio is incorrect, there is a problem with the sampling valves, secondary pump setting, or pump operation. Check the pump setting or service the sampling valves or pump.

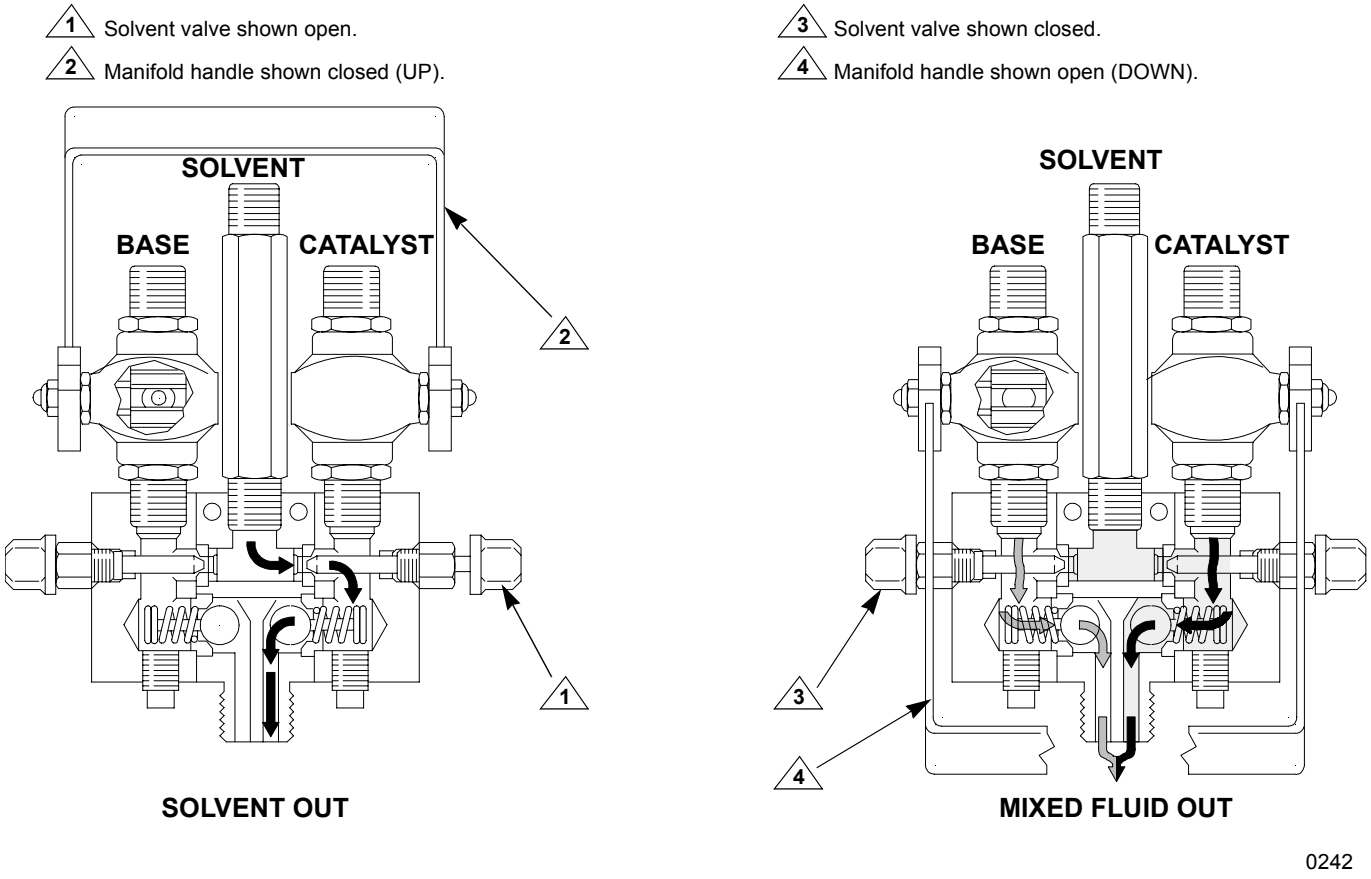


Figure 4 - Fluid Manifold

Two Color Flushing

When using a two color system, follow the procedure below to obtain good color change results. Refer to Figure 2 on page 9.

1. Close the color valve at the color selector manifold (S).

2. Close the catalyst shut-off valve (C).

3. Close the self-relieving air valve (B) on the Mini-Cat proportioner.

4. Open the solvent shut-off valve (R).

5. Holding the spray gun against the side of a grounded metal pail, trigger the gun until clean solvent comes out.

6. Close the solvent supply valve (R).

7. Open the color valve (S).

8. Place a grounded waste container under the sampling valves.

9. Slowly open the resin sampling valve (E) located on the mix manifold (F) and allow the fluid to drain until pure color comes out, then close the valve.

10. Open the catalyst supply valve (C).

11. Open the self relieving air valve (B).

12. Trigger the gun against a grounded metal pail until full color comes out. The Mini-Cat proportioner is now ready for operation.

NOTE: After making a color change, follow the procedure **Standard Operation Flushing** on page 14 to clean the mix manifold. This ensures that the internal check valves within the mix manifold are clean.

Troubleshooting

Troubleshooting Techniques

⚠ WARNING

Pressurized Equipment Hazard

To reduce the risk of serious injury, including splashing in the eyes or on the skin or injury from moving parts, follow the **Pressure Relief Procedure** on page 13 before troubleshooting or servicing the equipment and whenever you are instructed to relieve the pressure.

Use very low air pressure to the air motor when following the procedure at right to isolate the problem or doing any other troubleshooting requiring air pressure.

Moving Parts Hazard

To reduce the risk of injuring or amputating hands, fingers, or other body parts, never place your hands, body, or tools inside the air motor cover or near other moving parts while the equipment is operating.

Because the pumps are mechanically linked, the action of one pump can affect the readings of the second pump. Therefore, the key to successful troubleshooting is to isolate the problem.

For example, the secondary pump pressure, as read on the gauge, is low and sluggish during the pump change-over. The most likely problem is a binding primary pump.

To isolate the problem:

1. Relieve the pressure as instructed in the **Pressure Relief Procedure** on page 13.

2. Remove the catalyst pump. Now you can verify the operation of the primary pump alone.

   a. Check for pump stalling on both the up and down strokes.

   b. Check for rapid gauge response during pump change-over.

