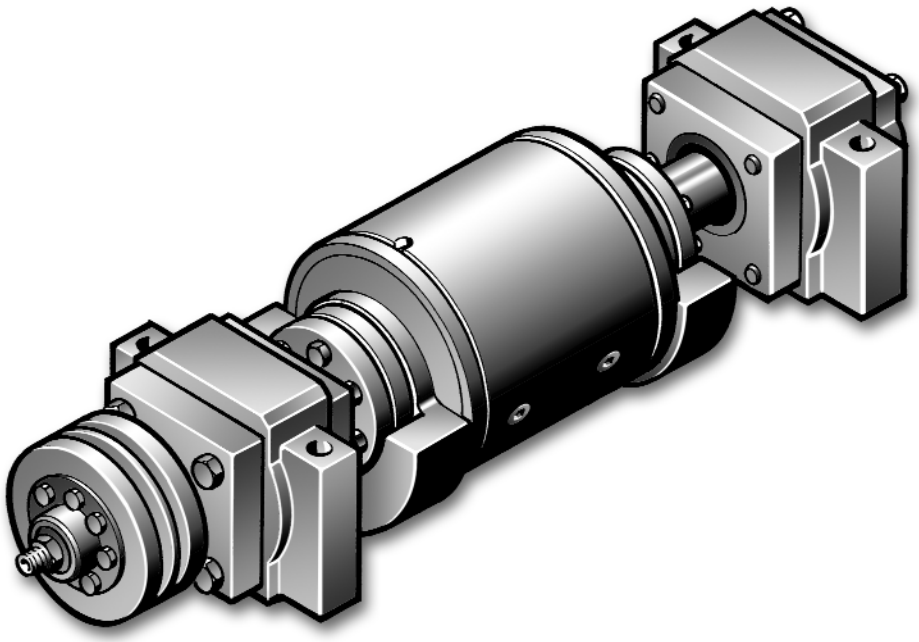
ISO 9001 CERTIFIED

502-SP-002-04

SERVICE MANUAL
AND
REPAIR PARTS
FOR
AFC SmartPac®
Series II (Model PV2-98)
VIBRATOR SHAFT



MANUFACTURED FOR:

BESSER

BESSER COMPANY

MANUFACTURED BY:

FORCE CONTROL®

FORCE CONTROL INDUSTRIES, INC.

WARNING - Read this manual before any installation, maintenance and operation.

MANUFACTURERS OF MECHANICAL AND ELECTRICAL POWER TRANSMISSION EQUIPMENT

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Force Control Industries, Inc. ("Force Control") warrants its products to be free from defects in material and workmanship under normal and proper use for a period of one year from the date of shipment. Any products purchased from Force Control that upon inspection at Force Control's factory prove to be defective as a result of normal use during the one year period will be repaired or replaced (at Force Controls' option) without any charge for parts or labor. This limited warranty shall be void in regard to (1) any product or part thereof which has been altered or repaired by a buyer without Force Control's previous written consent or (2) any product or part thereof that has been subjected to unusual electrical, physical or mechanical stress, or upon which the original identification marks have been removed or altered. Transportation charges for shipping any product or part thereof that the buyer claims is covered by this limited warranty shall be paid by the buyer. If Force Control determines that any product or part thereof should be repaired or replaced under the terms of this limited warranty it will pay for shipping the repaired or replaced product or part thereof back to the buyer. EXCEPT FOR THE EXPRESS WARRANTY SET OUT ABOVE, FORCE CONTROL DOES NOT GRANT ANY WARRANTIES EITHER EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE. The warranty obligation set forth above is in lieu of all obligations or liabilities of Force Control for any damages. Force Control specifically shall not be liable for any costs incurred by the buyer in disconnecting or reinstalling any product or part thereof repaired or replace under the limited warranty set out above. FORCE CONTROL EXPRESSLY EXCLUDES ALL LIABILITY FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES THE BUYER MAY SUSTAIN IN CONNECTION WITH THE DELIVERY, USE, OR PERFORMANCE OF FORCE CONTROL PRODUCTS. Under no circumstances shall any liability for which Force Control is held responsible exceed the selling price to the buyer of the Force Control products that are proven to be defective. This limited warranty may be modified only in writing signed by a duly authorized officer of the company. This limited warranty applies exclusively to Force Control products; warranties for motors and gear reducers and other component parts may be provided by their respective manufactures. Any legal action for breach of any Force Control warranty must be commenced within one year of the date on which the breach is or should have been discovered.

A Return Goods Authorization (RGA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. Force Control will pay the shipping costs of returning the owner parts that are covered by warranty.

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Section 1 - DESCRIPTION AND OPERATION

1-1 AFC *SmartPac* VIBRATION SYSTEM

The versatility of your **Besser concrete products** machine is enhanced with the addition of **AFC *SmartPac* Vibration**. By employing truly independent amplitude and frequency control, vibration is tuneable to specific molds and requirements.The ability to control both amplitude and frequency results in more compaction and quicker finish times than can be obtained with conventional vibration systems. For example, when producing paving stone, low amplitude is used during feed time and high amplitude is utilized during finish time.

AFC *SmartPac's* Vibration results in variable mold displacement allowing the operator to obtain optimum feed and finish times for a given mold which contributes to the high production rates achieved by **Besser concrete product systems.** Variable displacement is proven to be advantageous over fixed displacement types of vibration in terms of production rate, versatility and most importantly producing high quality concrete masonry units.

Vibration is adjustable and can be engaged or disengaged multiple times within the machine cycle***. "On the Fly"*** adjustment is possible because the motors are running continuously.

The production versatility of the concrete products machine is further enhanced because an operator can tune in (induce) or tune out horizontal vibration using the frequency controls on each 10 HP motor. Small components of horizontal vibration have proven beneficial when producing hard to fill unit shapes.

Figure 1.1 shows the **AFC *SmartPac* Series II (Model PV2-98) Vibrator Shafts** on a typical Universal Half High Mold set-up to produce (3) 7-5/8" wide x 3-5/8" high x 15-5/8" long units.

1-2 BENEFITS TO THE AFC *SmartPac* VIBRATION SYSTEM

- Longer mold life than with conventional vibration.
- Independent feed and finish vibration settings.
- Amplitude and frequency can be adjusted from the control panel during the machine cycle.
- Settings can be stored for instant recall on future production runs.
- Reduces vibrator motor maintenance.

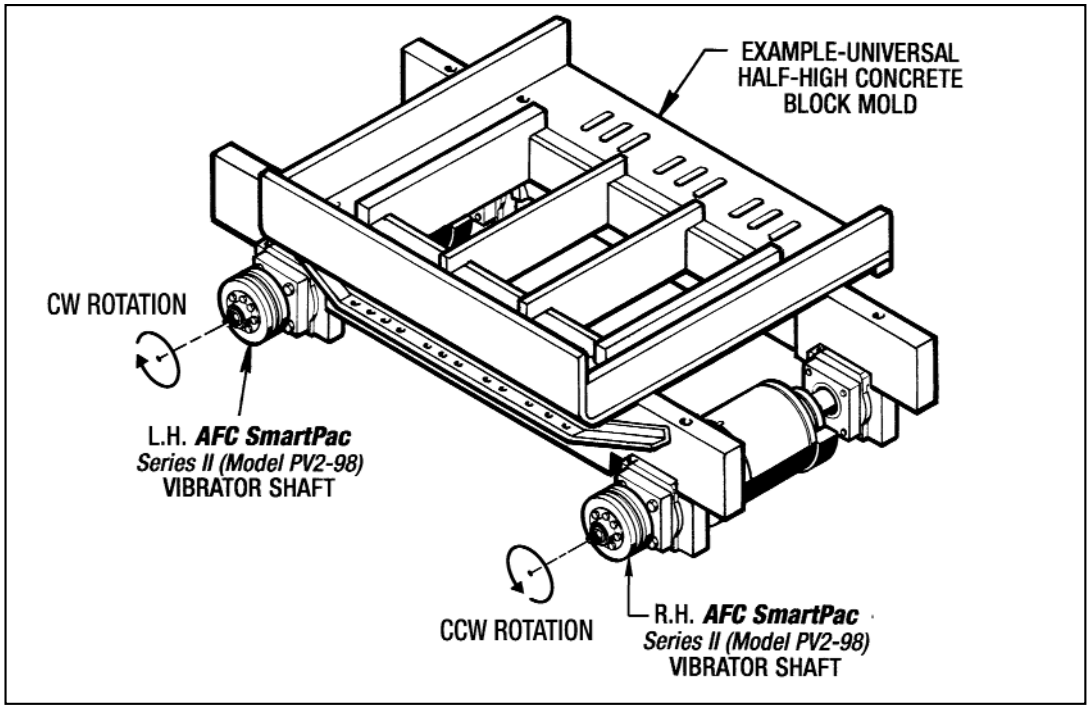


Figure 1.1 - Typical AFC SmartPac Application

True Production Versatility featuring Independent Amplitude and Frequency Control

1-3 *SmartPac* VIBRATOR SHAFT OPERATION

(See Figure 1.2)

The AFC *SmartPac* Vibration System provides vibration to masonry product machines.

Control of the AFC *SmartPac* Vibration System maybe adjusted in two ways:

(1) The Frequency of Vibration is adjusted by two AC Variable Frequency Controllers through a range of 2500 to 2900 RPM shaft speed. Shaft speeds in excess of 2900 RPM may result in premature vibrator shaft bearing failure.

(2) The Vibration Force (Amplitude) is determined by the volume of fluid that is metered into each shaft. The volume of fluid delivered to each shaft determines the amount of internal counterweight rotation, which controls the shaft imbalance. The shaft is returned to a balanced state by an internal Spring (#32) when fluid pressure is relieved.

When fluid pressure is applied and a volume of fluid enters the shaft, the Piston (#34) moves in an axial direction. The spring force is overcome. The Bearing Pin (#18) and (3) Cam Follower Bearings (#14), attached to the Piston (#34) rotates in the Cam Slot in the Counterweight (#16). The greater the piston stroke, the greater the rotation of the Counterweight (#16) is. Resulting in a greater imbalance and **Vibration Force.** As a result, controlling the volume of fluid entering the shaft controls the **Vibration Force (Amplitude)**.

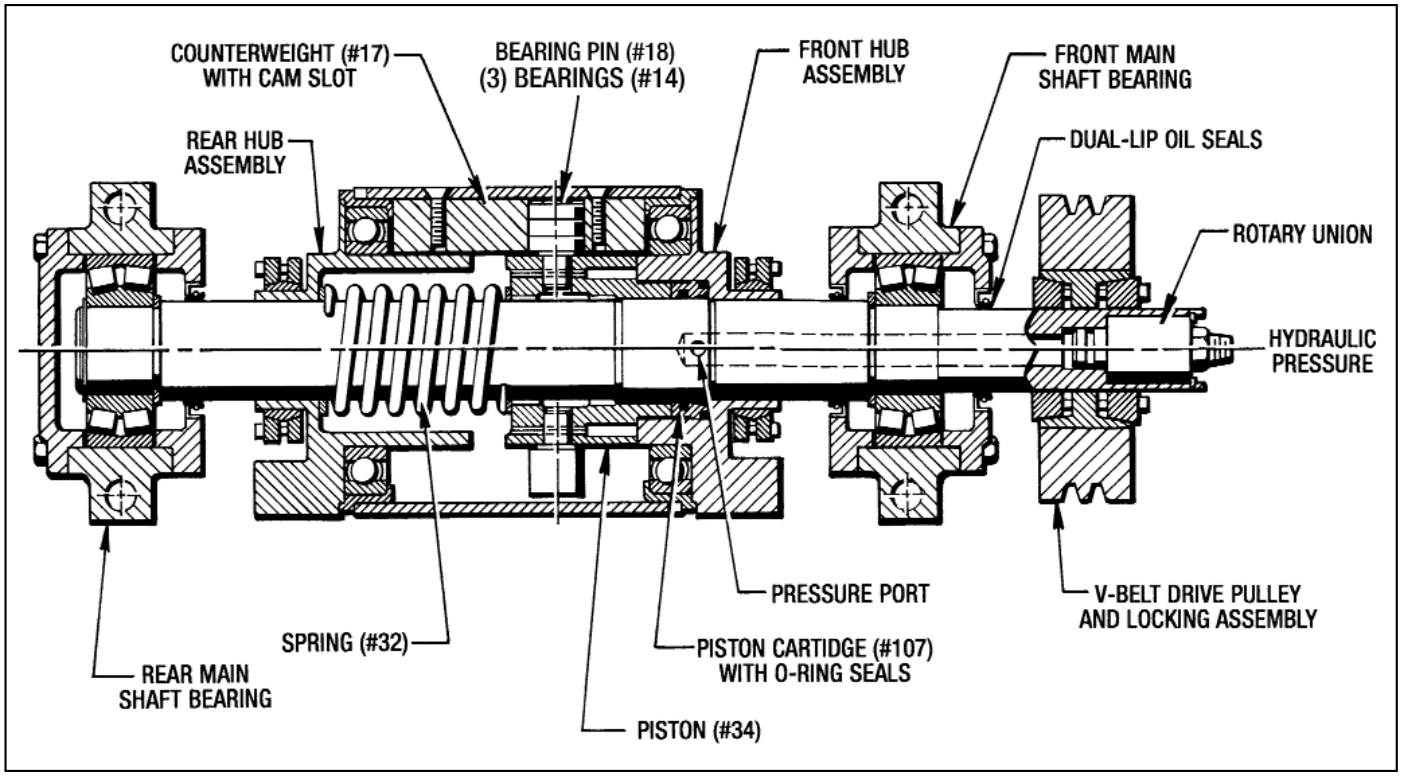
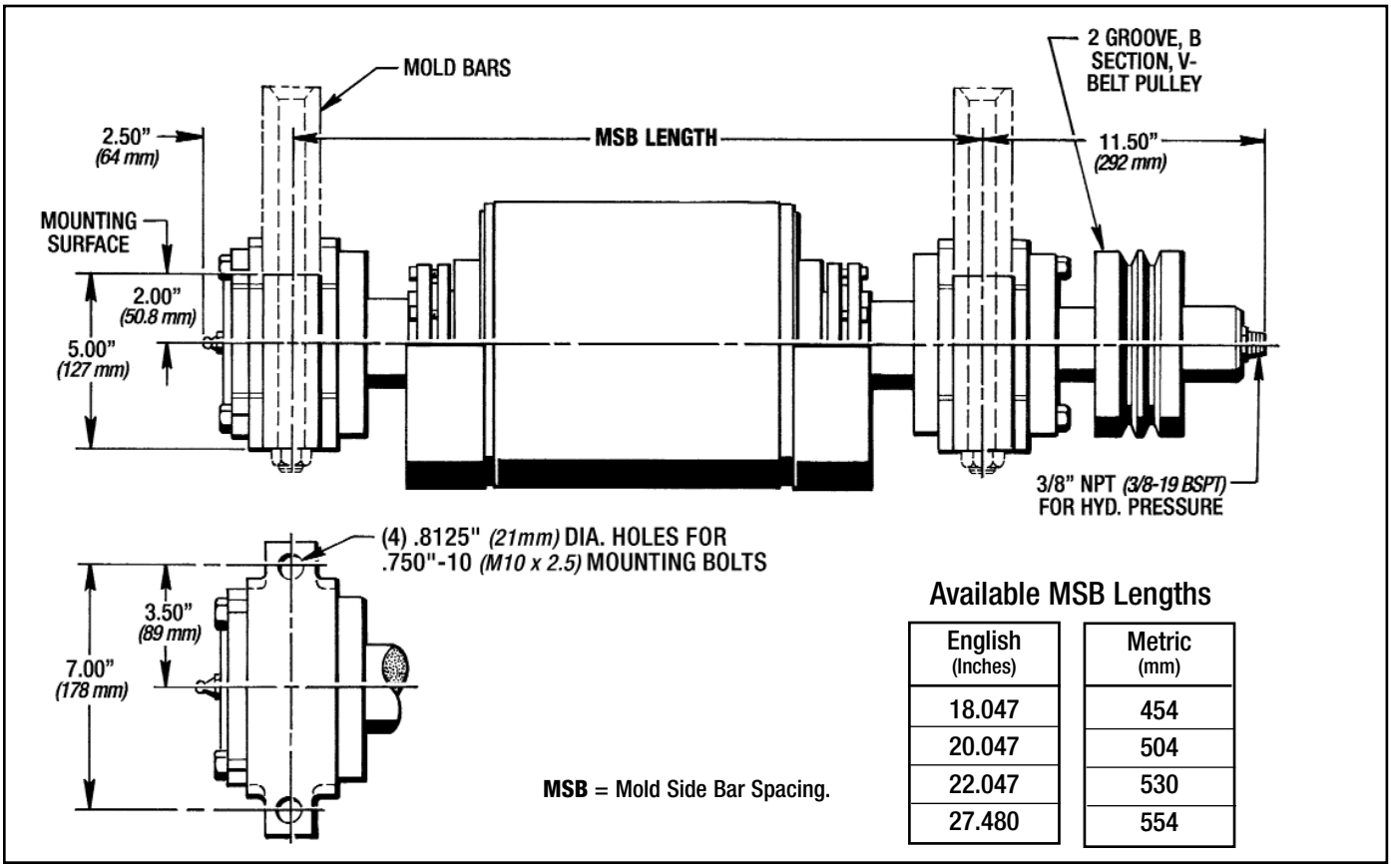


Figure 1.2 - Cross Section thru SmartPac Vibrator Shaft

Section 2 - SPECIFICATIONS

2-1 *SmartPac* SHAFT DIMENSIONAL SPECIFICATIONS



Available MSB Lengths

English (Inches)	Metric (mm)
18.047	454
20.047	504
22.047	530
27.480	554

Figure 2.1 - SmartPac Dimensions

2-2 MACHINE TECHNICAL SPECIFICATIONS

Voltage: All available, including industrial voltages.

