

INSTALLATION KIT 215934

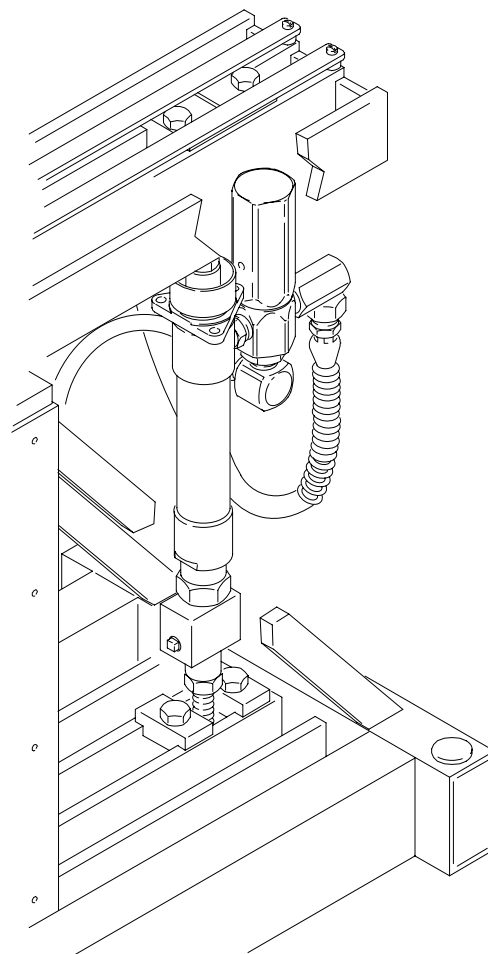
307432 rev.H

- For installing a third displacement pump into a Variable Ratio Hydra-Cat® System.
- The connecting rod (refer to page 2, Fig 1, Ref. letter X) must be ordered separately as it differs from one displacement pump to another.



Important Safety Instructions

Read all warnings and instructions in this manual.
Save these instructions.



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WARNING

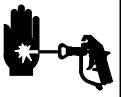
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Installation

Pressure Relief Procedure

WARNING



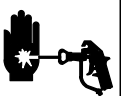
SKIN INJECTION HAZARD

The system pressure must be manually relieved to prevent the system from 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 for more than 10 minutes,
- check or service any of the system equipment,
- or install or clean the spray nozzle.

1. Engage the trigger safety latch.
2. Turn off the power source to the pump.
3. Open the mixer manifold.
4. Disengage the trigger safety latch.
5. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun into the pail to relieve pressure.
6. Engage the trigger safety latch.
7. *If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above:* Disengage the trigger safety latch and trigger the gun to relieve pressure. Wrap a rag around the hose end coupling and VERY SLOWLY loosen the coupling to relieve pressure gradually, then loosen completely. Now clear the tip or hose.

WARNING



SKIN INJECTION HAZARD

All components must meet or exceed the pressure ratings printed on the pressure relief valve. The lever amplification

of the secondary pump enables very high fluid pressures to be achieved. A relief valve is provided on the secondary side to limit the fluid pressure. Do not tamper with this pressure relief valve or serious injury could result.

1. Generously oil the inside of the lower bearing (5A) and surface of the pin (17A), using Graco gear reducing oil (204559, see page 3 to order). See Fig 1.

2. Screw the locknut (2) onto the bearing threads until it bottoms out. Slide the bearing into the slot in the narrow end of the support (15A). Slide the pin (17A) into place with the countersinks under the setscrew holes.

CAUTION

Never force the pin into the bearing. Tolerances between the surface of the pin and the bearing are very close. If the pin does not fit, sand the pin from the end to just past the countersink. If the pin still does not fit, return it to the factory for replacement. If the pin needs replacement, the bearing should also be replaced.

3. Tighten the setscrews (7) to 35 in-lb (4 N·m). These setscrews are self-locking. If some drag is not felt while turning, replace them.
4. Tighten the pipe plug (3) into the manifold(16). Tighten the swivel union (10) into
5. Screw the manifold (16) onto the bearing (5A) 12 complete turns. The 3/4 npt inlet of the manifold must face the end of the unit as shown. If it does not, rotate the displacement pump until it does, and tighten the locknut (2) against the manifold to 60 ft-lb (81 N·m).
6. Screw the displacement pump onto the manifold (16).
7. Align and loosely install the two clamps (13) and capscrews (6).
8. Generously oil the inside of the upper bearing (5B) and the surface of the pin (17B), using Graco gear reducing oil 204559, (see page 4 to order).