3. When the operation of the primary side has been verified, reinstall the catalyst pump.

4. Disconnect the master pump connecting rod from the pump and repeat the checks in step 2 (above) on the secondary pump side.

Troubleshooting Chart

Problem	Cause	Solution
The system will not run or it stops while running.	Air pressure or volume is too low.	Increase the air pressure. Check the air compressor.
	Air line or an air valve is closed or restricted.	Open or clean the air line or air valve as required.
	Fluid valves are closed.	Open the fluid valves.
	The air motor is worn or damaged.	Service the air motor. See the Service section.
	Displacement pump is seized.	Service the pump. See the displacement pump manual 307944.
The fluids are not mixing properly.	Fluid line filter is clogged.	Clean the filter and replace the element, if necessary.
	Manifold is not operating correctly.	Refer to manual 307400.
	Check the ratio.	Check or replace the pump.
	Fluid hose is clogged.	Replace the fluid hose.
The system speeds up or runs erratically.	Fluid containers are empty.	Check the containers often and keep them filled.
	Displacement pump parts are worn or damaged.	Service the pump. See the displacement pump manual 307944.
A squeaking or knocking noise is heard.	Bearing(s) dry or worn.	Lubricate the bearing(s) or replace them, if required.
Continuous air exhaust from muffler.	Motor piston o-ring (32) is worn or damaged.	Inspect and replace the o-ring. See page 21.
	Air cup (7) not seating properly or it is damaged.	Inspect the air cup; reseat or replace it. See page 24.
Continuous air exhaust from pilot valve vent holes	Carriage spool u-cups (3c) are worn or damaged.	Inspect the u-cups and replace if necessary. See page 24.
	Actuator valve pin o-rings (23) are worn or damaged.	Inspect the o-rings and replace if necessary. See page 22.
Air motor not shifting properly; erratic operation/stalling.	Actuator valve pin o-rings (23, top or bottom) are worn or damaged.	Inspect the o-rings and replace if necessary. See page 22.
	Actuator valve springs (16, top or bottom) damaged.	Replace the springs. See page 22.
	Carriage spool u–cups (3c) worn or damaged (characterized by continuous air leakage from actuator valve vents).	Inspect the u-cups and replace if necessary. See page 24.
	Clogged or obstructed valve porting.	Clean porting.
	Worn out valve housing (3).	Replace the valve. See page 24.
	Improper seating or damaged port or valve housing o-rings.	Inspect o-ring and groove. Clean or replace as necessary. See page 24.
Air leaking from air motor base vent hole.	Worn or damaged low pressure u-cup seal (19).	Inspect the u-cups and replace if necessary. See page 21.
Fluid leaking from air motor base vent hole.	Worn or damaged bearing (20).	Inspect the bearing and replace if necessary. See page 20.

Service

⚠ WARNING

Pressurized Equipment Hazard

To reduce the risk of serious injury, including splashing in the eyes or on the skin or injury from moving parts, follow the **Pressure Relief Procedure** on page 13 before checking or servicing the equipment and whenever you are instructed to relieve the pressure.

Bearing and Pump Lubrication

Insert one end of a nylon hose into the wet-cup. Hold the other end of the hose up and pour the Throat Seal Liquid through the hose and into the wet-cup until it is full.

Lubricate the Mini-Cat proportioner's main pivot beam periodically with Graco Gear Reducer Oil.

Service instructions are in the manuals for the separate components. Refer to the **Troubleshooting Chart** on page 18 to help find the cause of the problem. The component manual numbers are shown in the Solution column in the chart.

Air Lubrication

If your air supply is very dry, install air line lubricators between the air regulators and pumps for automatic air motor lubrication.

Proportioning Pump Removal

1. Flush the entire system with a solvent compatible with the fluid being pumped.
2. Disconnect the air line.
3. Follow the **Pressure Relief Procedure** on page 13.
4. Disconnect the fluid hose from the pump outlet.
5. Loosen the four adjusting knobs (pull up on the knob to disengage the thread).
6. Remove the master pump stop pin.
7. Slide the pump(s) along the rail and remove the pump(s) from the front of the Mini-Cat proportioner.

Proportioning Pump Installation

1. With the four adjusting knobs loose, install the catalyst pump assembly from the front of the Mini-Cat proportioner. Slide the mounting plate between the rails and the frame.
2. Install the master pump stop pin.
3. Install the master pump assembly and slide the mounting plate until it meets the master pump stop pin.

NOTE: The motor and master pump are located off center of the mounting plate. When properly installed, the mounting plate should be approximately flush with the front of the frame, with the distance from the center of the air motor to the front of the frame being 2-7/8" (73 mm). If the master pump is installed backwards, an off-ratio condition will result.

4. Set the ratio. Refer to **Setting the Ratio** on page 12.

Air Motor Service

Throat Packing Disassembly

1. Follow the procedure **Proportioning Pump Removal** on page 19.

2. Remove the air motor cover (69). See Figure 5.

3. Disconnect the air motor (1) from the displacement pump, as explained in displacement pump manual 307944.

4. Remove the three screws (29) holding the outlet housing (18) to the bottom cylinder cap (4). Pull the housing off the cap, being careful not to damage the piston rod (17).