Frequency: 50/60 Hz.

Horsepower: Two 10 HP motors (7.5 kW)

Shaft Amplitude: Programmable and variable Fixed at 11,000 lbs. (49 kN), 13,000 lbs. (58 kN) and 15,000 lbs. (67 kN) for each shaft @ **2900 RPM**.

Shaft Speed (Frequency): Programmable and variable 2500 to 2900 rpm. Shaft speed in excess of 2900 RPM may result in premature vibrator shaft bearing failure.

2-3 CONTROL SPECIFICATIONS

Electrical Control: 110 VAC 50/60 Hz.

Fluid Pressure: 300-600 PSI (20-40 Bar)

Air Control: 5 cfm (.14M^3/minute) at 80 PSI for 10 cycles/minute.

Speed Control: Analog controlled frequency drives.

Method of Weight Shift: Internally activated air over hydraulic.

2-4 MECHANICAL SPECIFICATIONS

Straight bore bearings, synthetic lubrication same as standard bearings.

A Besser set of parts is available with all parts required to change V3-12 Vibrapac through V6-12 Superpac concrete products machines, from standard or Bescodyne vibration to the **AFC *SmartPac* System.**

2-5 VIBRATOR SHAFT ORIENTATION

The front of the shaft is the hollow end where the rotary union is located. The rear of the shaft is the solid end. These terms are used in the procedure steps. *(See Figure 2.2)*

The *SmartPac* units are color coded as follows:

- 11,000 lb units – Yellow
- 13,000 lb units – Green
- 15,000 lb units – Red

2-6 PART IDENTIFICATION IN PROCEDURE STEPS

Refer to the figure illustration given in a procedure step and to the master exploded view illustrations in Section 8 to help identify a part. Within a procedure step, the item number of the part within parentheses references a part. For example, if you see "(#37)" in a procedure step, look for call out number 37 in the Parts List for part identification.

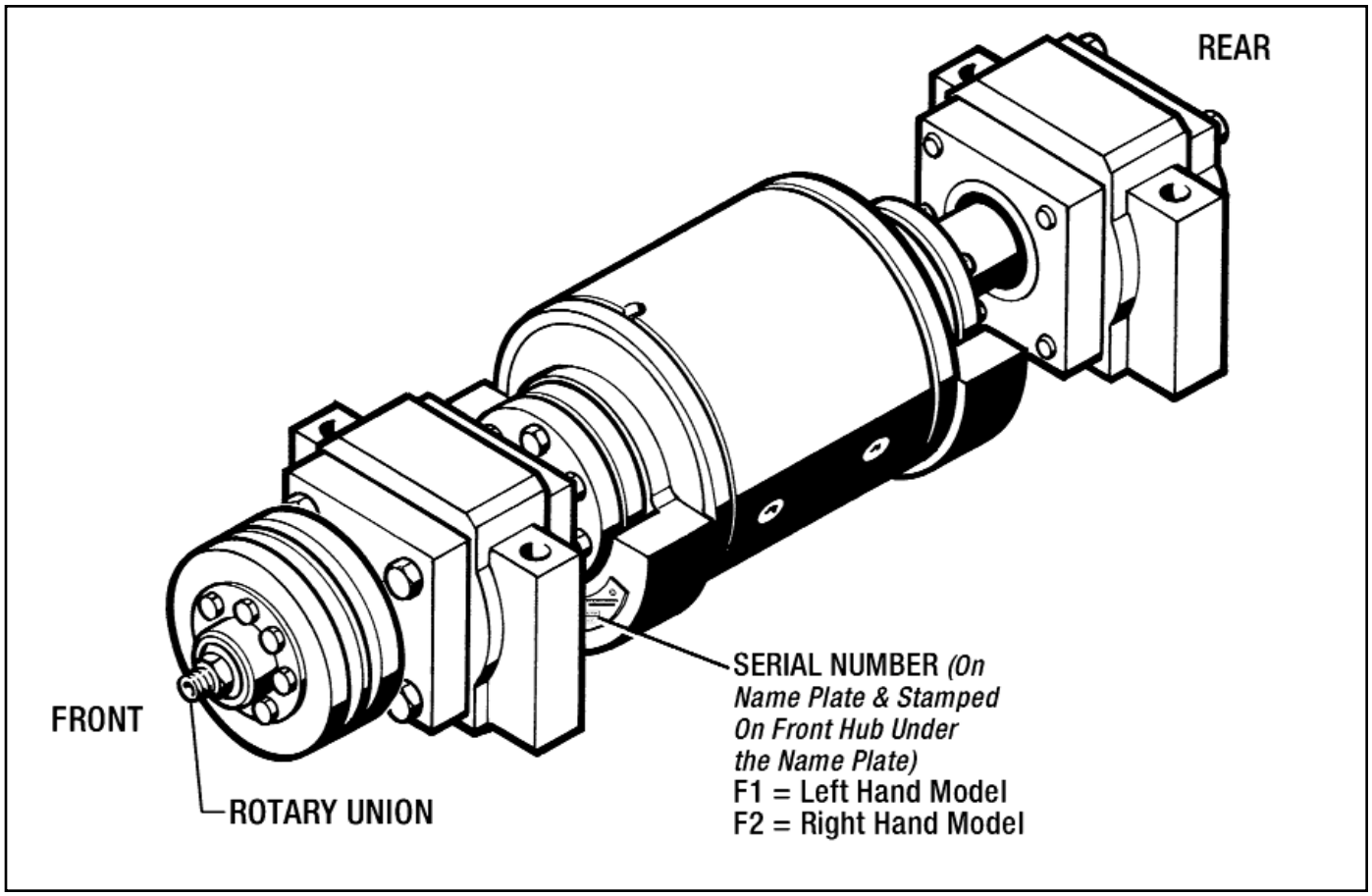


Figure 2.2 - SmartPac Vibrator Assembly Orientation

AFC Smart Pac Series II
Besser Shaft Assembly Part Numbers

MSB CENTER DISTANCE	LEFT HAND SHAFT				RIGHT HAND SHAFT			
	FORCE CONTROL PART No.	NEW SHAFT WITH MSB WITH S.O.P.	NEW SHAFT WITH MSB W/O S.O.P.	RAPID EXCH. WITH MSB W/O S.O.P	FORCE CONTROL PART No.	NEW SHAFT WITH MSB WITH S.O.P.	NEW SHAFT WITH MSB W/O S.O.P.	RAPID EXCH. WITH MSB W/O S.O.P.
11,000 lb. ASSEMBLIES								
18.047”	SP11L18	477685 F1800		477685 F18EX	SP11R18	477686 F1800		477686 F18EX
20.047”	SP11L20	477685 F2000		477685 F20EX	SP11R20	477686 F2000		477686 F20EX
22.047”	SP11L22	477685 F2200		477685 F22EX	SP11R22	477686 F2200		477686 F22EX
27.480”	SP11L27	477685 F2700		477685 F27EX	SP11R27	477686 F2700		477686 F27EX
454 mm	SP11L45	477685 F4500		477685 F45EX	SP11R45	477686 F4500		477686 F45EX
504 mm	SP11L50	477685 F5000		477685 F50EX	SP11R50	477686 F5000		477686 F50EX
530 mm	SP11L53	477685 F5300		477685 F53EX	SP11R53	477686 F5300		477686 F53EX
554 mm	SP11L55	477685 F5500		477685 F55EX	SP11R55	477686 F5500		477686 F55EX
13,000 lb. ASSEMBLIES								
18.047”	SP13L18	480503 F1800		480503 F18EX	SP13R18	480504 F1800		480504 F18EX
20.047”	SP13L20	480503 F2000		480503 F20EX	SP13R20	480504 F2000		480504 F20EX
22.047”	SP13L22	480503 F2200		480503 F22EX	SP13R22	480504 F2200		480504 F22EX
27.480”	SP13L27	480503 F2700		480503 F27EX	SP13R27	480504 F2700		480504 F27EX
454 mm	SP13L45	480503 F4500		480503 F45EX	SP13R45	480504 F4500		480504 F45EX
504 mm	SP13L50	480503 F5000		480503 F50EX	SP13R50	480504 F5000		480504 F50EX
530 mm	SP13L53	480503 F5300		480503 F53EX	SP13R53	480504 F5300		480504 F53EX
554 mm	SP13L55	480503 F5500		480503 F55EX	SP13R55	480504 F5500		480504 F55EX
15,000 lb. ASSEMBLIES								
18.047”	SP15L18	480501 F1800		480501 F18EX	SP15R18	480502 F1800		480502 F18EX
20.047”	SP15L20	480501 F2000		480501 F20EX	SP15R20	480502 F2000		480502 F20EX
22.047”	SP15L22	480501 F2200		480501 F22EX	SP15R22	480502 F2200		480502 F22EX
27.480”	SP15L27	480501 F2700		480501 F27EX	SP15R27	480502 F2700		480502 F27EX
454 mm	SP15L45	480501 F4500		480501 F45EX	SP15R45	480502 F4500		480502 F45EX
504 mm	SP15L50	480501 F5000		480501 F50EX	SP15R50	480502 F5000		480502 F50EX
530 mm	SP15L53	480501 F5300		480501 F53EX	SP15R53	480502 F5300		480502 F53EX
554 mm	SP15L55	480501 F5500		480501 F55EX	SP15R55	480502 F5500		480502 F55EX

NOTES: S.O.P. refers to *Besser* Hardware Kit #646749 which includes Locking Assembly (#200), V-Belt Pulley (#201) and Hose Assembly (#202).
MSB refers to Main Shaft Bearings.

Section 3 - MACHINE SAFETY BULLETIN

This notice is issued to advise you that some previously accepted shop practices may not be keeping up with changing Federal and State Safety and Health Standards. Your current shop practices may not emphasize the need for proper precautions to insure safe operation and use of machines, tools, automatic loaders and allied equipment and/or warn against the use of certain solvents or other cleaning substances that are now considered unsafe or prohibited by law. Since many of your shop practices may not reflect current safety practices and procedures, particularly with regard to the safe operation of equipment, it is important that you review your practices to ensure compliance with Federal and State Safety and Health Standards.

3-1 MACHINE SAFETY PRECAUTIONS

IMPORTANT

The operation of any machine or power-operated device can be extremely hazardous unless proper safety precautions are strictly observed. Observe the following safety precautions:

- Always be sure proper guarding is in place for all pinch, catch, shear, crush and nip points.
- Always make sure that all personnel are clear of the equipment before starting it.
- Always be sure the equipment is properly grounded.
- Always turn the main electrical panel off and lock it out in accordance with published lock-out/tag-out procedures prior to making adjustments, repairs, and maintenance.
- Always wear appropriate protective equipment like safety glasses, safety shoes, hearing protection and hard hats.
- Always keep chemical and flammable material away from electrical or operating equipment.
- Always maintain a safe work area that is free from slipping and tripping hazards.
- Always be sure appropriate safety devices are used when providing maintenance and repairs to all equipment.
- Never exceed the rated capacity of a machine or tool.
- Never modify machinery in any way without prior written approval of the Besser Engineering Department.
- Never operate equipment unless proper maintenance has been regularly performed.
- Never operate any equipment if unusual or excessive noise or vibration occurs.
- Never operate any equipment while any part of the body is in the proximity of potentially hazardous areas.
- Never use any toxic flammable substance as a solvent cleaner.
- Never allow the operation or repair of equipment by untrained personnel.
- Never climb or stand on equipment when it is operational.

It is important that you review Federal and State Safety and Health Standards on a continual basis. All shop supervisors, maintenance personnel, machine operators, tool operators, and any other person involved in the setup, operation, maintenance, repair or adjustment of Besser-built equipment should read and understand this bulletin and Federal and State Safety and Health Standards on which this bulletin is based.

3-2 MACHINE SAFETY SIGNS

Sign	Machine Description	Required
1	All Panels	1
2	Mixer	4
3	Concrete Products Machine	1
	Depalleter	2
4	Mixer	2
5	Skiploader	4
6	Skiploader/Mixer Platforms	8
7	Skiploader/Mixer Platforms	8
8	Vertical: Pallet Transport System	2
	Horizontal: LSC-40A/LSC-100	6
	Pallet Transport System	4
9	Besser-Matic	4
10	Besser-Matic	4
11	Skiploader	4
12	All Panels	1
13	Overhead Block Transfer	4
14	Block Pusher	2
	Pallet Transfer System	4
15	Concrete Products Machine	2
16	Conveyors	12
17	Cuber	8
18	Cuber	3
	Block Turnovers	2
	Slat Conveyors	2

To order safety decals, contact your local Besser representative or the Besser Central Order Department.
Thank you!

WARNING:
The operation of any machine or power-operated device can be extremely hazardous unless you strictly observe the correct safety precautions. Make sure you observe the following safety precautions.

1

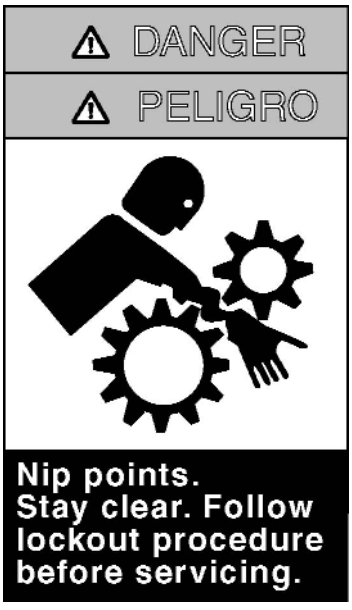
Large: 113236F0409
High Voltage
Width 4 1/2 inch
Height 9 5/8 inch
Small: 113236F0204
High Voltage
Width 2 inch
Height 4 1/8 inch

2

113237F0410
Mixer Blade Hazard
Width 4 1/2 inch
Height 10 1/4 inch

3

Vertical: 113240F0307
Crush Hazard
Width 3 1/2 inch
Height 7 1/2 inch
Horizontal: 113239F0604
Crush Hazard
Width 6 5/8 inch
Height 4 inch



4

114692F1006
Nip Points
Width 5 3/4 inch
Height 9 1/2 inch

5

114688F0906
Crush Hazard
Width 6 1/4 inch
Height 9 1/2 inch

6

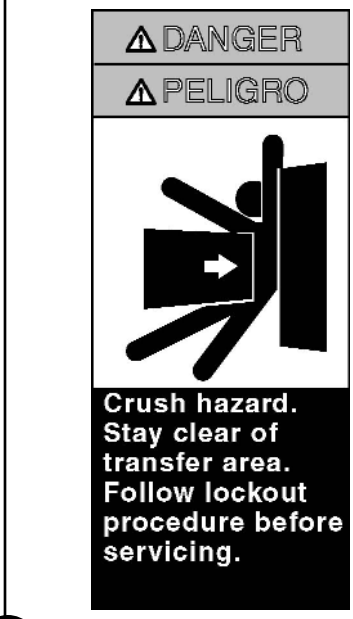
114689F0804
Fall Hazard
Width 4 1/2 inch
Height 7 3/4 inch

7

114690F0805
Falling Objects
Width 4 3/4 inch
Height 8 inch

8

Vertical: 113244F0410
Crush Hazard
Width 4 1/2 inch
Height 10 inch
Horizontal: 113245F1005
Crush Hazard
Width 10 inch
Height 5 3/4 inch