9. Slide the support (15B) onto the bearing (5B). Insert the pin (17B) with the countersinks under the setscrew holes. Do not force the pin into place. See the preceding **CAUTION**.

10. Tighten the setscrews (7) to 35 in-lb (4 N·m).
These setscrews are self-locking. If some drag is not felt while turning, replace them.
11. Apply 3 drops of Loctite® (20) to the threads of the bearing (5B). Place the support (15B) in a vise, and screw the connecting rod (X) onto the bearing.

NOTE: If the connecting rod (X) is unscrewed from the bearing (5B), they can only be used one more time. If they are taken apart a second time, both the connecting rod and the bearing must be replaced.

12. Screw the connecting rod (X) onto the pump piston rod. If a cotter pin is to be installed in the connecting rod, make sure the cotter pin holes line up, then install the cotter pin (1). Tighten down the connecting rod against the piston shoulder of the displacement pump.

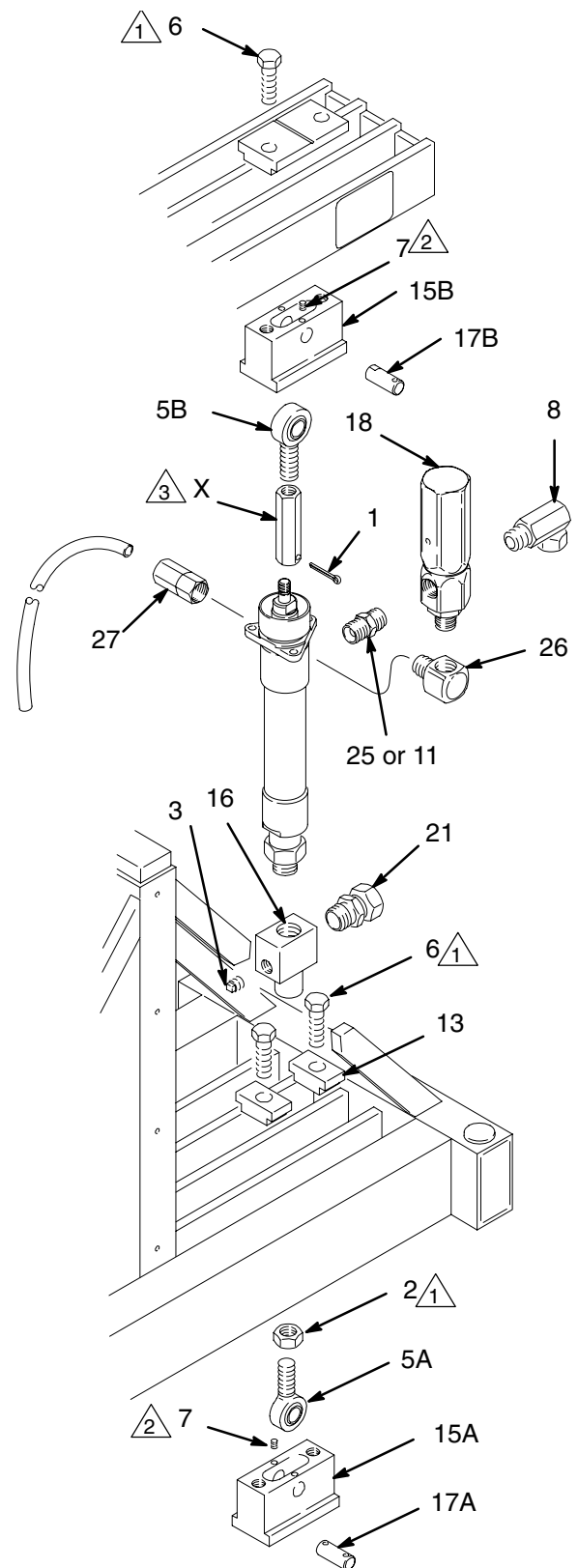
13. Raise the lever arm, and place the support (15B) under the proper slot. Push down the lever arm until the support fits into the slot. If the support does not line up with the slot, rotate it clockwise until it does.