5. Remove the u-cup packing from the cap (4).

6. Remove the retaining ring (39) and the bearing (20) from the outlet housing (18).

Throat Packing Reassembly

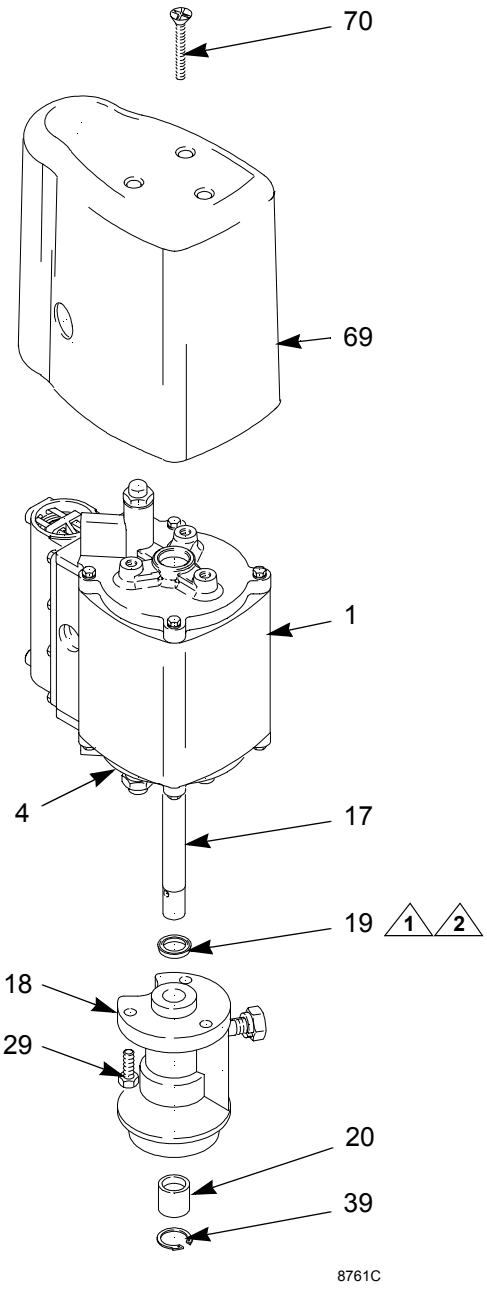
1. Lubricate the u-cup packing (19) and install it in the bottom cylinder cap (4), with the lips facing up toward the air motor (1). See Figure 5.

2. Install the bearing (20) and the retaining ring (39) in the outlet housing (18).

3. Install the housing (18) on the cap (4).

4. Reconnect the air motor (1) to the displacement pump, as explained in displacement pump manual 307944.

5. Install the air motor cover (69).



1 Lubricate

2 Lips face up, toward air motor (1)

Figure 5 - Air Motor

Cylinder and Piston Disassembly

1. Follow the procedure **Proportioning Pump Removal** on page 19.

2. Disconnect the air motor from the displacement pump, as explained in displacement pump manual 307944.

3. Remove the six screws (25 and 42) holding the bottom cylinder cap (4) to the cylinder (2). Lift the cylinder off the cap to expose the piston (14). See Figure 6 on page 23.

4. Pull the piston (14) and piston rod (17) out of the outlet housing (18) and bottom cylinder cap (4).

5. Remove the piston o-ring (32). Insert a punch in the hole at the end of the piston rod (17) to hold it steady, and unscrew the nut (35) from the rod. Remove the two washers (27), o-ring (32) and piston (14).

6. Stand the cylinder (2) upright. Remove the six screws (25 and 42) and lift off the top cap (5).

7. Examine the inner surface of the cylinder for scoring or damage.

8. Remove the large o-ring (22) and two small o-rings (34) from the inside of the top cylinder cap (5). Remove o-rings (3g, 24) and the pilot plug (68). Repeat for the bottom cylinder cap (4).

Cylinder and Piston Reassembly

1. Grease the large o-ring (22) and the two small o-rings (34) and install them on the top cylinder cap (5). Install o-rings (3g, 24) and the pilot plug (68). Repeat for the bottom cylinder cap (4). See Figure 6.

2. Install the top cap (5) on the cylinder (2). Be sure that the large o-ring (22) does not roll out of the groove. Install two M4 screws (25) in the square section of the cap and four M5 screws (42) in the tabs. Torque the two M4 screws (25) to 14 to 17 in-lb (1.6 to 1.9 N•m) and the four M5 screws (42) to 35 to 45 in-lb (4.0 to 5.1 N•m).

3. Install a washer (27), an o-ring (32), the piston (14), *with the chamfer facing down toward the o-ring (3g),* and a washer (27) on the piston rod (17). Screw the self-locking nut (35) onto the rod. Install the o-ring (32) on the piston (14), and lubricate the o-ring.

4. Grease the piston rod (17) and the inner wall of the cylinder (2).

5. Insert the piston rod (17) into the bottom cap (4) and the outlet housing (18), being careful not to damage the u-cup packing (19) inside the cap.

6. Install the cylinder (2) down over the piston (14). Be sure that the large o-ring (22) does not roll out of the groove. Install the screws (25 and 42) in the bottom cap (4), as explained in step 2, above.

7. Reconnect the air motor to the displacement pump, as explained in displacement pump manual 307944.

Actuator Valve Disassembly

1. Follow the procedure **Proportioning Pump Removal** on page 19.

2. Remove the air motor cover (69). See Figure 6.

3. Remove the actuator valve plug (11) from the top cap (5). Inspect the sealing gasket (15) and spring (16) in place on the plug. If the gasket needs replacement, thread it off the plug (11).

4. Pull the pin (12) out of the top cap (5). Remove the two o-rings (23) from the pin.

5. If it is necessary to remove the o-ring (24) from the actuator valve cavity, you must first remove the top cap. See **Cylinder and Piston Disassembly** on page 21.

6. Repeat for the bottom cylinder cap (4).

Actuator Valve Reassembly

1. If the o-ring (24) was removed, it must be installed from the inside of the top cap (5). Lubricate the o-ring. See Figure 6. Reinstall the top cap. See **Cylinder and Piston Reassembly** on page 21.

2. Install the two o-rings (23) on the pin (12). Grease the pin and insert it in the top cap (5). The long end must point toward the inside of the motor.

3. Thread the gasket (15) onto the plug (11). Grease the spring (16) and install it in the plug. Screw the plug into the top cap (5) and torque to 60 to 80 in-lb (6.8 to 9.0 N•m).