9

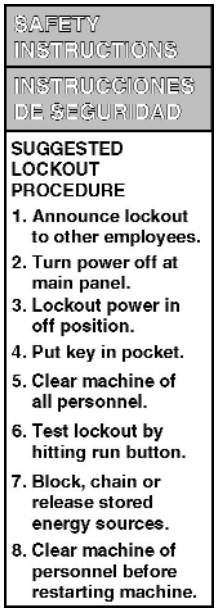
113242F0409
Crush Hazard
Width 4 1/2 inch
Height 9 5/8 inch

10

113243F0410
Falling Objects
Width 4 1/2 inch
Height 10 inch

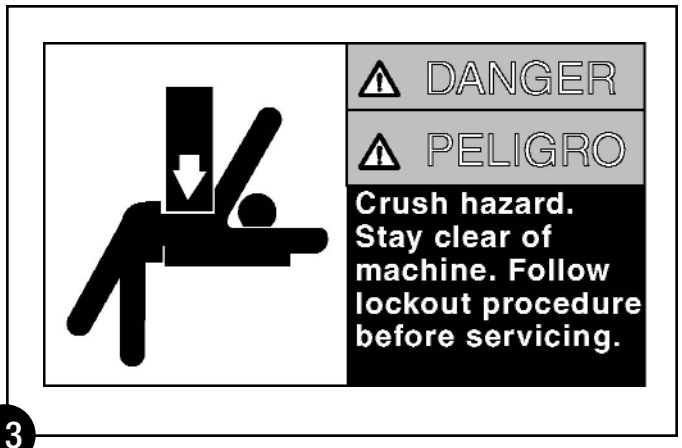
11

114691F1006
Shear and Fall Hazards
Width 5 3/4 inch
Height 9 3/4 inch



12

113249F0410
Safety Instructions Decal – Suggested Lockout Procedure
Width 4 inch
Height 10 inch

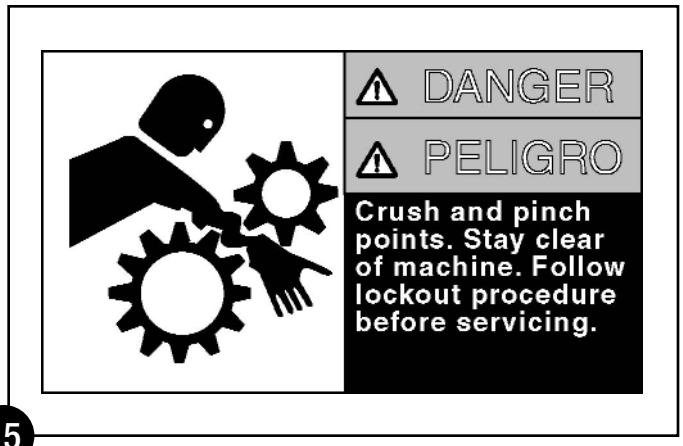


13

113238F1005
Crush Hazard
Width 10 inch
Height 5 3/4 inch

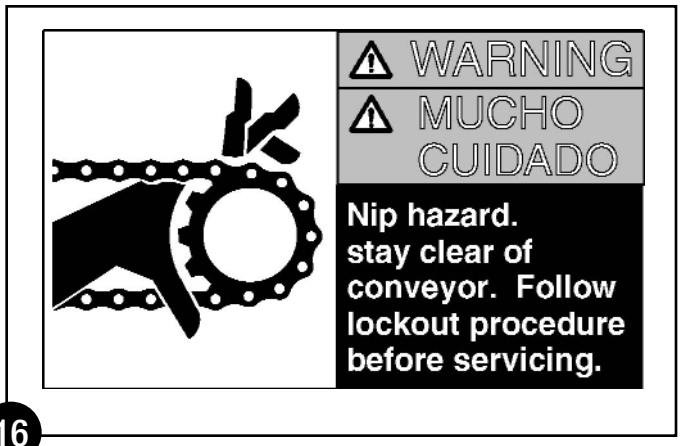
14

113248F1006
Crush Hazard
Width 10 inch
Height 6 inch



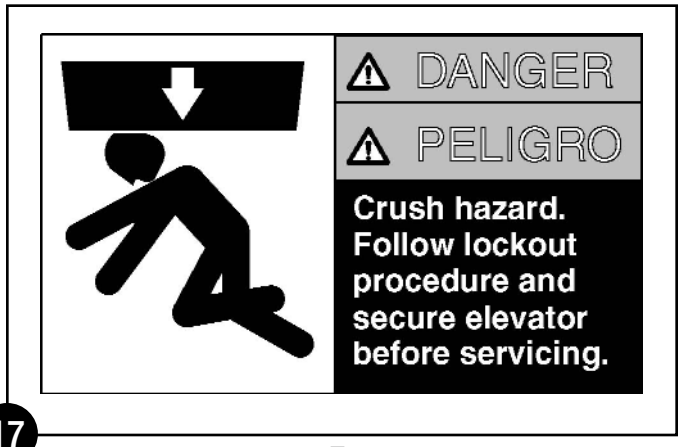
15

113241F0605
Crush and Pinch Points
Width 6 5/8 inch
Height 4 inch



16

113246F0704
Nip Hazard
Width 7 inch
Height 4 1/2 inch



17

113247F1006
Crush Hazard
Width 10 inch
Height 6 inch

18

113250F1006
Crush and Pinch Hazard
Width 10 inch
Height 6 inch

Section 4 - INSTALLATION

4-1 REMOVING *SmartPac* VIBRATOR SHAFTS

1. Place the Mold Box with the *SmartPac* Vibrator Shaft sets attached into the Roll-Over Fixture.
2. Roll the whole Fixture and Mold Box over to the inverted Installation Position.
3. Break loose and remove the (2) Vibrator Mounting Bolts and Hex Nuts from each Bearing Housing.
4. Insert a pry bar into each gap and pry the Front Main Bearing Housing and the Rear Main Bearing Housing loose from the Mold Bar notches as shown in *Figure 4.1.*

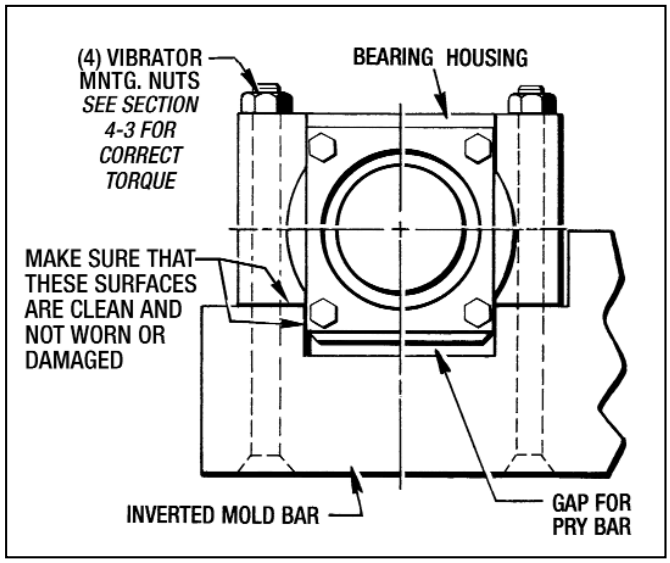


Figure 4.1 - Removing & Installing Vibrator Shafts

5. Lift and remove the *SmartPac* Vibrator Shaft Assembly with a soft sling and overhead hoist.

CAUTION - Never lift the *SmartPac* Vibrator Shafts by the Bearing Housings. This could damage the Oil Seals in the Bearing Housings.

4-2 INSTALL *SmartPac* VIBRATOR SHAFTS

1. Make sure the mold side bar pockets are clean and free from all concrete.
2. Set the new *SmartPac* vibrator shafts into position on the mold bars. You may have to use the pry bar in each gap to nudge the bearing housings down until they seat themselves completely into the mold bar notches. *See Figure 4.2.*

   NOTE - Don't forget that when the Mold Box is inverted the L.H. Shaft is on the right side and the R.H. Shaft is on the left side as shown in *Figure 4.2.*

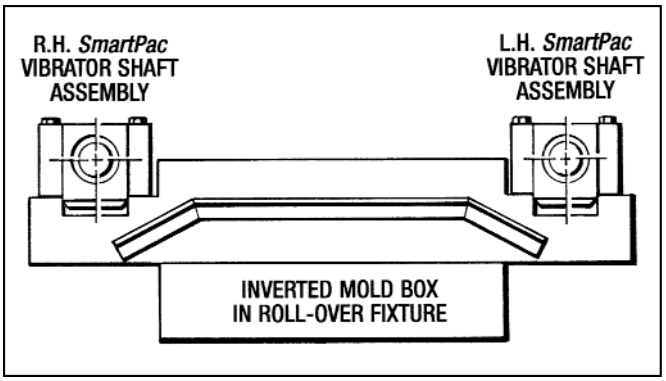


Figure 4.2 - Inverted Mold Box

3. After placing the vibrator housings in the mold side bars make sure the top of the housing does not come in contact with the mold side bar. This is critical to achieve the proper bolt torque.
4. Attach the bearing housings with the vibrator mounting bolts, washers and hex nuts to the mold side bars. Use a Hex Hd. Bolt/Flat Hd. Screw, Lock Washer and Hex Nut for Standard Mounting. Replace bolts with thread damage or thinning (necking). Do not apply lubrication to the threads of the fastener or nut. **See Section 4-3 for correct parts, Besser Part Numbers and required torque for Vibrator Mounting Bolts.**

CAUTION - As shown on page 14, NEVER install an older *SmartPac* Vibrator Shaft (Model PV1-91) with a newer *SmartPac* Series II (Model PV-2-98) Vibrator Shaft. Always install the same models of Vibrator Shafts together.

5. Make sure the shafts will rotate freely by hand prior to installation of the mold into the machine. Shafts not rotating freely may indicate a preload on the outer bearing race. Tap the housing with a brass hammer to relieve the preload on the bearings.
6. Clean paint off bearing housing before inserting into mold side bar.

   IMPORTANT - See Section 4-4 for an installation checklist. Failure to follow these installation instructions may cause the following:

   - Broken bearing housings
   - Broken mold side bars.
   - Egg shaped bolt holes in bearing housing
   - Premature bearing wear
   - Iratic vibration
   - Major damage to bearings and housings
   - Broken components inside the *SmartPac*

4-3 VIBRATOR SHAFT MOUNTING BOLT USAGE

Standard vibrator mounting bolts can only be used one time, then they must be replaced. If the bolts are not replaced when vibrators are changed they will fail and may cause damage to the vibrator assembly and the mold side bars.

After the bolts are torqued to yield the first time, the threads will stretch to a point where further reuse of the bolts will result in fatigue and cause it to break.

The following is a list of Standard Vibrator Shaft Bolts with Besser Part Numbers:

A. Standard Vibrator Mounting Bolts

National Course Thread

Besser Part No.	Part Description
AL-215652	Hex Hd. Bolt, 3/4” x 12” Lg.
AL-215653	Hex Hd. Bolt, 3/4” x 12-1/2” Lg.
AL-215654	Hex Hd. Bolt, 3/4” x 13” Lg.
AL-215655	Hex Hd. Bolt, 3/4” x 13-1/2” Lg
AL-215656	Hex Hd. Bolt, 3/4” x 14” Lg.
AL-227374	Hex Hd. Bolt, 3/4” x 14-1/2” Lg.
AL-244561	Hex Hd. Bolt, 3/4” x 15” Lg.
AL-397037	Hex Hd. Bolt, 3/4” x 15-1/2” Lg.
AL-109157	Hex Hd. Bolt, 3/4” x 16” Lg.
AL-087883	Lock Washer, Medium, 3/4”
AL-087808	Hex Nut, Heavy, 3/4” (Grade B)
AL-069368	Flat Hd. Slotted Bolt, 3/4” x 13” Lg.
AL-397343	Flat Hd. Slotted Bolt, 3/4” x 13-1/2” Lg.
AL-422738	Flat Hd. Slotted Bolt, 3/4” x 15” Lg.
AL-445610	Flat Hd. Slotted Bolt, 3/4” x 15-1/2” Lg.

National Fine Thread

AL-221934	Hex Hd. Bolt, 3/4” x 12” Lg.
AL-221935	Hex Hd. Bolt, 3/4” x 13” Lg.
AL-221936	Hex Hd. Bolt, 3/4” x 14” Lg.
AL-407944	Hex Hd. Bolt, 3/4” x 15” Lg.
AL-087700	Special N. F. Locking Nut

Torque Hex Nuts to - 250 Ft. Lbs. (339 Nm)

B. Vibrator Fastening System For Ultrapac Mold

Special Bolts, Washers and Nuts have been developed for the Ultrapac Mold that can be used up to 10 times. *(See Figure 4.3)*

A Complete SOP Fastening System can be ordered with Part No. AL-648371. It includes the following parts:

(4)	AL-488059	Hex Hd. Bolt, 3/4” x 13” Lg.
(4)	AL-488060	Flat Socket Hd. Bolt, 3/4” x 13-1/4” Lg.
(8)	AL- 087871	3/4”-10 Full Height Flexloc Nut
(12)	AL- 115333	Hardened Washer
(1)		Instruction Drawing

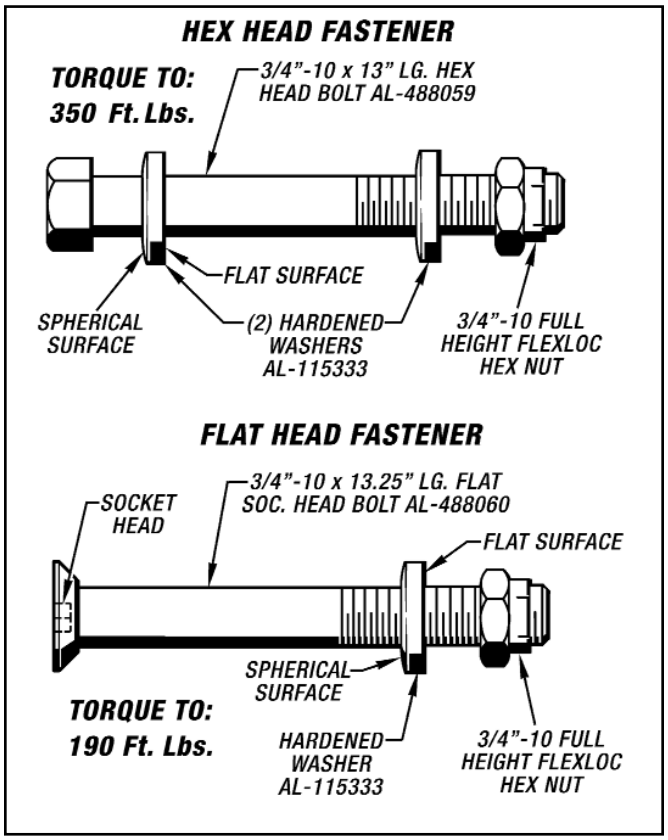


Figure 4.3 - Ultrapac Fastening System

Torque Hex Nuts to -
With Hex Hd. Bolts - 340 Ft. Lbs. (461 Nm)
With Flat Hd. Bolts - 190 Ft. Lbs. (257 Nm)

WARNING:
SERIOUS DAMAGE CAN OCCUR TO THE SMARTPAC VIBRATING SHAFT ASSEMBLY OR THE MOLD SIDE BARS IF THE VIBRATOR MOUNTING BOLTS ARE NOT TORQUED PROPERLY.

4-4 INSTALLATION CHECK LIST

Table 2.1 summarizes operational checks and adjustments for the *SmartPac* System. For complete information, refer to your machine's operation and maintenance manual.

WARNING - Do not operate the system if the vibrators or control unit is not functioning correctly.