14. Place the ratio index clamp (14) over the top of the support (15B). Insert the capscrews (6).

15. Set the ratio index clamp for the proper ratio, and tighten the capscrews (6) to 60 ft-lb (81 N·m).

16. Tighten the capscrews (6) at the bottom of the secondary displacement pump to 60 ft-lb (81 N·m).

17. See Fig 2. Unscrew the fluid hose (Y) of the primary displacement pump from the VHRC manifold (Z). Assemble and tighten the fluid hoses (19 & Y) and fittings (4, 9, 12, 22, 23 & 24). Check the fluid outlet of the displacement pump to see if it is 3/8 npt(f) or 1/2 npt(f). Screw in and tighten the correct nipple (25 or 11) into the displacement pump fluid outlet, making sure the exterior thread of the nipple is 3/8 npt. Screw the relief valve (18) onto the nipple (25 or 11). Screw and tighten the other end of the fluid hose (19) into the relief valve (18).



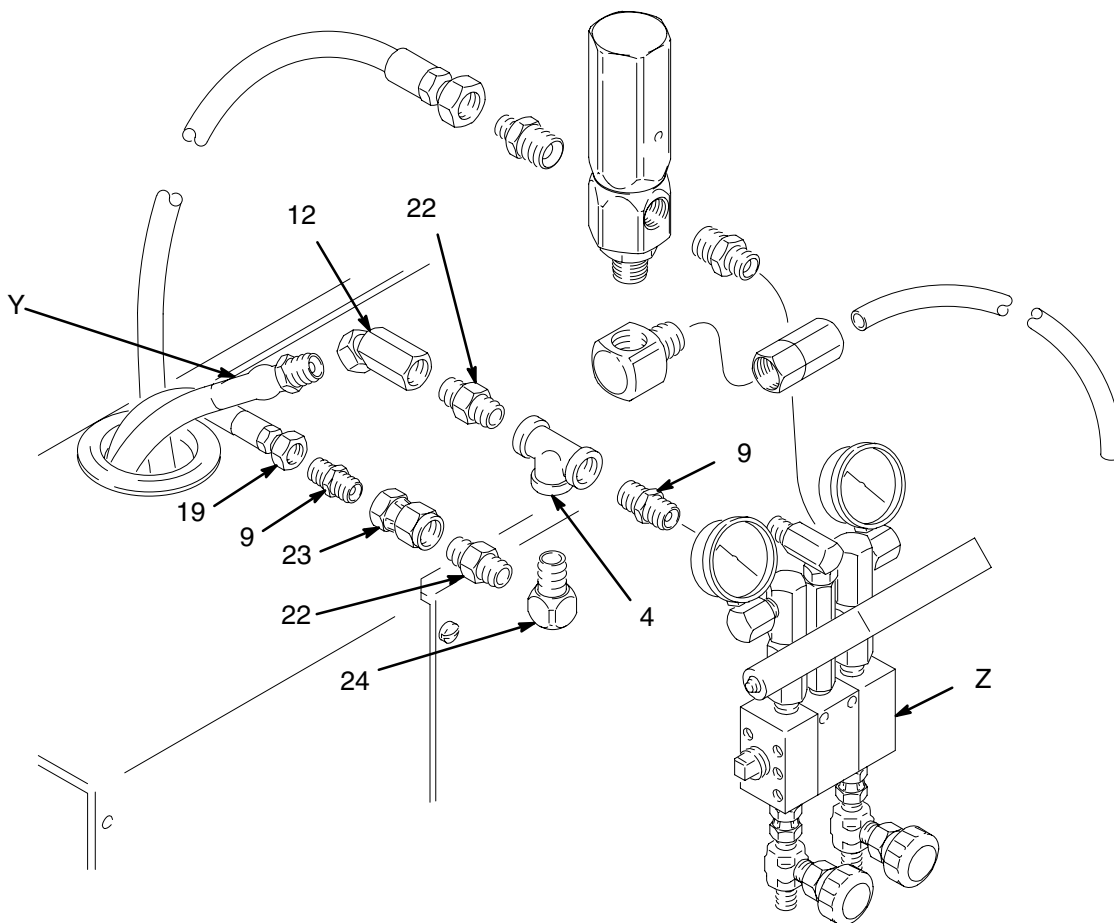
△1 Torque to 60 ft-lb (81 N·m)