4. Repeat for the bottom cylinder cap (4).

5. Install the air motor cover (69).

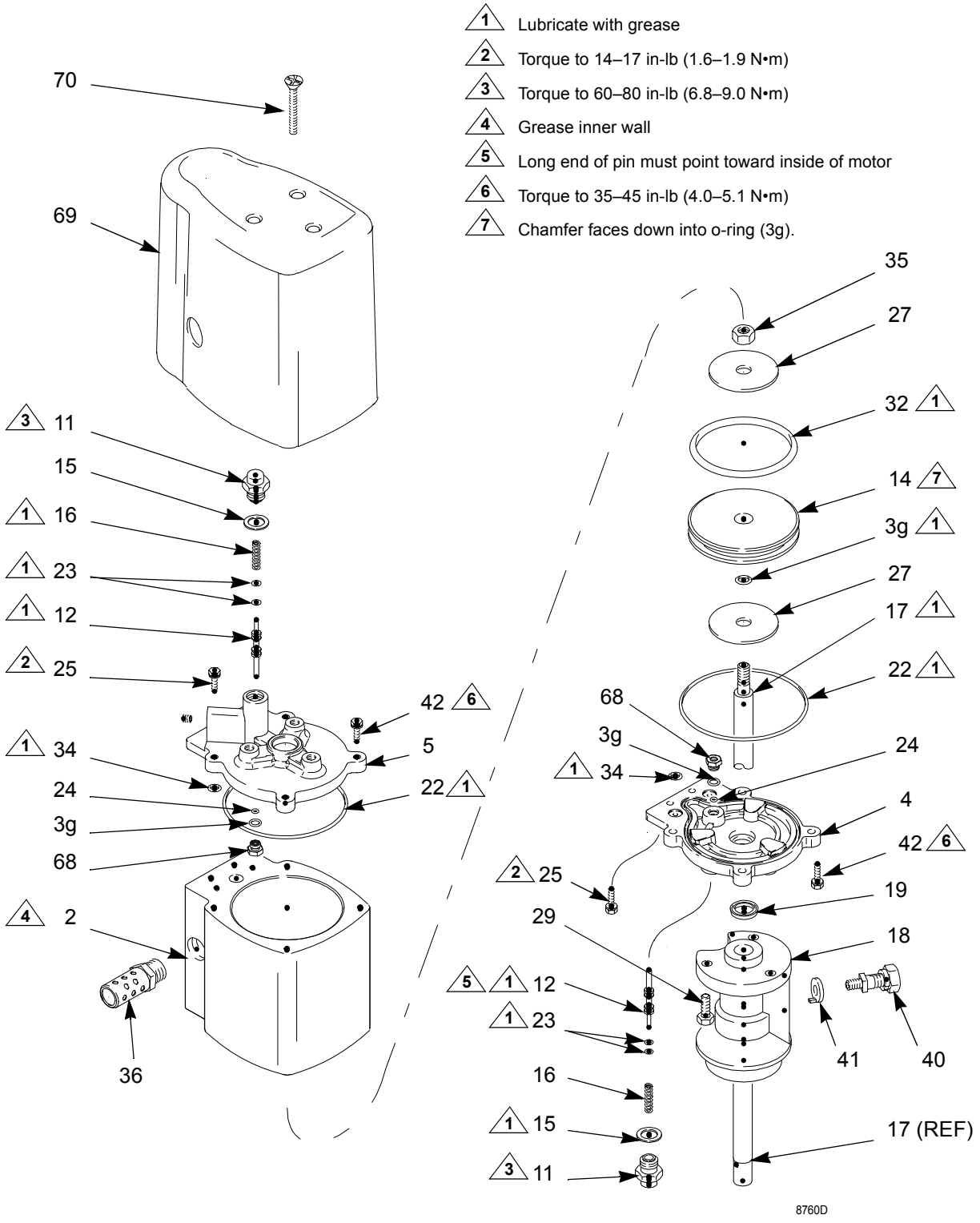


Figure 6 - Air Motor

Director Valve Disassembly

1. Follow the procedure **Proportioning Pump Removal** on page 19.

2. Remove the air motor cover (69). See Figure 7.

3. Remove the screws (25) holding the director valve housing (3a) to the cylinder (2). Note the position of the spool inside of the valve housing.

   Be careful not to drop the valve cup (7) as you remove the housing; the cup can be easily damaged. Inspect the cup surface for scratches. If damaged, replace the cup.

NOTE: The surface of the valve cup (7) can be repaired by rubbing it with 300 to 600 grit sandpaper on a flat surface.

4. Remove the screws (28) holding the valve plate (8) to the cylinder (2). Be very careful not to drop or damage the plate. Inspect the plate surface for scratches. If damaged, replace the plate.

5. Remove the gasket (13) from the face of the cylinder (2).

6. Clean and inspect all parts. Replace any parts that are worn or damaged.

Director Valve Reassembly

1. Install the valve gasket (13) and plate (8) on the cylinder (2). Be sure the surface of the plate facing out is free of scratches or damage. Install the screws (28), and torque them oppositely and evenly to 4 to 6 in-lb (0.5 to 0.7 N•m).