SMARTPAC INSTALLATION CHECKLIST	
***SmartPac* to Mold**	
☐	Assure the left and right hand units are the same model.
☐	Verify that the left and right sides of the bearing housings are snug up to the mold side bar. *Damage to the mold side bar or bearing housings may prevent this from occurring. If this is the case, replace the worn components.*
☐	Check for a gap of 1/16 inch between the top of the bearing housing and the mold side bar. *If the top of the housing is in contact with the mold side bar severe damage can occur to the transmission of vibration into the mold side bar.*
☐	SmartPac brg. housing nuts and bolts are torqued to: Hex Hd. Bolts-340 Ft.Lbs.;Flat Hd. Bolts-190 Ft.Lbs
☐	Assure that the shafts can be turned freely by hand when the *SmartPac* units are bolted to the mold. *If the shafts are not turning freely, it is an indication of preloading the bearing. This situation does not allow the bearing to rotate properly and can result in the overheating and failure of the bearings.*
☐	Assure *SmartPac* units are on the proper side of the mold.
Mold Assembly with *SmartPacs* in the Machine	
☐	Verify that lower hoses at the "V" fitting on the dump valve assemblies are filled with ATF fluid. *This prevents air from entering your lines and possibly causing erratic shifting of the unit.*
☐	Verify that control unit tank is 3/4 filled with ATF fluid.
☐	Verify that air pressure for the cylinder rod end is set to 60 psi (413.7 kPa).
☐	Verify that air pressure for cylinder cap end is set to 30 psi (206.9 kPa).
☐	Thoroughly clean both ends of the quick disconnects and attach hoses to dump valve assemblies.
☐	Operate air valve to extend air cylinder rod.
☐	Retract air cylinder. Wait two seconds and then extend air cylinder rod again while watching both vibrators shift 90 degrees. If vibrators do not shift fully when rod is retracted, stop operation and refill reservoir tank.
☐	Assure that when air cylinder rod is extended, both vibrators return to balanced position.
☐	Assure the shafts are rotating inward.
☐	Adjust one motor to match the RPM of the other motor (+/- 2 RPM)

Table 2.1 - Installation Checklist

AFC SmartPac® Model Variations

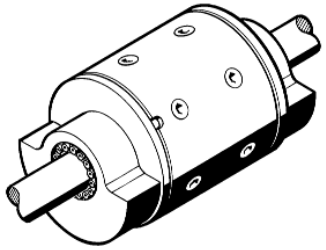
CAUTION - *AFC SmartPac®* and *AFC SmartPac® Series II*
Shafts must NEVER be installed together.

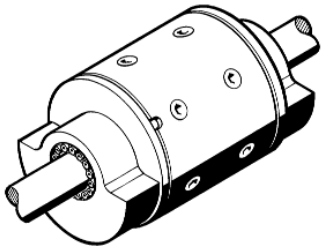
AFC SmartPac
L.H. Shaft
(Model PV1-91)

YES

THIS IS OK.

AFC SmartPac
R.H. Shaft
(Model PV1-91)



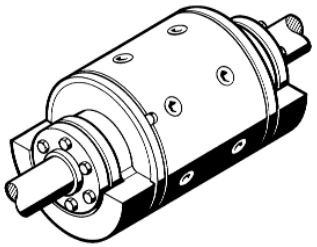


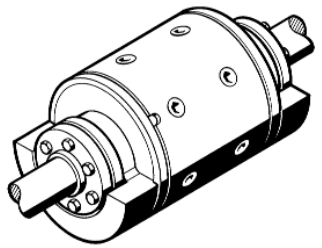
AFC SmartPac
Series II
L.H. Shaft
(Model PV2-98)

YES

THIS IS OK.

AFC SmartPac
Series II
R.H. Shaft
(Model PV2-98)



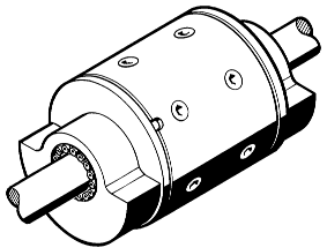


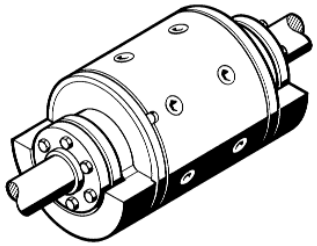
AFC SmartPac
L.H. Shaft
(Model PV1-91)

NO

THIS IS NOT OK.

AFC SmartPac
Series II
R.H. Shaft
(Model PV2-98)



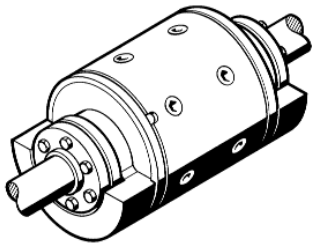


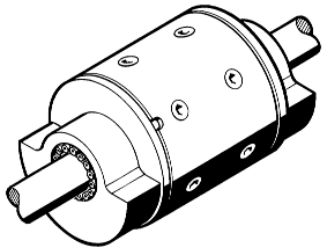
AFC SmartPac
Series II
L.H. Shaft
(Model PV2-98)

NO

THIS IS NOT OK.

AFC SmartPac
R.H. Shaft
(Model PV1-91)





L.H. = Left Hand **R.H. = Right Hand**

Section 5 - MAINTENANCE, ADJUSTMENTS & TROUBLESHOOTING

5-1 GENERAL MAINTENANCE AND CARE

1. Store in clean dry area.
2. Lubricate Main Shaft Bearings before storing.
3. Keep Quick Disconnects clean and capped.
4. For extended storage, spray rust preventative in tube holes and seals.
5. Handle *SmartPac* Vibrator Shaft Assemblies with care. Don't hit or pry on counter weights.
6. Mount to good Mold Side Bars and make sure that the Main Shaft Bearing Housings are seated directly to the bar and the Vibrator Mounting Bolts are properly torqued.
7. Always lift the *SmartPac* Vibrator Shaft by the shaft using a soft sling and overhead hoist. A 3/8" eye bolt can also be installed in the rear end of the Vibrator Shaft (#1).

   Never lift the *SmartPac* Vibrator Shaft by the bearing housings. This could damage the Oil Seals.
8. Thoroughly clean both ends of the Quick Disconnects before engaging.
9. Replace the O-Ring in each Quick Disconnect each month or when they become worn or damaged.
10. Never operate the system pressure above 80 PSI.
11. Always use new clean fluid when filling the system. Contaminants will cause erratic operation.
12. Do not disassemble the *SmartPac* Vibrator Shaft Assembly unless it is necessary to replace worn or damaged parts.
13. Tighten the V-Belt Pulley to recommended torque of **18 Ft. Lbs.** Over tightening will cause the rotary union to bind and reduce its life.
14. Never put undue pressure on the rotary union. fittings or connection hose.
15. Lubricate each Main Shaft Bearing Housing every 8 hours with 1 fluid ounce of NLGI Rated Synthetic, Grade 2 Extreme Pressure Grease. See *Figure 5.1* for location of grease fittings.
16. When installing Locking Collars (#12) torque screws to **23 Ft. Lbs**. on a new one and **22 Ft. Lbs**. for one that has been previously used.
17. Always have guards in place when operating vibrator drive motors.
18. Keep system in top condition by replacing worn belts, pulleys and/or hoses.

5-2 VIBRATOR SELECTION TIPS

Select a vibrator according to your plant's equipment and production. See the Table below for some general rules for standard products. For larger concrete units you may want a larger *SmartPac* unit and for lower height product smaller *SmartPac* units.

YOUR MACHINE	USE THIS TYPE OF VIBRATOR		
	11,000 Lbs.	13,000 Lbs.	15,000 Lbs.
3-At -A-Time	X		
4-At -A-Time	X	X	
5-At -A-Time		X	
6-At -A-Time		X	X

5-3 OPERATIONAL GUIDELINES

Follow these operational guidelines to optimize your *SmartPac* vibrator's performance.

1. If the weights are too heavy, you may see the following:

   a. The material will have the appearance of "boiling" or "bubbling" during feed time.

   b. Segregation of material within each cavity.

   If you notice these conditions, lower the amplitude.
2. Use only the rotary unions supplied by Besser. The rotary union is a special design and cannot be replaced by standard stock rotary unions.
3. There may be front to back movement of the vibrator shafts while mounted in the mold side bars. This movement may be as much as 1/16 inch [2 mm]. Do not be alarmed as this will not effect vibrator performance.

A. Control Unit

1. The hydraulic supply tank should be maintained at no less then 3/4 full.
2. The hydraulic lines from the pump to the vibrator shaft must be of equal length and size to assure smooth and equal shifting of the right and left hand vibration units.
3. The air silencer will require periodic cleaning depending upon plant environment conditions.
4. The air filter on the supply tank needs periodic cleaning depending upon plant environment conditions.

5-4 LUBRICATION

(See Figure 5.1)

Vibrator bearing housings should be lubricated every eight hours with one fluid ounce of NLGI Rated Synthetic, Grade 2 Extreme Pressure Grease. (Besser part number 114135).

5-5 FREQUENCY ADJUSTMENT

Do the following to check or set the vibrator frequency of AFC SmartPac systems.

1. Stop the machine when feed drawer is over the mold.
2. Start vibrator motors with vibration off.

   Top of vibrator belts must be moving towards center of machine.
3. Bring up SmartPac screen on monitor.
   - Set shaft speed to desired rpm.
   - Check shaft speed with strobe light (Besser Part # 115212) or photo tachometer(Besser Part # 112910).
4. Adjust one motor to match the rpm of the other motor (+/- 2 RPM).

   Use registers #N10:30 and #N10:31 to adjust motor speeds. (#N10:40 and #N10:41 for Ultrapac II)

5-6 AMPLITUDE ADJUSTMENT

Make amplitude adjustments with the vibrator motors stopped and the large cylinder rod in the control panel fully extended. With this condition set up, adjust the transducer to read zero while monitoring register #N10:21 (SLC500), or #467 (PLC2).

5-7 TRANSDUCER ADJUSTMENT

(See Figure 5.2)

Adjust the transducer by doing the following.

1. Loosen transducer mounting screws.
2. While watching register, #N10:21 (SLC500), or #462 (PLC2) move transducer to get zero on the register.
3. Tighten transducer mounting screws.

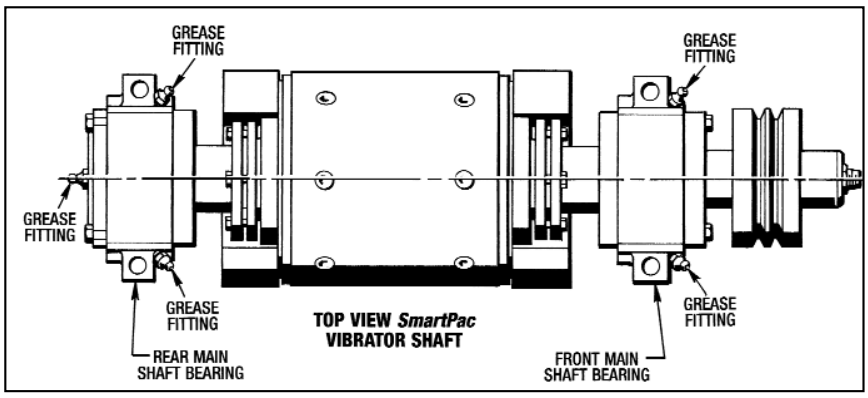


Figure 5.1 - Main Shaft Bearing Lubrication

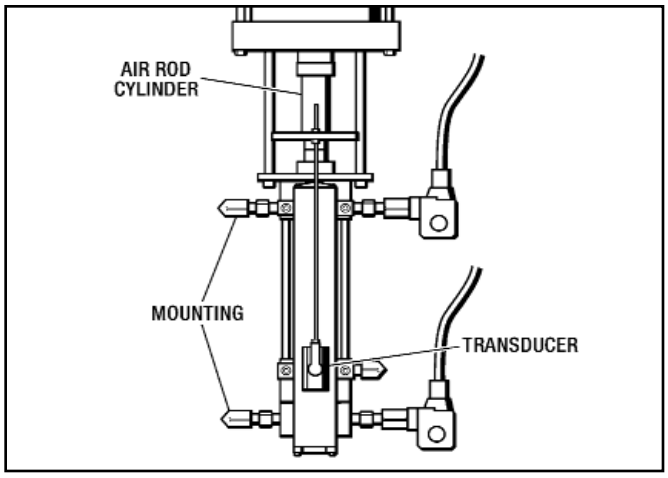


Figure 5.2 - Transducer Adjustment

4. Retract air cylinder rod by manually activating valve.
   - Register reading should go to 900 – 1000.
   - Both vibrator weights should shift 90°.
5. Extend air cylinder rod and recheck zero.
6. Enter zero into register N10:26.
7. Set amplitude on SmartPac screen to 500.
8. With vibrator motors off, set vibrator switch to hand.
9. Check register reading. Subtract 500 from this reading and enter result into register #N10:26 (SLC500), or #543 (PLC2).
   - This value is the “offset” that compensates for delays in the system. The offset should be updated periodically.
10. Operate vibration “hand” and check reading on register #N10:21 (SLC500), or #467 (PLC2).
    - Reading should be close to 500.
    - Vibrator weights should be shifting about halfway.

5-8 VERIFY DUMP VALVES

Use the following procedure to check the dump valves for leaks.

1. Turn the vibrator motors off.
2. Put the vibrators in manual.
3. Manually shift the weights and watch for the weights to roll back. If they roll back, you may have a leaky valve.

5-9 TROUBLESHOOTING

Read the entire maintenance section to assure the vibration system is set up correctly and recommended actions are being taken. If troubles with the vibration system are still present the following are guidelines which may help solve the problem.

TROUBLESHOOTING CHART

Concern	Possible Problem	Actions
Not vibrating at start-up.	Leaky dump valves.	Check dump valves. See Section 5-8.
Slow shifting or jerky shifting of weights.	Restricted air silencer.	Check air silencer for restrictions. Clean or Replace, if needed.
	Piston chamber has air pocket.	Cycle unit while not rotating drive motors for approximately 20 mi.
	Concrete dust & Debris between moving parts. *(See Figure 5.3)*	Clean between moving parts.
	Broken ball bearing	Roll *SmartPac* unit in quiet area and listen for loose ball bearings.
Vibration not shutting off.	Broken spring.	Replace spring.
	Left and right hand vibration units switched.	Verify units are installed properly. *(See Figure 4.2.)*
	Concrete dust & Debris between moving parts. *(See Figure 5.3)*	Clean between moving parts.
Unequal shifting of vibrator weights.	Restricted oil filter.	Check filter.
	Leaky dump valves.	Check dump valves. See Section 5-8.
Main bearings overheating.	Bearings preloaded.	Rotate shafts by hand prior to starting.
	Too much grease.	Remove excess grease and follow procedure in Section 5-4.
	Not enough grease.	Add grease per procedure in Section 5-4

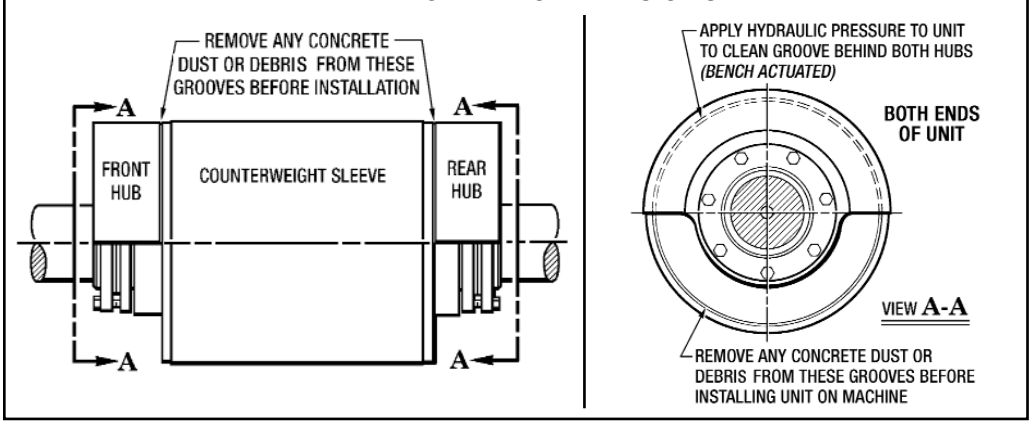


Figure 5.3 - Cleaning SmartPac Unit of Concrete Dust & Debris

IMPORTANT

When storing *SmartPac* units always cover with a cloth or plastic tarp to keep concrete dust and other contaminants out of the unit.

***SmartPac* Vibrator Shaft Units should be cleaned after removal and before every installation on the machine.**

Section 6 - DISASSEMBLY

WARNING
Before attempting any disassembly procedure, open the drive motor disconnect, shut-off the control electrical supply and the hydraulic supply. Lock them out to avoid any possibility of personal injury.

Unless the ***SmartPac*** **Vibrator Shaft** is to be completely overhauled, it should be disassembled only to the extent necessary to gain access to any worn or damaged parts.

See **Section 8** for a visual reference to all parts being disassembled.

See Pages 36 and 37 for Disassembly Tools

6-1 REMOVING *SmartPac* ASSEMBLY

(See Figures 8. 1 to 8.5)

1. Disconnect the Hydraulic Hose (#202) and drain the fluid out of the Vibrator Shaft (#1).
2. Remove any Belt Guards. Release the Drive Belt Tension and remove the Drive Belts from the V-Belt Pulley (#201).
3. Remove the whole Mold Box with the ***SmartPac*** **Vibrator Shafts** attached out of the machine and place it in the Roll-Over Fixture.
4. Take the ***SmartPac*** **Vibrator Shafts** off the Mold Box as per instructions given in **Section 4 - Installation, 4-1 Removing *SmartPac* Vibrator Shafts.** Place on a suitable work bench.
5. Remove the V-Belt Pulley (#201) and Locking Assembly (#200) as per manufacturers instructions given at the back of this manual on Pages 40 & 41.