△2 Torque to 35 in-lb (4 N·m)

△3 Apply Loctite®

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Fig. 1



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Fig. 2

Parts List

Ref No.	Part No.	Description	Qty	Ref No.	Part No.	Description	Qty
1	100103	COTTER PIN; 1/8 dia x 1-1/2	1	19	H53806	HOSE, nylon; 3/8 (10 mm) ID; 3/8 npsm(fbe); 6 ft (1.8 m) long	1
2	100155	LOCKNUT, hex; 5/8-18	1	20	102969	LOCTITE®	1
3	100509	PLUG, pipe; 1/4 npt	1	21	102281	BUSHING, pipe; 3/4 npt x 3/8 npt(fbe)	1
4	105690	TEE, pipe; 3/8 npt	1	22	501684	VALVE, check; 3/8 npt(mbe)	2
5	105751	BEARING	1	23	156173	UNION, swivel; 3/8 npt x 3/8 npsm	1
6	105761	CAPSCREW, hex; 1/2-13 x 1-34	1	24	155699	ELBOW, street; 3/8 npt(m x f)	1
7	105762	SETSCREW; 10-32	1	25	158491	NIPPLE, pipe; 1/2 npt	1
8	161037	UNION, 90°; 1/2 npte x 3/4 npti	1	26	113187	CONNECTOR, female; tube	1
9	156849	NIPPLE, pipe; 3/8 npt	3	27	190738	TUBE, nylon	1
10	157785	UNION, swivel; 3/4 npt x 3/4 npsm	1				
11	159239	NIPPLE, pipe; 1/2 npt x 3/8 npt	1				
12	207411	UNION, 45°; 3/8 npsm(fbe) swivel	1				
13	177089	CLAMP	1				
14	177099	CLAMP, ratio index	1				
15	177100	SUPPORT, pin	1				
16	177101	MANIFOLD, pump inlet	1				
17	177106	PIN	1				
18		VALVE, relief; user's choice; See 308547 for parts; see Relief Valve Selection Table on page 4 for selection	1				

To order replacement parts,
see **TO PLACE AN ORDER**, back cover.

GRACO GEAR REDUCING OIL 204559
8 oz., for lubricating the bearings and pins.

Operation

Understanding the terms used with the Variable Ratio Hydra-Cat® (VHRC) system, how it functions, and how to find and set the correct ratio(s) for your application, is the key to easier, more versatile operation of your system.

Be sure to read and understand the following information and the instructions in your component manuals before operating the equipment.

Terms

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

The primary pump (AA) is the pump directly under the air motor; it usually pumps the base (polyol). The secondary pump (BB) is on the opposite end of the lever arm; it usually pumps the catalyst (hardener). More than one secondary pump may be used: one for pumping catalyst and the other for reducer (solvent) injection. If two secondary pumps are used, then two ratios exist. The ratio of the secondary pump(s) can be changed by adjusting the ratio index clamp (CC). See Fig 3.

There are three main areas of concern when applying the use of ratios: (1) determining the ratio required, (2) calculating the ratio setting, and (3) setting the ratio on the VHRC System.

Determine the Ratio

If you are using one primary and one secondary pump and the fluids are supplied at a ready-to-spray viscosity, simply set the ratio as instructed in your VHRC System Manual; Manual 307428 for the President VHRC System or 307399 for the Monark VHRC System.

If you are using one primary and one secondary pump and the fluids are not supplied at a ready-to-spray viscosity, the ratio must be determined after the reducer is added to the base, as instructed in Procedure 1.

If you are using two secondary pumps, one for pumping the catalyst and one for reducer injection, deter-

mine the ratio, as instructed in Procedure 2 if the mixing instructions say to reduce the base by a certain number of parts reducer, or as in Procedure 3 if the instructions say to reduce the base by a percentage.