2. Position the spool in the new director valve in the position you noted during disassembly.

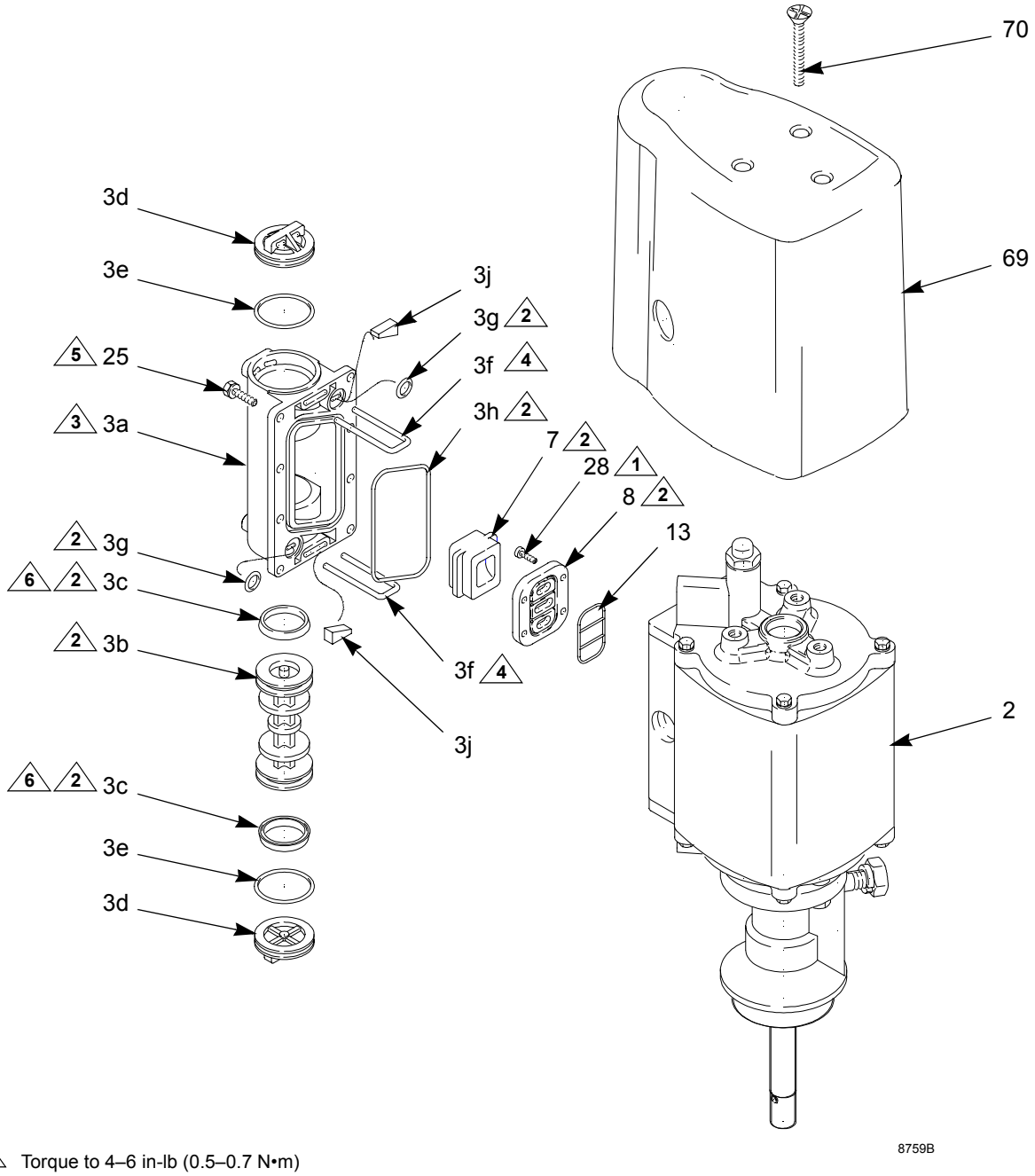
3. Grease the o-ring grooves in the valve housing (3a), then install the large o-ring (3h) and two small o-rings (3g). The grease holds the o-rings in place during assembly.

4. Grease the valve cup (7) and the valve plate (8). Orient the cup as shown in Figure 7. Place the cup on the valve plate so its position corresponds to the position of the spool, as noted during disassembly.

5. Place the director valve housing (3a) on the cylinder (2). The spool (3b) must engage the valve cup (7), or the valve housing assembly will not fit correctly. If necessary, move the cup to engage the spool.

6. Install the screws (25), and torque oppositely and evenly to 14 to 17 in-lb (1.6 to 1.9 N•m). Be sure the o-rings (3h, 3g) do not slip out of the grooves on the housing (3a).

7. Install the air motor cover (69).



1 Torque to 4–6 in-lb (0.5–0.7 N•m)

2 Lubricate with grease

3 Grease inside diameter

4 Clips (3f) must be installed from inside of housing (3a)

5 Torque to 14–17 in-lb (1.6–1.9 N•m)

6 Lips point toward center of spool

Figure 7 - Director Valve

Parts

Model 244143 Air Motor

Ref. No.	Part No.	Description	Qty.
2	194715	CYLINDER, motor	1
3	241357	VALVE, director *(Includes 3a to 3h);* Parts drawing on page 27.	1
3a		• HOUSING, valve	1
3b	276264	• SPOOL; acetal	1
3c	112181	• PACKING, u-cup	2
3d	276605	• RETAINER, spool; acetal	2
3e	108730	• O-RING; buna-N	2
3f	188583	• CLIP	2
3g	154741	• O-RING; buna-N	5
3h	191839	• SEAL, housing	1
3j		DAMPENER, foam	2
4	194718	CAP, cylinder, bottom	1
5	194719	CAP, cylinder, top	1
7	188947	CUP, air; acetal	1
8	191778	PLATE, valve; stainless steel	1
11	188539	PLUG, actuator; aluminum	2
12	194723	PIN, actuator; stainless steel	2
13	191777	GASKET, plate, valve; Buna-N	1
14	196872	PISTON, motor	1
15	188582	GASKET, plug; nylon	2
16	113876	SPRING, compression	2
17	188399	ROD, piston, air motor; stainless steel	1
18	626170	HOUSING, outlet; zinc-plated ductile iron	1
19	112110	PACKING, u-cup; nitrile	1
20	551400	BEARING, bronze	1
22	112106	O-RING; buna-N	2
23	112107	O-RING; polyurethane	4
24	112104	O-RING; polyurethane	2
25	112111	SCREW, cap, hex hd.; M4 x 0.7;14 mm (0.55 in.) long	12
26	112112	SCREW, set, socket hd.; M5 x 0.8; 5 mm (0.20 in.) long	4
27	112717	WASHER, flat; 38 mm (1.5 in.)	2
28	112116	SCREW, machine, pan hd; M3 x 0.5:10 mm (0.40 in.) long	4
29	112117	SCREW, cap, hex hd; M6 x 1.0; 18 mm (0.71 in.) long	3
32	113755	O-RING; buna-N	1
34	156454	O-RING; buna-N	4
35	112840	NUT, hex; M8 x 1.25	1
36	113779	MUFFLER	1
37Δ	188830	LABEL, warning	1
39	551399	RING, retaining	1
40	104029	LUG, grounding	1
41	104582	WASHER, tab, grounding	1
42	113945	SCREW, flange, hex hd; M5 x 0.8; 20 mm (0.79 in.) long	8
68	194720	PLUG, pilot	2
69	244140	COVER, Falcon air motor	1
70	115139	SCREW, mach. phillips, flat HD	3

Δ *Replacement Danger and Warning labels, tags and cards are available at no cost.*