6-2 REMOVING MAIN SHAFT BEARINGS

(See Figure 8.4)

A. Front Bearing

NOTE: If the Front Bearing is not damaged it does not have to be removed to gain access to the Piston Assembly.

1. Take the Retaining Ring (#40) out of the Vibrator Shaft (#1) and pull the Swivel Union (#41) out.
2. Take the (4) Screws (#3) and (4) Lockwashers (#4) out of the Front Bearing Closure (#38).
3. Carefully pull the Front Bearing Closure (#38) off the Vibrator Shaft (#1).

CAUTION - Do not damage the Oil Seal (#39) when removing this Bearing Closure (#38).

4. Inspect the Oil Seal (#39) and press it out with an Arbor Press if it needs replaced.
5. Attach the Front Bearing Puller #601-SP-020 and pull the whole front bearing loose from the Vibrator Shaft (#1) as shown in *Figure 6.1.*

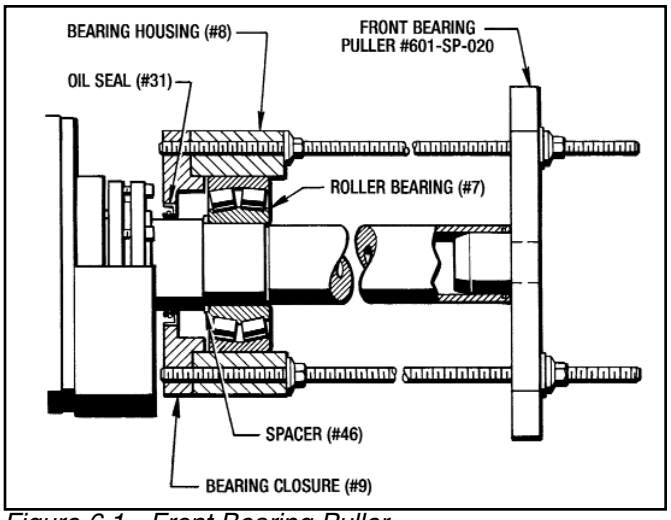


Figure 6.1 - Front Bearing Puller

It may be necessary to moderately heat up the Bearing to approx. 250° F. to remove it from the shaft. **CAUTION-Use protective gloves.**

After it is loosened up, it can then be removed from the Vibrator Shaft (#1) by hand.

CAUTION - Be careful not to damage the Oil Seal (#31) when removing this Front Bearing.

6. Inspect the Oil Seal (#31) and remove it with an Arbor Press if it is damaged and needs replaced.
7. Be careful not to lose the Spacer (#46). Set it aside. **NOTE:** This spacer in not on shafts with 27.48" MSB length or any metric shaft lengths.

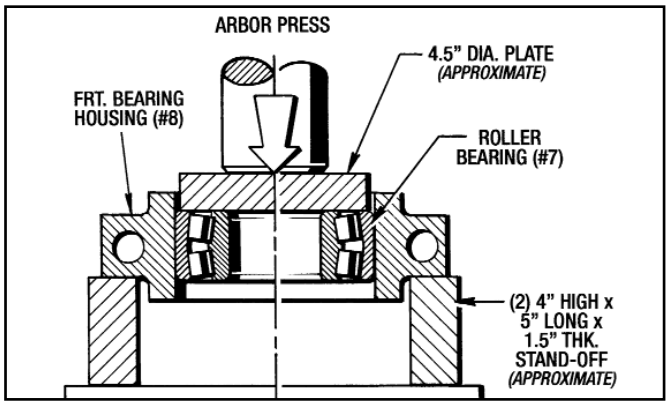


Figure 6.2 - Removing Roller Bearing (#7)

8. Press the Roller Bearing (#7) out of the Bearing Housing (#8) with an Arbor Press as shown in *Figure 6.2*.

B. Rear Bearing

1. Take the (4) Screws (#3) and (4) Lockwashers (#4) out and remove the End Bearing Closure (#6) from the Bearing Housing (#8).
2. Take the Retaining Ring (#29) off the end of the Vibrator Shaft (#1) .Also remove Spacer (#30a) for metric length shafts only.
3. Attach a standard Bearing Puller and pull the whole Rear Bearing off the Vibrator Shaft (#1) as shown in *Figure 6.3*.

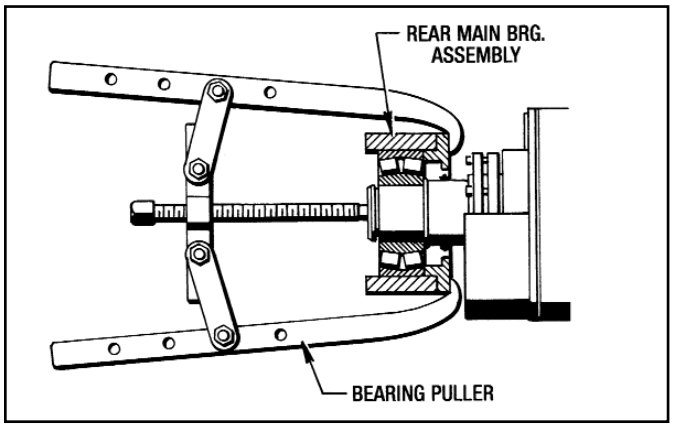


Figure 6.3 - Removing Rear Main Bearing

4. On English length shafts, except for the 27.48" length, the Spacer is (#30b) and is on the inside of the Bearing (#7). Remove it and set it aside.
5. Inspect the Oil Seal (#31) and remove it with an Arbor Press from the Bearing Closure (#9) if it needs replaced.
6. Press the Roller Bearing out of the Rear Bearing Housing (#8) with the same procedure as shown in *Figure 6.2*.

6-3 ACCESS TO THE PISTON ASSEMBLY

(See Figure 8.4)

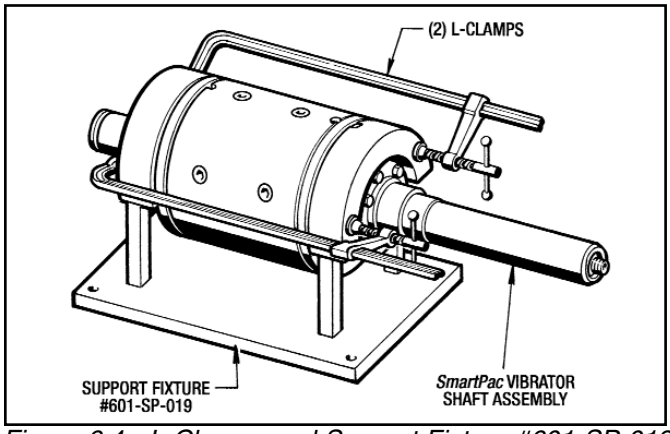


Figure 6.4 - L-Clamps and Support Fixture #601-SP-019

1. Set the ***SmartPac* Assembly** on the Support Fixture #601-SP-019. *(See Figure 6.4)*
2. Use the (2) **L-Clamps**, which are furnished in the Assembly Tool Kit, to clamp the ***SmartPac* Assembly** together as shown in *Figure 6.4.*
3. Remove the Rear Locking Ring (#12) as per manufacturers instructions in the back of this manual on Page 40**.**
4. Take the (2) L-Clamps off. The internal spring will force the Rear Hub Assembly back some. Continue pulling the Rear Hub Assembly off the rear of the Vibrator Shaft (#1).
5. Take the Thrust Washers (#42a) and the Spring (#32) off the Vibrator Shaft (#1). **NOTE -** There are (2) Thrust Washers (#42a) for the 27.48" long shaft.
6. Remove the (6) Flat Hd. Screws (#15) and slide the Sleeve (#17) off.

   NOTE - These (6) Screws have Blue Loctite #242 on the threads. Use an impact wrench to break them loose. If they get damaged in removal, there are (6) new ones in the Minor Overhaul Kit.
7. Take the Counterweight (#16) off.
8. Put the **Tapered Sleeve #601-SP- 014** on the rear end of the Vibrator Shaft (#1) as shown in *Figure 6.5.*
9. Pull the Thrust Washer (#42b) and Piston Assembly

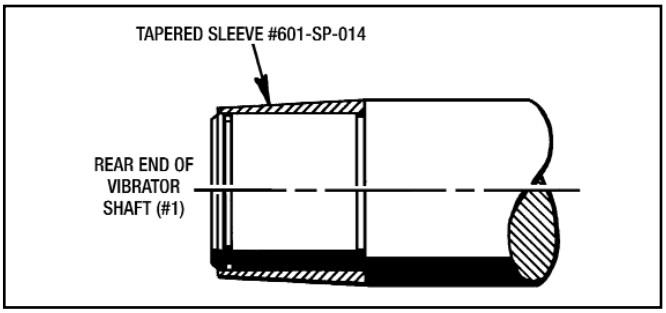


Figure 6.5 - Tapered Sleeve #601-SP-014

   off the Vibrator Shaft (#1).
10. Pull the Piston Cartridge (#107) off the Vibrator Shaft (#1).

    NOTE: This may require light air pressure applied to the rotary union to get it out of the piston bore.

    CAUTION - Be careful not to damage the internal O-Ring (#36) when removing the Piston Cartridge (#107).
11. Remove both O-Rings (#35) and (#36) from the Piston Cartridge (#107).

6-4 PISTON DISASSEMBLY

(See Figure 8.1, 8.2 & 8.4)

The ***SmartPac*** **Vibrator** Piston can only be repaired one of two ways.

(A) As a Complete Assembly. (See *Figure 8.2* for Complete Piston Replacement Kit.)

(B) The Piston Bearing Sub-Assembly can be replaced. (See *Figure 8.1* for the Piston Bearing Replacement Kit.)

1. Using the Dowel Pin Remover #601-SP-018 press the (2) Roll Pins (#106) down in the Piston (#34) as shown in *Figure 6.6.*

   NOTE: These (2) Roll Pins (#106) do not have to be completely removed. They just have to be pushed down far enough to clear the Counter Balance Pin (#100) and the Bearing Pin (#18).

2 Place the Piston (#34) into the Cradle Assembly Tool #601-SP-027 with the Bearings (#14) pointed down

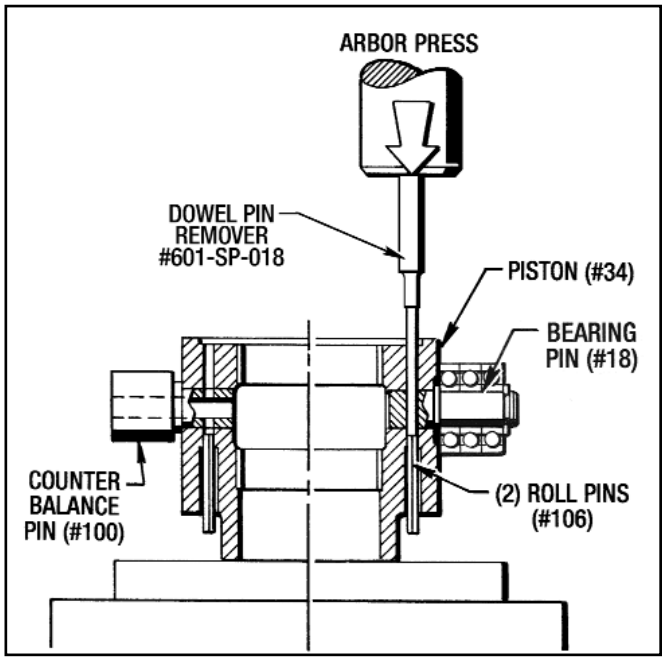


Figure 6.6 - Removing Dowel Pins (#106)

as shown in *Figure 6.7*. Use the 3/8" x 6-1/2" Lg. Soc. Hd. Cap Screw to press the Piston Bearing Sub-Assembly out of the Piston (#34). This 3/8" Cap Screw is furnished with the Assembly Tool Kit #02¬SP-002-03.

6-5 REMOVING FRONT HUB ASSEMBLY

(See Figure 8.2)

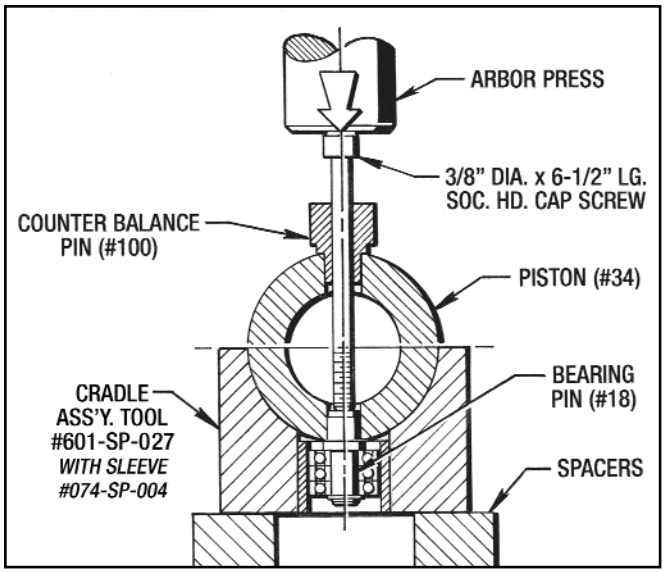


Figure 6.7 - Removing Piston Bearing Assembly

1. Remove the Shims (#130 to #135) from the Bearing Retainer (#13).
2. Remove the Locking Ring (#12) as per manufacturers Instructions in the back of this manual on Page 40.
3. Pull the Front Hub Assembly off the Vibrator Shaft (#1).
4. If any of the (4) Pins (#101), located in the Front Hub (#21), needs replaced, then press them out with an arbor press and the Dowel Pin Remover #601-5P-018, which is sup¬plied in the Assembly Tool Kit #02-5P-002-03. *(See Figure 6.8)*

6-6 REMOVING BALL BEARING (#19)

(See Figure 8.4)

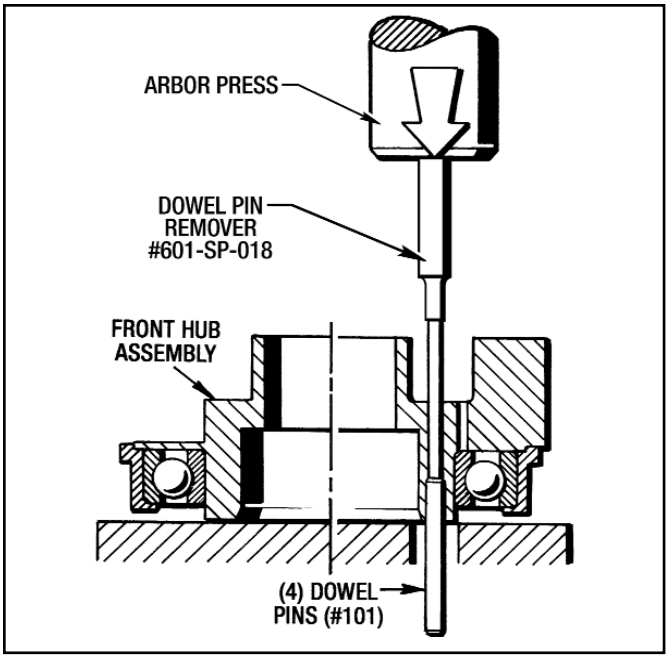


Figure 6.8 - Removing Dowel Pins (#101)

This procedure is the same for either the Front Hub (#21) or the Rear Hub (#11).

You may also have to heat the hub and bearing up with a blow torch to loosen up the Loctite adhesive.

1. Place the Hub into an arbor press.
2. Use the Bearing Removal Tool #601-SP-023 as shown in *Figure 6.9* to take the Ball Bearing (#19) and the Bearing Retainer (#13) off the Hub. Insert the (3) protruding pins on the tool into the (3) holes in each hub.
3. Press until the Ball Bearing (#19) and the Bearing Retainer is removed from the Hub.