- NOTES:**
1. Evaporation of the solvent in the base causes changes in the ratio. To prevent evaporation, store the base in closed containers.
 2. Some solvents have very little ability to lubricate and may cause seals to dry out. To prolong seal life, be sure your pump seals are compatible with the base's solvent. Contact your Graco representative for the correct seals to use.

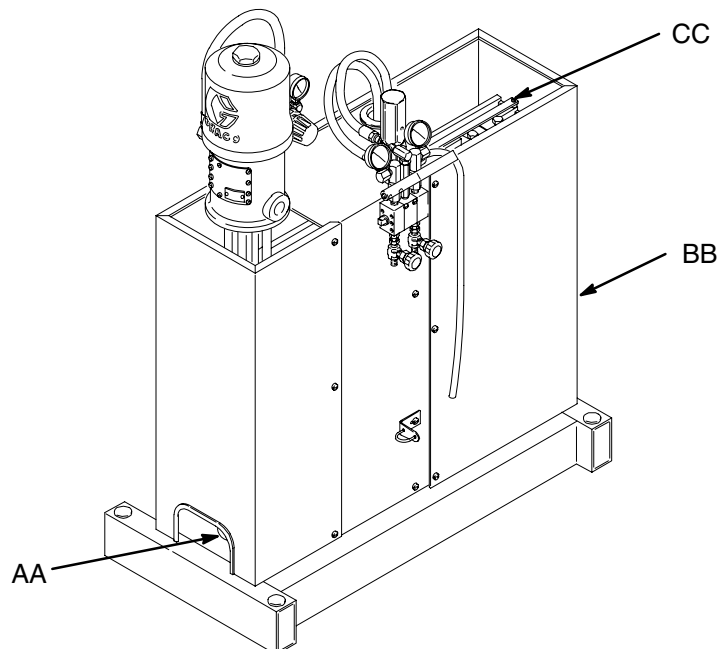


Fig. 3

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Procedure 1: Base is Pre-reduced

When reducer is added to the base before proportionating with the VHRC System, determine the ratio of the combined base/reducer mixture to the catalyst in order to set the secondary pump at the correct position.

In this example:

The instructions on the can are: Mix 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.
$$\begin{array}{r} 5 \text{ parts base} \\ + 1 \text{ part catalyst} \\ \hline 6 \text{ parts mixture} \end{array}$$
2. The next instruction on the can is: Reduce 3 parts of the mixture. So divide the parts of the mixture by 3 parts to reduce to find the parts reducer.
$$\begin{array}{r} 6 \text{ parts mixture} \\ \div 3 \text{ parts to reduce} \\ \hline 2 \text{ parts reducer} \end{array}$$
3. To determine the ratio of the secondary pump, add the appropriate parts of base and reducer to find the parts combined base/reducer.
$$\begin{array}{r} 5 \text{ parts base} \\ + 2 \text{ parts reducer} \\ \hline 7 \text{ parts combined base/reducer to 1 part catalyst} \end{array}$$

The ratio of the secondary pump is 7:1.

Procedure 2: Reducer Injection by a Third Displacement Pump

Using the same can instructions as in Procedure 1, you know that you need:

5 parts base
2 parts reducer (refer to Procedure 1, step 2)
1 part catalyst

1. Treat each secondary pump as a separate assembly. The ratio of base to catalyst is 5:1, so set the catalyst pump for a 5:1 ratio.
2. The ratio of base reducer is 5:2. But, since the number on the right side of the ratio must always be one, divide the base proportion by the reducer proportion.

$$\begin{array}{r} 5 \text{ base proportion} \\ \div 2 \text{ reducer proportion} \\ \hline 2.5 \text{ parts base} \end{array}$$

The ratio of base to reducer is 2.5:1, so set the reducer pump for a 2.5:1 ratio.

Procedure 3: Reducer Injection by a Third Displacement Pump

Use this procedure if the mixing instructions say to reduce the base by a percentage:

In this example:

The instructions on the can are: Mix 6 parts base to 1 part catalyst; reduce the base 20%.

1. Treat each secondary pump as a separate assembly. The ratio of base to catalyst is 6:1, so set the catalyst pump for a 6:1 ratio.
2. Convert the percentage to a fraction. 20% equals $\frac{1}{5}$ or a ratio of 5:1.