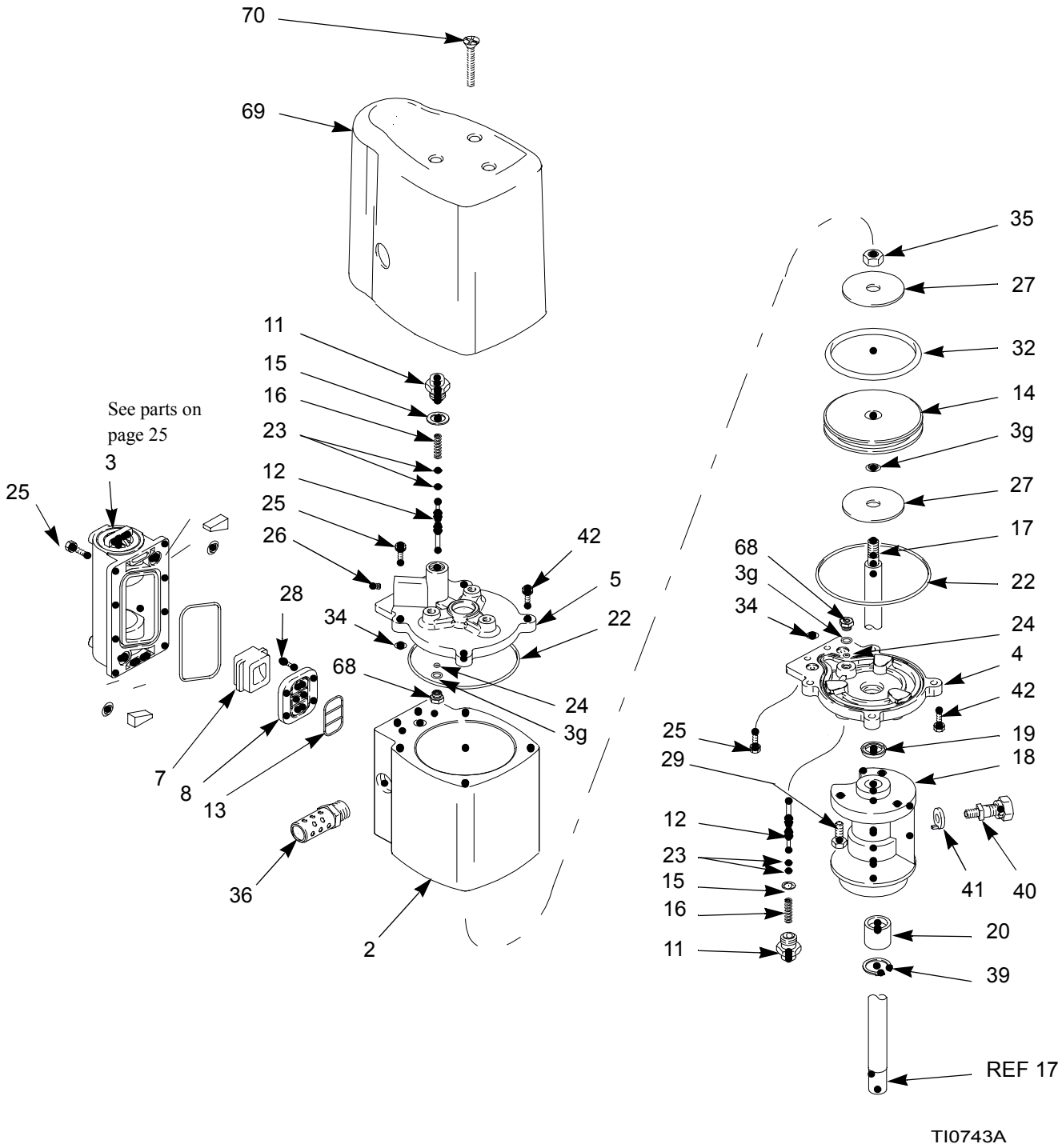


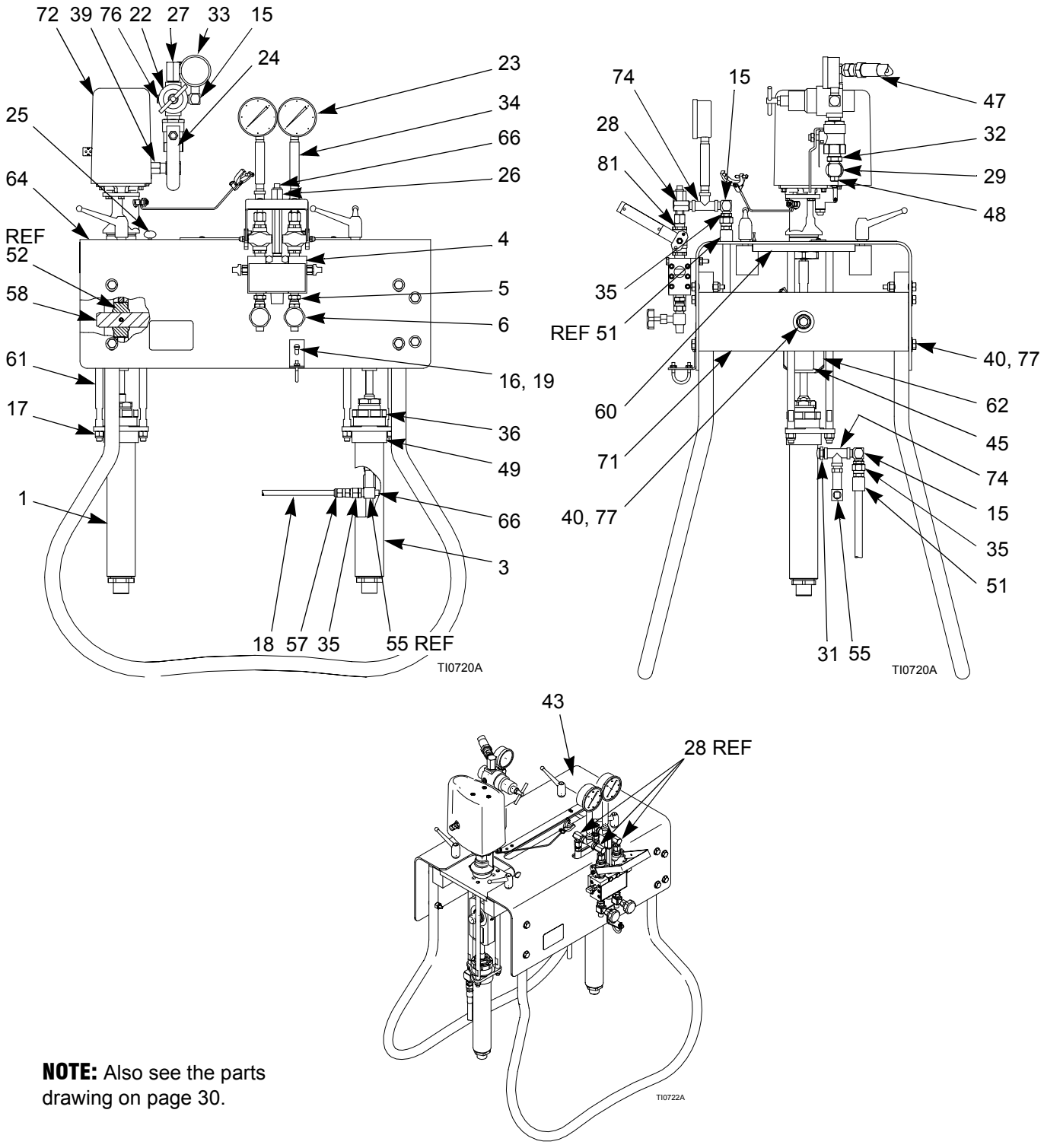
Figure 8 - Air Motor Parts

Models 965660 and 965661 Variable Ratio Mini-Cat Proportioner

Ref. No.	Part Number	Description	Qty.
1	222015	PUMP, displacement, primary; See Manual 307944 for parts	1
3	222012	PUMP, displacement; *Model 965660 only;* See Manual 307944 for parts	1
	222019	PUMP, displacement; *Model 965661 only;* See Manual 307944 for parts	1
4	215626	MANIFOLD, mixer; See Manual 307900 for parts	1
5	156823	UNION, swivel; 1/4-18 npt	2
6	108233	VALVE, needle	2
7	237569	WIRE ASSY., 25 ft. (7.6 m)	1
9	105172	SCREW, cap, hex hd.; 1/4-20 x 2	2
15	100840	ELBOW, street; 1/4-18 npt	3
16	101155	SCREW, machine; 1/4-20 x 0.75	1
17	101566	NUT, lock; 3/8-16	14
18	061132	HOSE, nylon, 225 psi (1.6 MPa, 16 bar) Max. Working Pressure	*
19	102040	NUT, lock; 1/4-20	1
20	102411	PIN, spring	1
21	100139	PLUG, pipe; 1/8-27 nptf	1
22	104267	REGULATOR, air, 0-125 psi (0-0.9 MPa, 0-9 bar)	1
23	105770	GAUGE, fluid pressure	2
24	113269	VALVE, ball, vented; 1/2-14 npt	1
25	100085	SCREW, thumb; 1/4-20 x 0.5	1
26	113093	CONNECTOR, pipe; 1/4-18 npt x 1.13	1
27	155470	UNION, swivel, 90°; 1/2 npsm x 1/2 npt	1
28	155541	UNION, swivel, 90°; 1/4 npt x 1/4 npsm	3
29	155699	ELBOW, street; 3/8-18 npt	2
30	100179	NUT, hex, 10-24	2
31	157350	NIPPLE, pipe, hex; 3/8 npt x 1/4 npt	2
32	159239	FITTING, nipple, pipe, reducing; 1/2 x 3/8 npt	1
33	160430	GAUGE, pressure, air	1
34	160745	TUBE, gauge	2
35	162453	NIPPLE; 1/4 npt x 1/4 npsm	3
36	164417	NUT, lock	2
37	100275	SCREW, machine; 6-32 x 0.26	2
38	100468	SCREW, cap, hex hd.; 3/8-16 x 2	8
39	171992	MANIFOLD, air	1
40	100469	SCREW, cap, hex hd.; 3/8-16 x 0.75	5
41	180673	BRACKET, static mixer	1