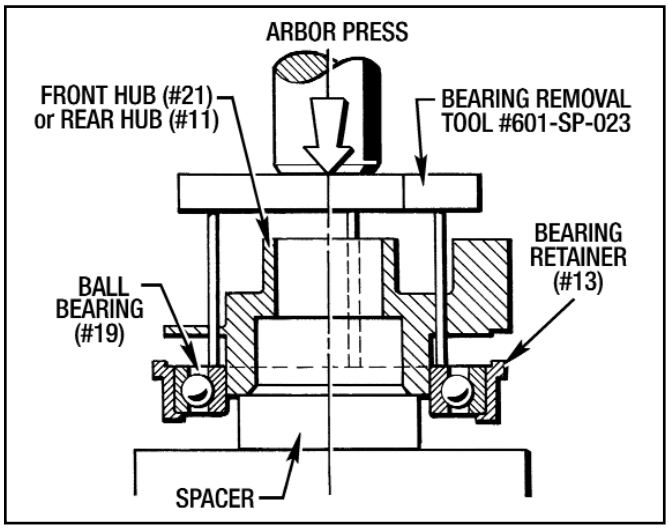


Figure 6.9 - Removing Ball Bearings (#19) and Bearing Retainer (#13) from Hub

4. Use Tool #601-SP-025 to press the Ball Bearing (#19) out of the Bearing Retainer (#13). *(See Figure 6.10)*

The Disassembly Procedure is now

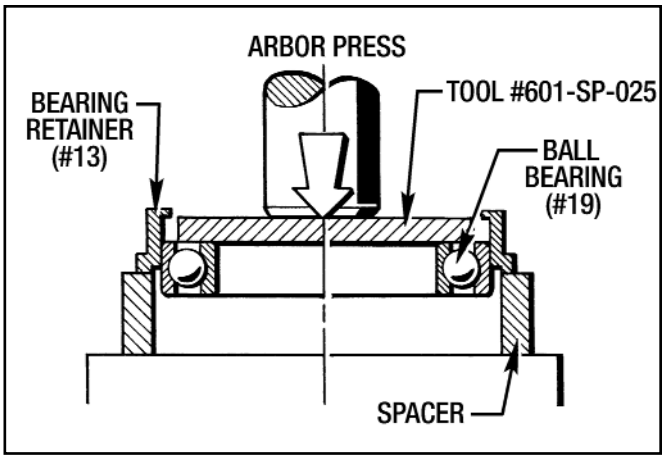


Figure 6.10 - Removing Ball Bearing (#19) from Bearing Retainer (#13)

Complete for your SmartPac Vibrator Shaft Assembly.

Section 7 - REASSEMBLY

7-1 GENERAL REASSEMBLY INFORMATION

1. Make sure that all mating surfaces of the Vibrator Shaft (#1), Bearings and the Piston are free of all scratches, nicks or any other surface damage that would affect the operation of the *SmartPac* Vibrator Assembly.
2. Use ***CRC Brakleen*** (or equivalent) to clean all parts before reassembly.
3. Use ***Loctite Primer T*** to clean and prime any surfaces that are to be Loctited at Reassembly.
4. Use ***Blue Loctite #242*** for the installation of the (6) Flat Head Screws (#15) and on the areas of the Shaft (#1) where the Main Roller Shaft Bearings (#7) contact the shaft.
5. Use ***Green Loctite #609*** to reassemble the Piston and Sleeve Bearing components.
6. ***NLGI Rated Synthetic Grade 2 Extreme Pressure Grease*** is recommended for all surfaces that require lubrication at reassembly. This will just be called ***Grease*** after this.
7. Make sure that the internal bore in the Vibrator Shaft (#1) is thoroughly cleaned and free of any foreign material before installing the Rotary Union (#41) into the shaft.

When you are replacing the Complete Piston Assembly, make sure that you have the correct part for a R.H. or L.H. Assembly. Both parts are stamped **"LH"** or **"RH"** on the rear face.

7-2 FRONT HUB REASSEMBLY

(See Figure 8.4)

A. Installing Ball Bearing (#19) and Bearing Retainer (#13) on to Front Hub (#21)

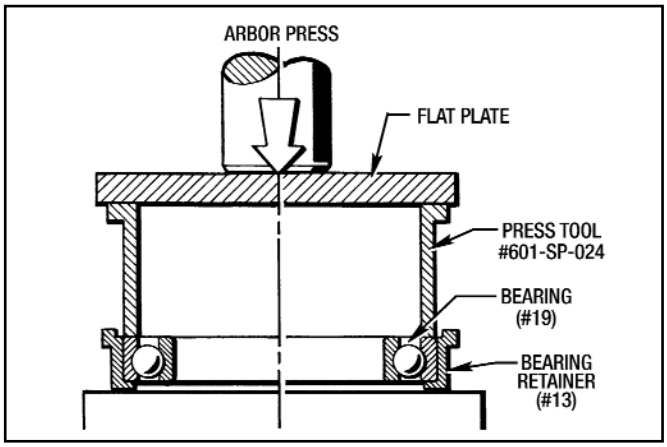


Figure 7.1 - Installing Bearing (#19) into Bearing Retainer (#13)

1. Apply a light coat of Green Loctite #609 to the O.D. of the Ball Bearing (#19) and the I.D. of the Bearing Retainer (#13).
2. Press the Ball Bearing (#19) into the Bearing Retainer (#13) with an arbor press as shown in *Figure 7.1*. Use the small end of Tool #601-SP-024 and press until the bearing is seated in the retainer.

   IMPORTANT - Wipe off any excess Loctite.
3. Apply a light coat of Green Loctite #609 to the I.D. of the Ball Bearing(#19) and the O.D. of the Front Hub (#21).
4. Place the Front Hub (#21) into an arbor press and install the Bearing and Retainer onto the Hub. Use the large end of Tool #601-SP-024 as shown in *Figure 7.2.*

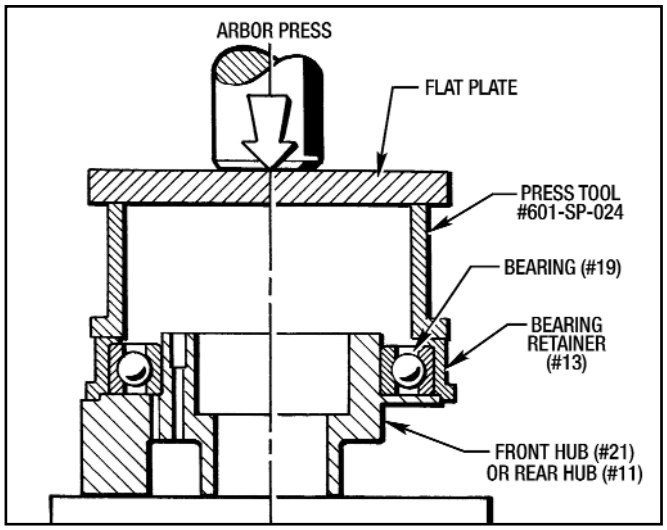


Figure 7.2 - Installing Bearing & Retainer onto Hub

IMPORTANT - Wipe off any excess Loctite.

B. Installing Dowel Pins (#101) into Front Hub

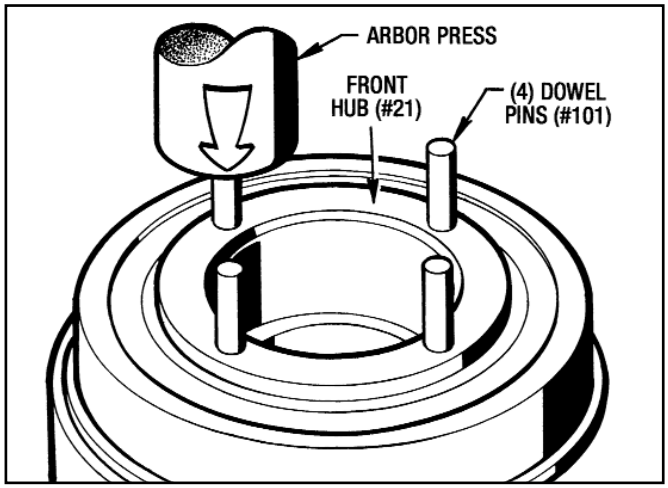


Figure 7.3 - Installing Dowel Pins (#101)

1. Clean the (4) Dowel Pins (#101) and the (4) holes in the Front Hub (#21) with ***Loctite Primer T.***
2. Apply a film of ***Green Loctite #609*** to one end of each dowel Pin (#101) and press them into the Front Hub (#21) with an Arbor Press until they are firmly seated as shown in *Figure 7.3*.

   IMPORTANT - Wipe off any excess Loctite.

7-3 INSTALLING FRONT HUB TO VIBRATOR SHAFT

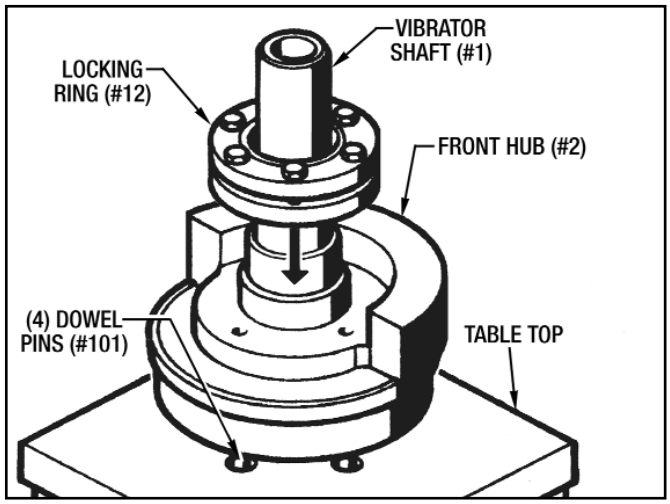


Figure 7.4 - Installing Front Hub to Vibrator Shaft

1. Thoroughly clean the shaft, hub I.D. and the hub O.D. where the Locking Ring (#12) rides with ***CLC Brakleen*** (or equivalent).
2. Place the Vibrator Shaft (#1) in a vertical position with the rotary union end pointed up. Make sure there are (4) clearance holes in the bench top for the (4) Dowel Pins (#101) which are pointing downward. *(See Figure 7.4)*
3. Slide the Front Hub (#21) down and over the Vibrator Shaft (#1) with the locking ring end up until it firmly seats on the proper shaft shoulder. Lightly tap it with a soft hammer to ensure that the Front Hub (#21) is seated properly.
4. Prepare the Locking Ring (#12) for installation by setting a common gap between the inner and outer rings and applying a light film of oil to the I.D.
5. Install the Locking Ring (#12) onto the Front Hub (#21) as per manufacturer's instructions given in the back of this manual on page 38. **Torque Screws to 23 Ft. Lbs for a new ring and 22 Ft. Lbs. for a ring previously used.**

7-4 REAR HUB REASSEMBLY

The procedure for the Rear Hub Reassembly is the same as the Front Hub Reassembly except for one thing. There are no Dowel Pins in the Rear Hub.

7-5 INSTALLING ROTARY UNION (#41)

(See Figure 8.3)

Make sure the bore in the Vibrator Shaft (#1) is completely clean and smooth.

If you are installing a new Rotary Union (#41), then it may be required to lightly file the stamped part number area to obtain the correct slip fit in the bore.

1. Apply ***Grease*** to the O-Ring on the Rotary Union (#41) and slip it into the bore.
2. Install the Retaining Ring (#40) into the Vibrator Shaft (#1).

   NOTE - Be sure to locate the sharp edge of the Retaining Ring (#41) away from the Rotary Union (#40) as shown in *Figure 7.5*.

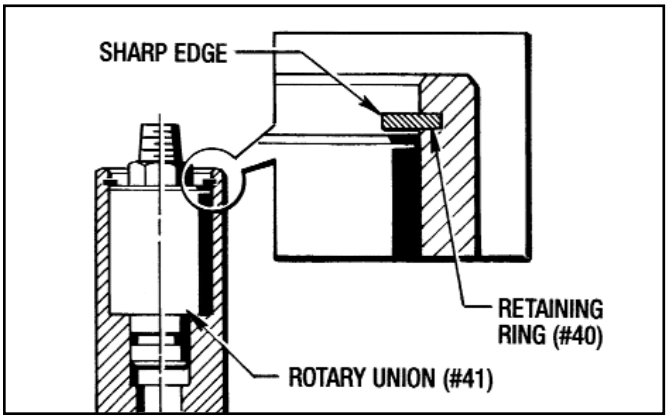


Figure 7.5 - Installing Rotary Union (#41)

7-6 INSTALLING PISTON BEARING SUB-ASSEMBLY INTO THE PISTON *(See Figures 7.6, 7.7 and 7.8)*

1. Lightly coat the OD of the Bearing Pin (#18) and the ID of the hole in the Piston (#34) with ***Green Loctite #609.***
2. Place the Piston (#34) into the Cradle Assembly Tool #601-SP-027 and press the Bearing Pin (#18) into the Piston (#34) as shown in *Figure 7.6*.

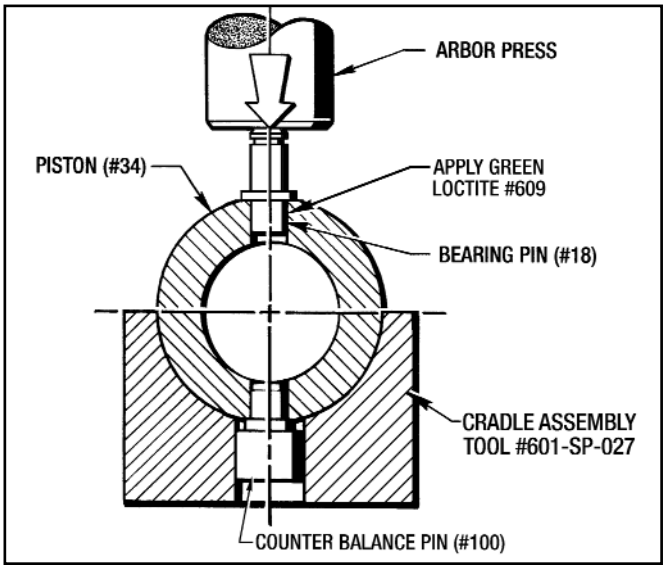


Figure 7.6 - Installing Bearing Pin (#18)

3. Cross-drill a 3/16” hole through the Bearing Pin (#18) and install a Roll Pin (#101) into the Piston (#34) as shown in *Figure 7.7*.

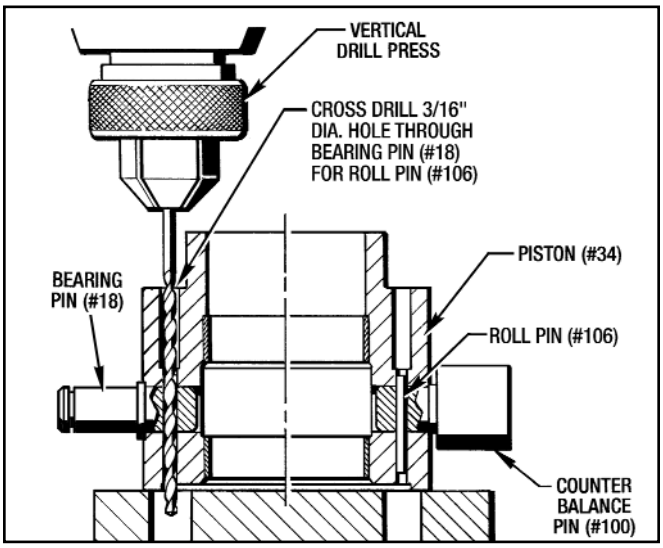


Figure 7.7 - Cross Drilling Piston Bearing Pin (#18)

4. Lightly coat the remaining O.D. of the Bearing Pin (#18) and the I.D. of the (3) Bearings (#14) with Green Loctite #609.

5. Press the (3) Bearings (#14), one at a time, onto the Bearing Pin (#18) with an Arbor Press and Bearing Installation Tool #601-SP-013 as shown in *Figure 7.8.*

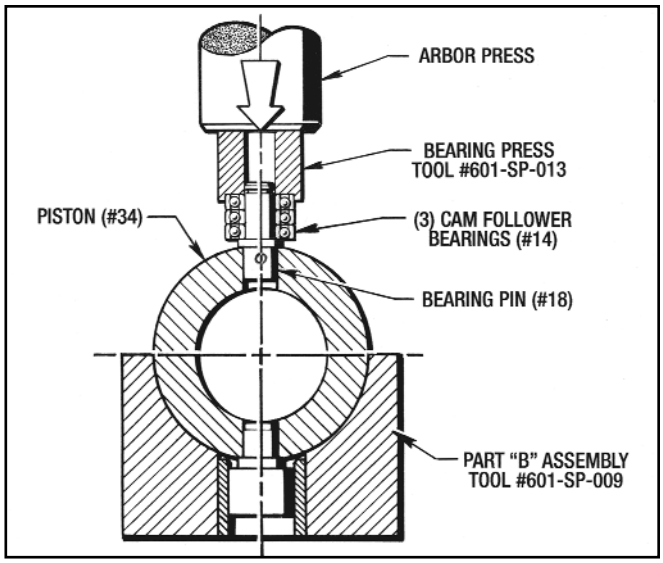


Figure 7.8 - Installing Cam Follower Bearings (#14)

6. Install the Retaining Ring (#20) on the Bearing Pin (#20).

7-7 INSTALLING PISTON ASSEMBLY ON TO THE VIBRATOR SHAFT *(See Figure 8.4)*

First set the Vibrator Shaft and Front Hub in a vertical position with the rotary union end pointed down. Use suitable bracing and support.