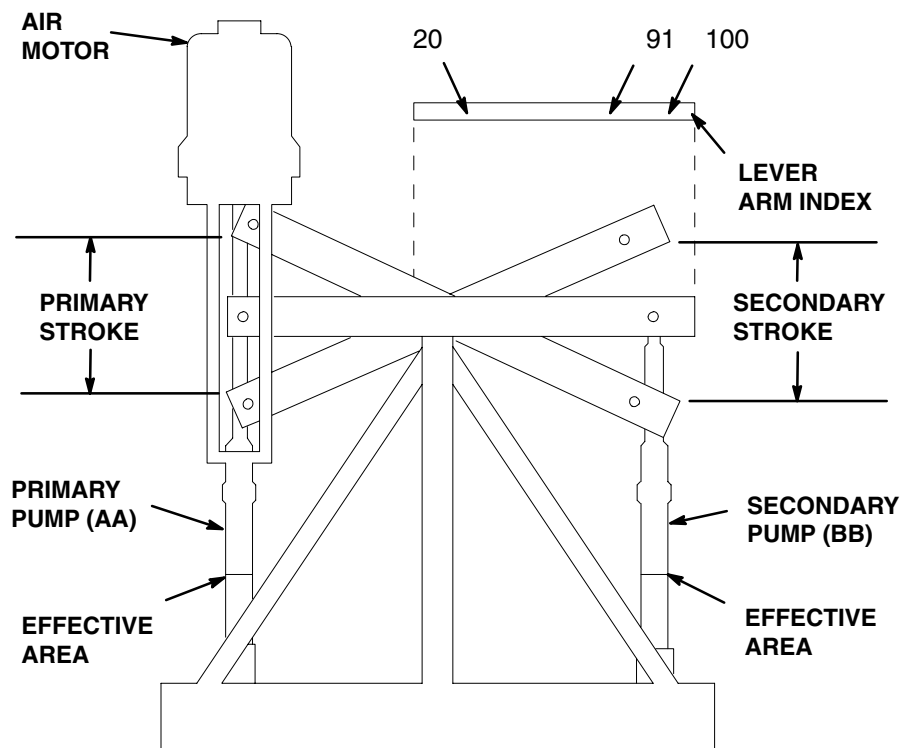
The ratio of base to reducer is 5:1, so set the reducer pump for a 5:1 ratio.

Relief Valve Selection Table

To select the appropriate relief valve:

1. Determine the Maximum Pump Fluid Pressure of your system.
2. Verify that all system components meet or exceed the pressure ratings of the pressure relief valve that you have selected.
3. Select the lowest pressure relief valve with a maximum working pressure that exceeds the Maximum Pump Fluid Pressure.

Part Number	Working Pressure Range psi (bar)		Cracking Pressure Range psi (bar)	
	Minimum	Maximum	Minimum	Maximum
237060	475 (33)	575 (40)	710 (49)	860 (59)
237061	950 (66)	1150 (79)	1425 (98)	1725 (119)
237112	1400 (97)	1800 (124)	2140 (148)	2590 (179)
237062	1800 (124)	2300 (159)	2850 (197)	3450 (238)
237073	2300 (159)	2900 (200)	3560 (245)	4310 (297)
237063	2900 (200)	3600 (248)	4275 (295)	5175 (357)
237074	3600 (248)	5000 (345)	5700 (393)	6900 (476)



Relationship Between Primary Pump and Secondary Pump

Moving the secondary pump closer to the primary pump (to a lower index setting) reduces the secondary stroke length, reducing its fluid output. Moving the secondary pump farther from the primary pump (to a higher index setting) increases the secondary stroke length, increasing its fluid output.

02368

Fig. 4

PUMP SPECIFICATIONS CHART			
Pump	Effective Area	Max. Stroke	Secondary Conn. Rod
222019	0.277	4.75"	177113
221026	0.278	4.0"	177116
222017	0.370	4.75"	177113
222015	0.443	4.75"	177113
221074	0.470	4.25"	177115
222012	0.554	4.75"	177113
215930	0.884	4.4"	177115
215932	1.478	4.25"	177114

To set the secondary pump on a standard VHRC System with only two pumps, see the instructions on setting the ratio in your VHRC System manual, 307428 for the President VHRC System or 307399 for the Mo-nark VHRC System.