42	180674	BOLT, u-type; 10-24	1
43Δ	185953	LABEL, Danger, English	1
44	190774	FITTING, resistor	*
45	186500	LABEL, Caution	2
46	206994	FLUID, TSL, 8 oz. bottle	1
47	214656	HOSE, coupled; 10 ft. (3 m); buna-N; 180 psi (1.3 MPa, 13 bar) Max. Working Pressure	1
48	214691	VALVE, relief	1
49	215690	PLATE, mounting	2
50	217374	LUBRICANT, ISO pump	1
51	947233	HOSE, coupled; 1/4 npsm coupling; 3 ft. (0.9 m); 2750 psi (19 MPa, 190 bar) Max. Working Pressure	1
52	512916	BEARING, connecting rod	2
53	512918	LEG, bent tube	2
54	512920	HANDLE, adjustable	4
55	513024	VALVE, relief, adjustable; 300-1000 psi (2.1-7 MPa, 21-69 bar); 1/4 npt(f)	1
56	513444	SCREW, set; 1/4-20	2
57	205447	COUPLING, hose; 1/4-18 npsm	1
58	624533	ROD, main drive	1
59	624534	PLATE, mounting, pump	1
60	624535	PLATE, mounting, catalyst pump	1
61	624536	ROD, tie, pump mounting	6
62	624537	ROD, connecting	1
63	624540	SUPPORT, pump clamp rail bar	2
64	624541	SHIELD, Mini-Cat	1
65	624548	SCALE, ratio gauge	1
66	100509	PLUG, pipe; 1/4-18 nptf	2
67	626155	NUT, mounting	1
68	626156	ROD, connecting	1
69	626157	ROD, connecting	1
70	223761	HOSE, coupled; 1/4 npsm(f) x 1/4 npt(m); 3 ft. (0.9 m); nylon; 3000 psi (21MPa, 207 bar) Max. Working Pressure	1
71	948427	SUPPORT, rear bearing	1
72	244143	MOTOR, air, pump	1
74	104984	TEE, pipe; 1/4 nptf	3
75	100718	WASHER, #10	2
76	100721	PLUG, pipe; 1/4-18 nptf	1
77	100731	WASHER, 3/8”	13
78	100833	FITTING, lubrication, ball check, 90°; 1/8-27 nptf	2
79	100016	WASHER, lock; 1/4”	2
80	100015	NUT, hex; 1/4-20	2
81	165274	NIPPLE, adapter; 1/4-18 npt	2

* *Order length/quantity needed.*

Δ *Replacement Danger and Warning labels, tags and cards are available at no cost.*



NOTE: Also see the parts drawing on page 30.