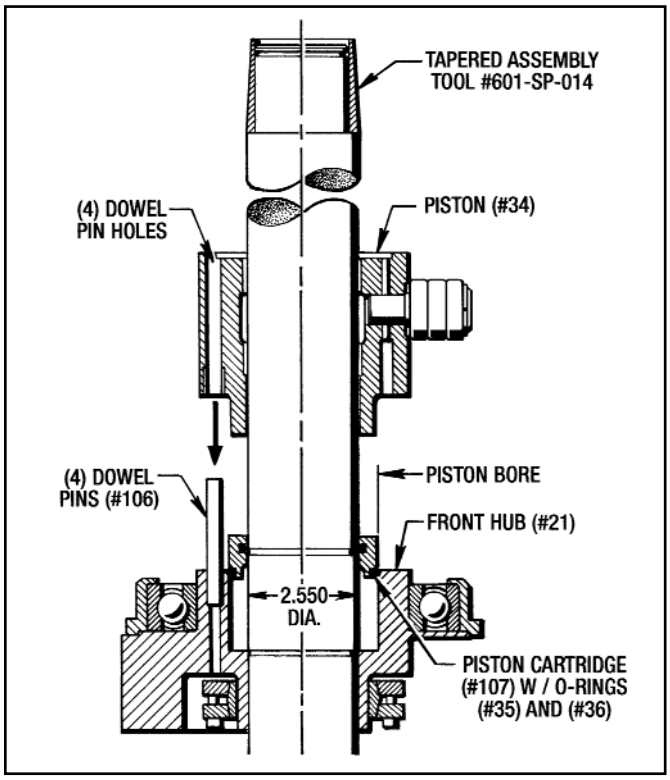


Figure 7.9 - Installing Piston

1. Lubricate the Piston Cartridge (#107) with ***Grease*** and install both O-Rings (#35) and (#36) on it.

2. Apply a liberal amount of *Grease* to the piston bore in the Front Hub (#21) and the 2.550” shaft diameter. *(See Figure 7.9)*

3. Place the **Tapered Assembly Tool #601-SP-014** on the rear end of the Vibrator Shaft (#1).

4. Carefully slide the Piston Cartridge (#107) down and over the shaft until it rests on the Front Hub (#21) as shown in *Figure 7.9.*

   CAUTION - Be very careful not to damage the O-Rings on the Piston Cartridge.

5. Lubricate the (4) Dowel Pins (#101), piston dowel holes and the rear face of the Piston Cartridge (#107) with a liberal amount of ***Royal Purple Grease***. *(See Figure 7.9)*

6. Push the Piston Sub-Assembly down and over the Vibrator Shaft (#1) and onto the (4) Dowel Pins (#106). Tap with a soft hammer to make sure that the Piston Cartridge (#107) and Piston (#34) is firmly seated against each other in the Front Hub (#21) piston bore.

   IMPORTANT: Make sure that you have a R.H. piston for a R.H.Assembly or a L.H. piston for a L.H. Assembly. *(See Figure 7.10 on the next page.)*

7. Seat the piston bushings by lightly tapping the Counter Weight Pin (#100) side to side with a soft hammer.

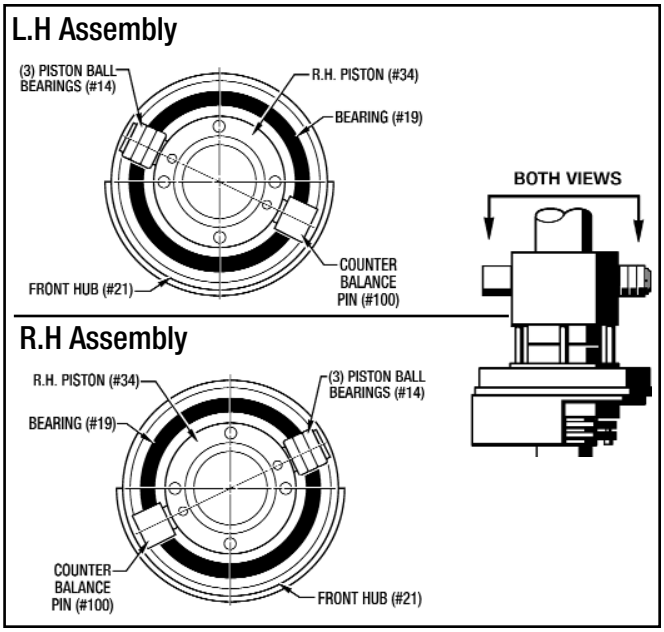


Figure 7.10 - Correct Piston Orientation

It is necessary at this time to check the piston for leaks.

8. Slide the **Trantorque and Ring Assembly #601-SP-021** down over the shaft and lock it so it is approx. 1/2" from the rear face of the Piston (#34) as shown in *Figure 7.11.*

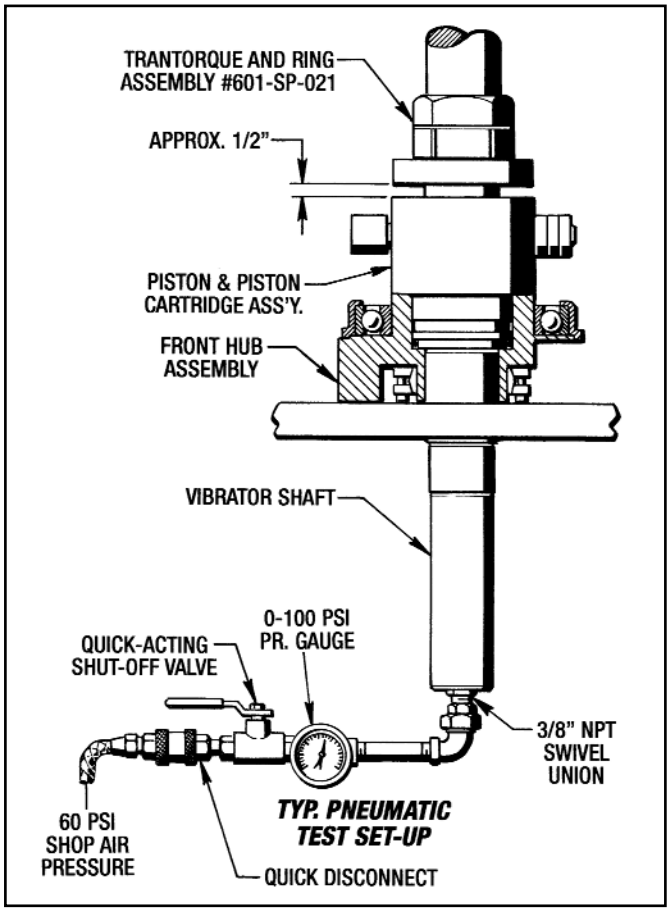


Figure 7.11 - Testing Piston for Leaks

CAUTION: Make sure that the Trantorque and Ring Assembly is firmly locked on the shaft before applying air pressure to the shaft.

9. Attach a Pneumatic Test Set-Up *(or similar)* as shown in *Figure 7.11* to the Rotary Union (#41) and apply 60 to 80 PSI air pressure. The piston will move up to the **Trantorque and Ring Assembly #601-SP-021**. Maintain this air pressure for approx. 30 to 60 seconds. Watch the pressure gauge very closely for any leaks.

   When applying air pressure also check around the Swivel Union (#41) for any air leakage. Use "Snoopy" air leak detection fluid (or equivalent) to check for any air leaks. Follow instructions on the bottle.

   IMPORTANT - There must not be any pressure drop at all for this test.

10. Remove the **Trantorque and Ring Assembly #601-SP-021** and the Pneumatic Test Set-Up from the shaft.

    CAUTION - Do not attempt to remove the Trantorque and Ring Assembly #601-SP-021 with the air pressure connected. Disconnect the air pressure first.

7-8 FURTHER ASSEMBLY BUILD-UP

(See Figures 7.12 , 8.4 and 8.5)

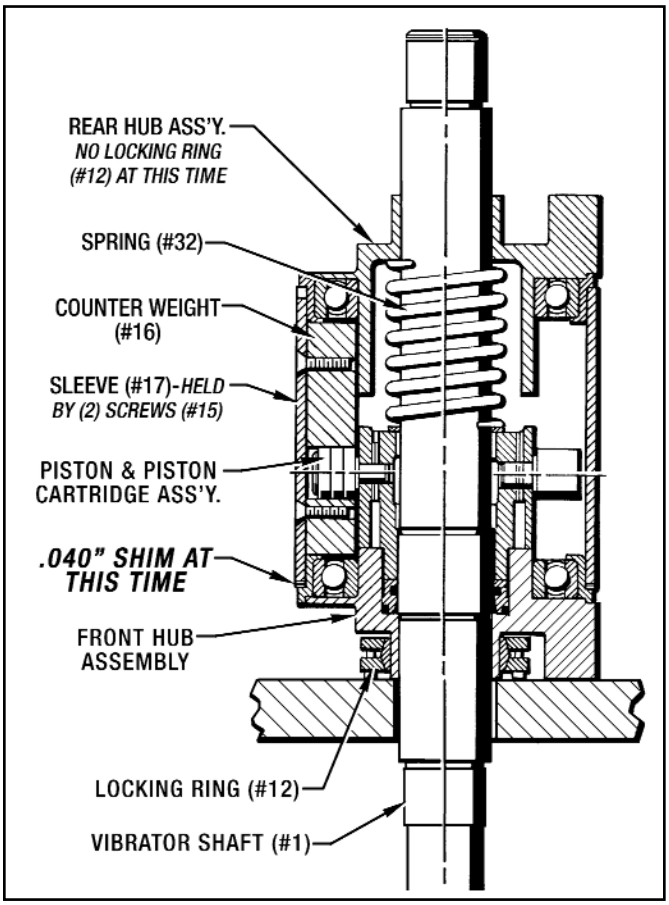


Figure 7.12 - Further Build-Up

1. Grease the rear face of the Piston (#34).
2. Place the Thrust Washer (#42b) over the shaft until it rests on the rear face of the Piston (#34). Apply some ***Grease*** to the rear face of this Washer (#42b).
3. Drop the Spring (#32) over the shaft until if firmly rests on the Thrust Washer (#42b).
4. Place a Thrust Washer (#42a) over the shaft and rest it on the Spring (#32). **NOTE -** On a 27.48" long shaft there will be (2) Thrust Washers (#42a).
5. Place the Counter Weight (#16) into place with the Roller Cam (#14), which is on the Piston Assembly, nestled in the counter weight cam slot.

   IMPORTANT - Do not move or adjust the piston to accomplish this.
6. Replace the exact same number of Shims (#130) to (#135), if possible, or place **.040" thick** Shims (#130) to (#135) on the Front Hub Assembly.

   NOTE - This is only a starting point for the Alignment and Balancing Procedure described in the next **Section 7-9**.
7. Place the Sleeve (#17) over the assembly and attach with (2) Flat Hd. Screws (#15). **Tighten, but do not use Loctite or torque yet .**

   NOTE - This is only temporary until the Alignment and Balancing Procedure is completed.
8. Make sure that the Rear Hub (#21) and the shaft where the Rear Hub seats is thoroughly cleaned of all grease and dirt.
9. Apply a film of ***Grease*** to the inner surface that contacts the Thrust Washer (#42a).
10. Lower the Rear Hub (#11) down and over the shaft.

    NOTE - This Rear Hub (#11) only has to be in an approx. position at this time.
11. With soft slings and an overhead hoist lift the whole assembly up and over to the **Support Fixture #601-SP-019**. Set it down so the flat surfaces of the Front and Rear Hubs are resting on the (4) key stock upright members of the fixture. *(See Figure 7.13)*

    This will automatically align the Rear Hub (#11) with the Front Hub (#21).
12. Compress the entire assembly with the (2) L-Clamps so that both hubs are seated solidly into the Sleeve (#17) as shown in *Figure 7.13*.

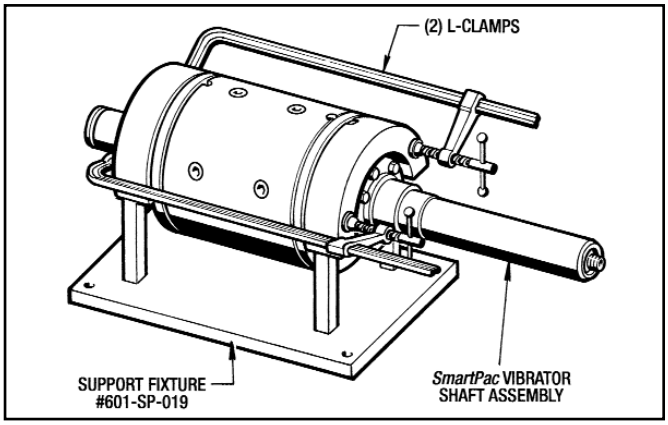


Figure 7.13 - Support Fixture #601-SP-019 & L-Clamps

7-9 *SmartPac* ALIGNMENT & BALANCING

(See Figure 7.14)

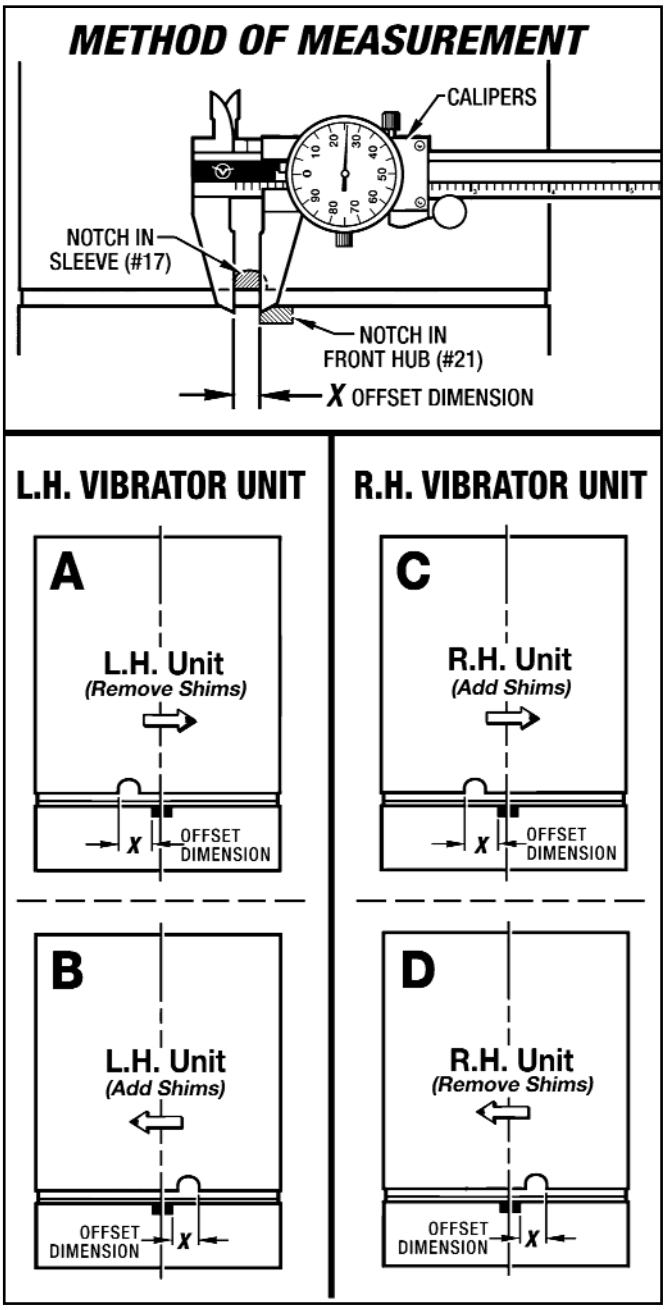


Figure 7.14 - Counterweight Alignment & Balancing

The Offset Dimension, as shown in *Figure 7.14* above, has to be measured to determine the required Shims

(#130) to (#135) to correctly balance the *SmartPac* Counterweight mechanism.