To set the secondary pump on a non-standard VHRC System or for an additional secondary pump, use the following method to calculate the ratio setting.

NOTE: The 91 index setting provides equal primary and secondary pump stroke lengths. 100 is 1.1 times the primary pump stroke, allowing adjustability on both sides of the nominal ratio setting of 91.

If the same primary and secondary pump models are used, a 91 setting will give a 1:1 ratio. If different pump models are used, you must know the pump's effective area to determine the setting. The displacement pump's effective areas are listed in the Pump Specifications Chart .

Calculate the Ratio Setting

In this example,

- A 5:1 ratio of base to catalyst is required.
- A 3:1 ratio of base to solvent is required.
- The base/primary pump Model is 221074; its effective area is 0.470.
- The catalyst/secondary pump Model is 221026; its effective area is 0.278.
- The solvent/secondary pump Model is 221026; its effective area is 0.278.

1. To determine the **base to catalyst setting**.

- a. Multiply the primary pump's effective area by 91 (nominal ratio setting).

$$\begin{array}{r} 0.47 \text{ primary pump's effective area} \\ \times 91 \text{ nominal ratio setting} \\ \hline 42.77 \text{ answer a} \end{array}$$

- b. Multiply the catalyst pump's effective area by the ratio required.

$$\begin{array}{r} 0.278 \text{ catalyst pump's effective area} \\ \times 5 \text{ ratio required} \\ \hline 1.39 \text{ answer b} \end{array}$$

- c. Divide answer a by answer b to determine the index setting.

$$\begin{array}{r} 42.77 \text{ answer a} \\ \div 1.39 \text{ answer b} \\ \hline 30.8 \text{ catalyst pump index setting} \end{array}$$

2. To determine the **base to solvent setting**.

- a. Multiply the primary pump's effective area by 91 (nominal ratio setting).

$$\begin{array}{r} 0.47 \text{ primary pump's effective area} \\ \times 91 \text{ nominal ratio setting} \\ \hline 42.77 \text{ answer a} \end{array}$$

- b. Multiply the reducer pump's effective area by the ratio required.

$$\begin{array}{r} 0.278 \text{ catalyst pump's effective area} \\ \times 3 \text{ ratio required} \\ \hline 0.834 \text{ answer c} \end{array}$$

- c. Divide answer a by answer c to determine the index setting..

$$42.77 \text{ answer a}$$

$$\div 0.834 \text{ answer c}$$

$$51.3 \text{ reducer pump index setting}$$

3. Make sure that the index setting does not exceed the secondary pumps' maximum stroke length:

- a. Multiply the index setting by 0.044 (a constant number).

$$\begin{array}{r} 30.8 \text{ catalyst pump index setting} \\ \times 0.044 \text{ constant} \\ \hline 1.355 \text{ catalyst pump stroke length} \end{array}$$

$$\begin{array}{r} 51.3 \text{ reducer pump index setting} \\ \times 0.044 \text{ constant} \\ \hline 2.257 \text{ reducer pump stroke length} \end{array}$$

- b. See the **Pump Specifications Chart** on page 7 for the pump's maximum stroke length. Do not use an index setting which will exceed the maximum stroke length for your pump model.

4. To make sure that the index setting does not go below the secondary pump's minimum ratio setting, see the Ratio Setting Charts in your VHRC System Manual, 307428 for the President VHRC System or 307399 for the Monark VHRC System.

5. These numbers (1.355 and 2.257, found in step 3a; above). do not exceed the pump's maximum stroke or go below the minimum ratio setting, so set the catalyst pump at the 30.8 index setting and the solvent pump at the 51.3 index setting.

SET THE SECONDARY PUMP(S)

To set the secondary pump(s) see the instructions on setting the pump in your VHRC System Manual, 307428 for the President VHRC System or 307399 for the Monark VHRC System.

Graco Information

TO PLACE AN ORDER, contact your Graco distributor, or call one of the following numbers to identify the distributor closest to you:

1-800-328-0211 Toll Free

612-623-6921

612-378-3505 Fax

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