Figure 9 - Variable Ratio Mini-Cat Proportioner

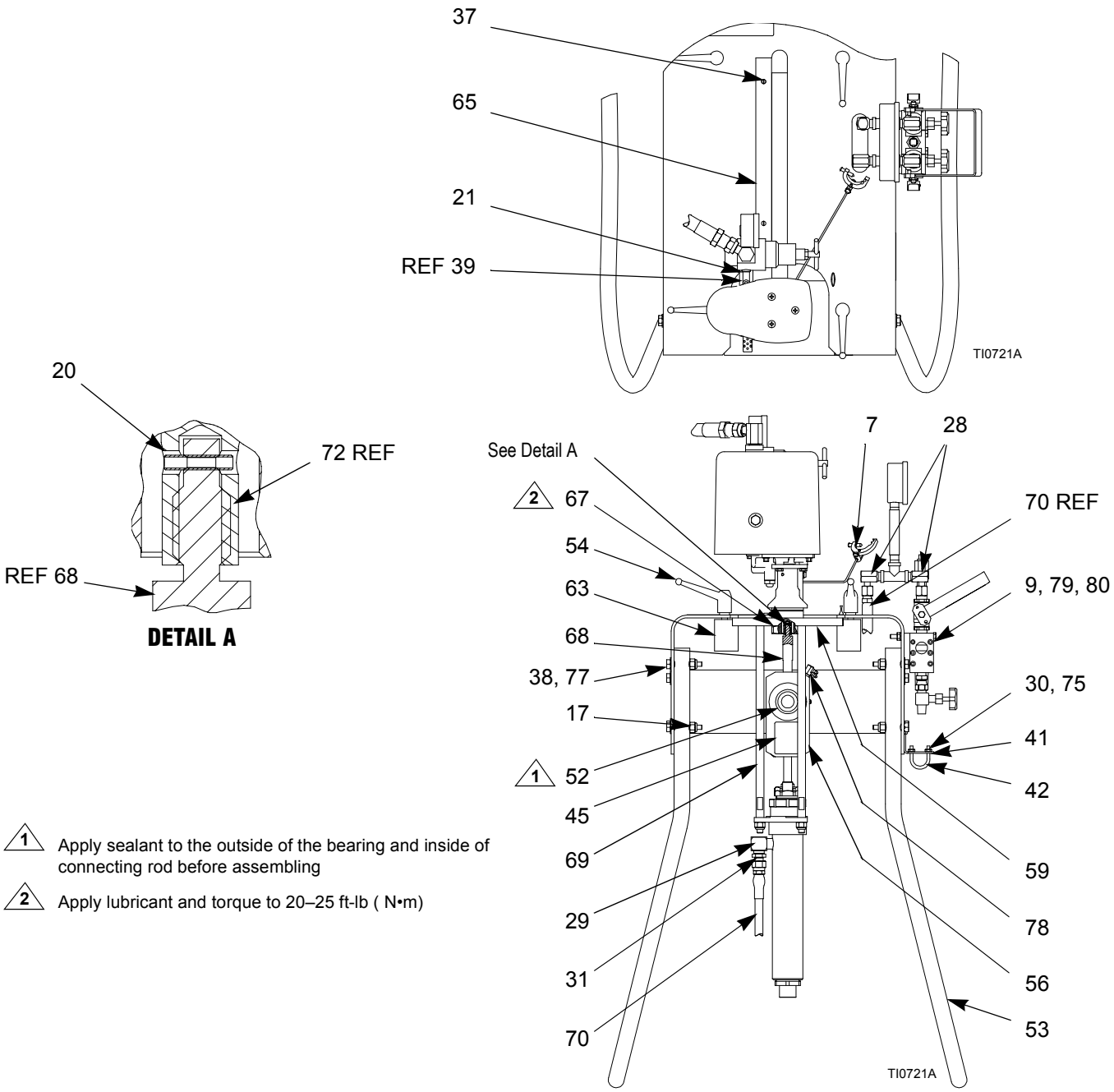


Figure 10 - Variable Ratio Mini-Cat Proportioner

Accessories

Siphon Extension

Part No. 168458

For siphon feeding paint into the inlet of the master pump. Recommended for the resin pump only.

Bleed-type Master Air Valve

Part No. 107142

300 psi (2.1 MPa, 21 bar) Maximum Working Pressure
Relieves air trapped in the air line between the pump air inlet and this valve when closed. 1/2 npt(m x f) inlet and outlet.

Color Selector Manifold

Part No. 948025

For use as a two color selector manifold. Has porting for solvent inlet. 3/8 npt(f) fluid inlet, 1/2 npt(m) fluid outlet.

Static Mixers

A static mixer consists of a tube with helical interior elements, which thoroughly blend base and catalyst into the proper mix.

Part No.	Size	Wetted Materials	Maximum Working Pressure	Fittings
504068	8” (203 mm) long 3/8” (9mm) OD 1/4” (6 mm) ID 24 elements	Polyethylene, brass	135 psi (1 MPa, 10 bar)	1/4 npt(m)
500639	14” (356 mm) long	Stainless steel	3000 psi (21 MPa, 210 bar)	See note 1
500586	25’ (635 mm) long	Stainless steel	3000 psi (21 MPa, 210 bar)	See note 2

NOTE 1: Order tube fittings separately.
Part No. 502170 — 3/8” (9 mm) OD tube x 3/8 npt(m)

NOTE 2: Order tube fittings separately.
Part No. 502172 — 1/2” (12 mm) OD tube x 1/2 npt(m)

Technical Data

Air motor effective area	6.5 square inches
Air motor stroke	3-1/4”
Operating air pressure range	10 to 50 psi
Maximum recommended pump speed	40 cycles per minute
Maximum fluid inlet pressure	25 psi
Maximum pump operating temperature	180° F (82° C)
Air to fluid pressure ratio	Model 965660 — 7:1 to 11:1 Model 965661 — 8.4:1 to 12.5:1

Wetted Parts

Primary and Secondary Displacement Pump	Chrome-plated and electro-polished stainless steel, carbon steel, and Teflon® plastics
Fluid Manifolds	Zinc-plated steel
Fluid Hoses	Nylon, zinc-plated steel couplings
Mixer Manifold	Chrome alloy, nickel chrome-plated and zinc-plated steels, stainless steel; Delrin®, nylon, and Teflon® plastics

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Notes

Graco Standard Warranty

Graco warrants all equipment manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.
This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.
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