There is a small amount of backlash movement between the Piston Sleeve Bearings and the cam slot in the Counterweight (#17) so there will be a Maximum Offset Dimension and a Minimum Offset Dimension. **Manually turn the Sleeve (#17) for each position.**
The Maximum Offset Dimension *(X_{MAX})* and the Minimum Offset Dimension *(X_{MIN})* must be measured to determine the Average Offset Dimension *(X_{AVG})*. Use a set of Calipers as shown in *Figure 7.15.*

Example: $X_{MAX} = .026"$; $X_{MIN} = .030"$

$$\frac{X_{MAX} + X_{MIN}}{2} = X_{AVG} \qquad \frac{.026" + .030"}{2} = .028"$$

The formula to convert this X_{AVG} to the required Shim Thickness is as follows:

$$\frac{X_{AVG}}{7} = \text{Required Shim Thickness}$$

$$\frac{.028"}{7} = .004"$$

SUMMARY: A ***.004"*** shim will create the average movement of ***.028"*** as calculated above.

In each of the (4) Conditions - **A** - **B** - **C** and **D** shown in *Figure 7.11*, this means that you will add or remove ***.004"*** of shim thickness from the existing ***.040***.

- **L.H. Vibrator Unit**

  Condition **A** - Remove ***.004"*** (.040" - .004" = .036")

  Condition **B** - Add ***.004"*** (.040" + .004" = .044")

- **R.H. Vibrator Unit**

  Condition **C** - Add ***.004"*** (.040" + .004" = .044")

  Condition **D** - Remove ***.004"*** (.040" - .004" = .036")

1. Measure and determine the **Required Shim Thickness** as demonstrated above.
2. Take the (2) L-Clamps off and lift the *SmartPac* Assembly off the Support Fixture. Set the assembly back in the vertical position with the Front Hub pointing downward.
3. Remove the Rear Hub Assembly and the Sleeve (#17).
4. Add or remove Shims (#130) to (#135) as required.
5. Place the Sleeve (#17) over the assembly. Attach with a couple of Flat Hd. Screws (#15) to check alignment. The notches should be aligned as shown in *Figure 7.15*.
6. Clean the (6) Flat Head Screws (#15) with ***Loctite Primer T***. Apply a little ***Blue Loctite #242*** to the screws and install them into the Sleeve (#17). **Torque to 14 Ft. Lbs.**

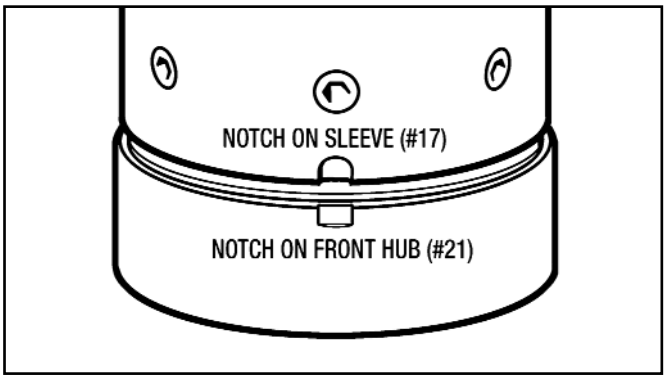


Figure 7.15 Correct Alignment of Notches

7. Make sure that the Rear Hub (#21) and the shaft where the Rear Hub seats is thoroughly cleaned of all grease and dirt.
8. Apply a film of ***Grease*** to the inner surface that contacts the Thrust Washer (#42a).
9. Lower the Rear Hub (#11) down and over the shaft.

   NOTE - This Rear Hub (#11) only has to be in an approx. position at this time.
10. With soft slings and an overhead hoist lift the whole assembly up and over to the **Support Fixture #601-SP-019**. Set it down so the flat surfaces of the Front and Rear Hubs are resting on the (4) key stock upright members of the fixture. *(See Figure 7.13)*

    This will automatically align the Rear Hub (#11) with the Front Hub (#21).
11. Compress the entire assembly with the (2) L-Clamps so that both hubs are seated solidly into the Sleeve (#17) as shown in *Figure 7.13.*
12. Prepare the Locking Ring (#12) for installation by setting a common gap between the inner and outer rings. Also apply a light film of oil on the I.D. of the Locking Ring.
13. Install the Locking Ring (#12) on the Rear Hub (#11) as per manufacturer's instructions given at the back of this manual on page 38. **Torque screws to 23 Ft. Lbs. for a new ring and 22 Ft. Lbs. for a ring previously used.**

7-10 MAIN SHAFT BEARING REASSEMBLY

(See Figure 8.4)

Clean all parts thoroughly before Reassembly.

A. Front Main Shaft Bearing

1. Place the Bearing Housing (#8) into an Arbor Press. Use the Bearing Closure (#9) to press the Roller Bearing (#7) into the Housing (#8).
2. Press the Oil Seal (#31) into the Bearing Closure (#9).
3. Press the Oil Seal (#39) into the Front Bearing Closure (#38).

NOTE - Both Oil Seals (#31) and (#39) must be installed backwards so the grease pressure can be relieved during operating time.

4. Install the (2) Grease Fittings (#10) into the Bearing Housing (#8).

B. Rear Main Shaft Bearing

1. Place the Bearing Housing (#8) into an Arbor Press. Press the Roller Bearing (#7) into the Housing (#8) until it is centered in the housing.
2. Press the Oil Seal (#31) into the Bearing Closure (#9).

   NOTE - The Oil Seal (#31) must be installed backwards so the grease pressure can be relieved during operating time.
3. Install the (2) Grease Fittings (#10) into the Bearing Housing (#8).
4. Install the Grease Fitting (#5) into the Bearing End Closure (#6).

7-11 MAIN SHAFT BEARING INSTALLATION

(See Figure 8.4)

A. Front Main Shaft Bearing

1. Place the assembled ***SmartPac*** **Vibrator Shaft** into a work bench hole with the Rotary Union (#41) facing up.
2. Apply ***Grease*** to the shaft area where the Oil Seal (#31) rides.
3. Slide the Bearing Closure (#9) with the Oil Seal (#31) in it over the shaft shoulder.

   CAUTION - Be very careful not to damage the lip of the Oil Seal (#31).
4. Clean the inner race of the Roller Bearing (#7) and the shaft bearing journal with ***Loctite Primer T.***
5. Heat the Bearing Housing (#8) and Roller Bearing (#7) to 200° F.

   CAUTION - Wear suitable work gloves when handling heated parts.
6. Slide the Spacer (#46) over the shaft until it rests on the shaft shoulder. **Make sure the inside bevel on the Spacer goes towards the shoulder.**

   NOTE - This Spacer (#46) is not used on Vibrator Shafts with a MSB Length of 27.48" or any metric length shafts.
7. Apply a generous amount of ***Blue Loctite #242*** to the shaft bearing journal.
8. Slide the heated assembled Bearing Housing (#8) and Roller Bearing (#7) over the shaft bearing journal until it seats against the Spacer (#46) or the shaft shoulder. **Be sure that the (2) Grease Fittings (#10) are facing the rotary union end of the shaft.**

   CAUTION - Wear suitable work gloves when handling heated parts.
9. Clean off any excess Loctite.
10. Apply ***Grease*** to the shaft where the Oil Seal (#39) rides.
11. Slide the Bearing Closure (#38) with the Oil Seal (#39) in it over the shaft shoulder and insert the pilot into the Bearing Housing (#8).

    CAUTION - Be very careful not to damage the lip of the Oil Seal (#39).
12. Attach with (4) Hex Hd. Screws (#3) and (4) Lockwashers (#4). **Torque to 14 Ft. Lbs.**

B. Rear Main Shaft Bearing

Let the Front Bearing cool or clamp in place before turning in over.

1. Place the assembled ***SmartPac*** **Vibrator Shaft** into a work bench hole with the Rotary Union (#41) facing down.

Repeat Steps 2 thru 5 in previous section ***A. Front Main Shaft Bearing.***

6. Slide the Spacer (#30b) over the shaft until it rests on the shaft shoulder.

   NOTE - This Spacer (#30b) is not used on Vibrator Shafts with a MSB Length of 27.48" or any metric length shafts.
7. Apply a generous amount of ***Blue Loctite #242*** to the shaft bearing journal.

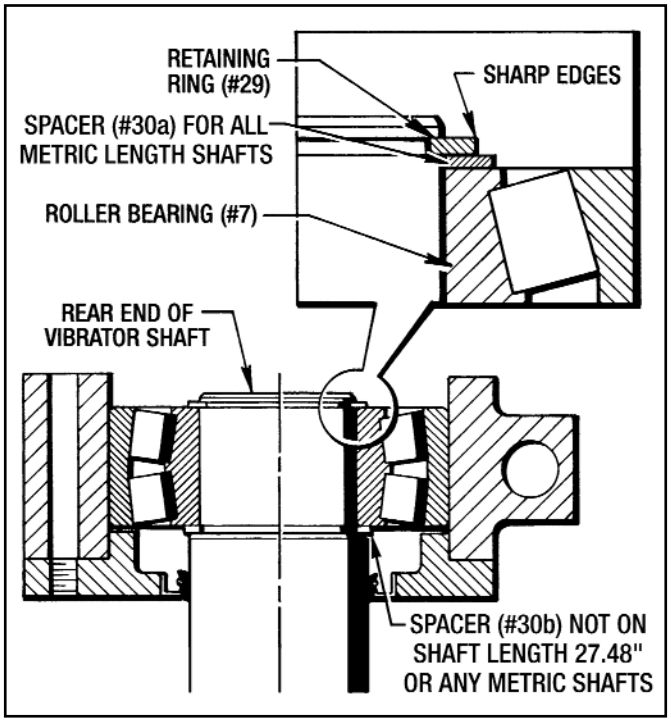


Figure 7.16 - Installing Retaining Ring (#29)

8. Slide the heated assembled Bearing Housing (#8) and Roller Bearing (#7) over the shaft bearing journal until it seats against the Spacer (#30b) or the shaft shoulder. **Be sure that the (2) Grease Fittings (#10) are facing the Rear Hub on the shaft.**

   CAUTION - Wear suitable work gloves when handling heated parts.

9. Clean off any excess Loctite.
10. Install a Spacer (#30a) on the shaft for all metric length shafts.
11. Install the Retaining Ring (#29) onto the shaft end with the sharp edges away from the bearing as shown in *Figure 7.16*. Be sure that this Retaining Ring (#29) snaps into the groove.
12. Attach the End Bearing Closure (#6) with (4) Hex Hd. Screws (#3) and (4) Lockwashers (#4). **Torque to 14 Ft. Lbs.**

7-12 LUBRICATE BEARINGS TO PREVENT RUST

After the vibrator is fully assembled, do the following:

1. Fill both the front and back bearing housings with ***NLGI Rated Synthetic Grade 2 Extreme Pressure Grease***. Fill each bearing housing with approximately 1 Fluid Oz. of Grease This step assumes new bearings have no lubrication.
2. Spray multipurpose synthetic lubricant (Besser P/N 114044) into the 0.125 inch [3.17 mm] vent hole in the Sleeve (#17) for 5 – 10 seconds to treat the interior of the assembly.

7-13 INSTALLING V-BELT PULLEY (#201) AND LOCKING ASSEMBLY (#200)

(See Figure 8.3)

1. Make sure that the shaft and bore areas are thoroughly cleaned and then lightly oiled.
2. Place the V-Belt Pulley (#201) and Locking Assembly (#200) on the shaft and as close to the Front Main Bearing as possible to reduce overhang load. **Do not torque the screws yet** .Final positioning will be determined when attaching the drive belt.
3. Remount the ***SmartPac*** **Vibrator Shaft Assembly** back on the Mold Bars as specified in **Section 4 - Installation; 4-2 Installing *SmartPac* Vibrator Shafts.**
4. Reposition the V-Belt Pulley (#201) and Locking Assembly (#200) to align with the drive belt. Torque as per manufacturer's instructions shown on **Page 41** in the back of this manual.
5. Reattach any belt guards that were removed at disassembly.

Section 8 - REPAIR PARTS

8-1 GENERAL INFORMATION

This section describes and illustrates all available repair parts for the ***SmartPac Series II*** **(Model PV2-98) Vibrator Shafts.**

Parts are identified on the exploded view drawings. The main assembly is shown on *Figure 8.2.* The *SmartPac* Control Unit is shown on *Figure 8.5.* These Reference Numbers are the same as used in the parts listing.

Several Kits are also available and they are:

1. **V-Belt Pulley and Hose Assembly Kit** is shown on *Figure 8.1.*
2. **Complete Piston Assembly Kit** is shown on *Figure 8.3.*
3. **The Assembly Tool Kit** is shown on page 30.
4. **Overhaul Kits** are also available. They are designated by * in the parts listing.

8-2 ORDERING REPAIR PARTS

Contact the Besser Central Order Department when ordering any Repair Parts or Kits. Please specify all of the following information:

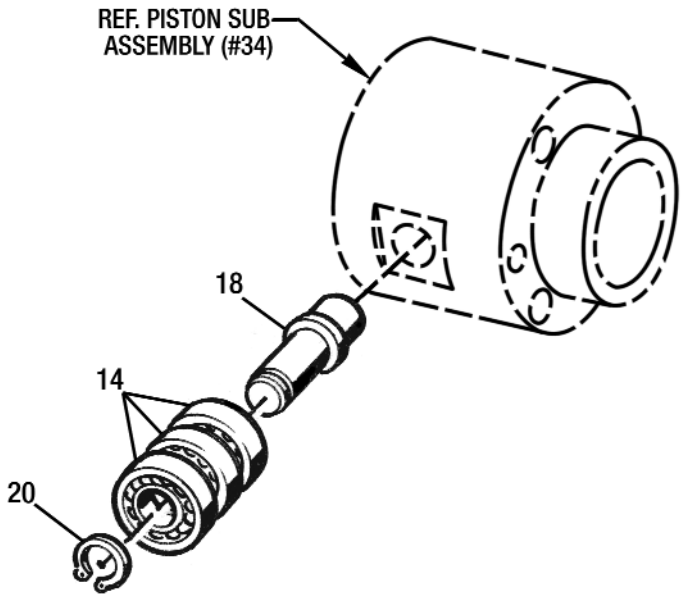
1. **Complete Model Number** (On Name Plate).
2. **Serial Number** (On Name Plate and stamped under the name plate on the Front Hub).
3. **Part Reference Number** (From Parts List and Exploded View Drawing).
4. **Part Name** (From Parts List).
5. **Quantity** (As Required).
6. **Complete Shipping Information.**

IMPORTANT - Failure to include all of the above information will only delay your parts order. Unless another method is specified for shipping information, parts weighing less than 150 Lbs. will be shipped United Parcel Service. Parts weighing more than 150 Lbs. will be shipped Motor Freight. Air freight and other transportation services are available but have to be specified on your order.

8-3 NAME PLATE INFORMATION

(This Name Plate is located on the Front Hub.)

Piston Bearing Replacement Kit



BESSER Part Number:
(#490734)

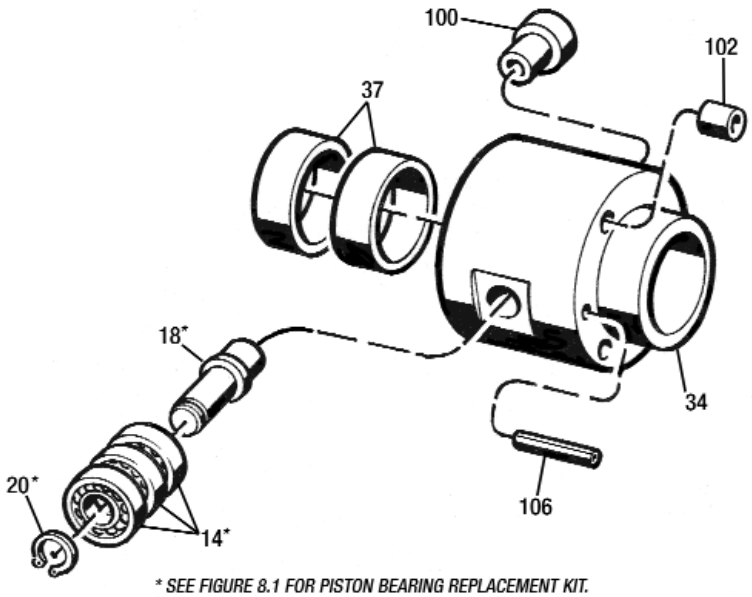
FORCE CONTROL Part Number:
(#02-SP-903-03)

INCLUDES:

- (3) Bearings (#14)
- (1) Retaining Ring (#20)
- (1) Bearing Pin (#18)

Figure 8.1 - Piston Bearing Replacement Kit

Complete Piston Replacement Kit



* SEE FIGURE 8.1 FOR PISTON BEARING REPLACEMENT KIT.

BESSER Part Numbers:
L.H. ASSEMBLY - (#490733)
R.H. ASSEMBLY - (#490735)

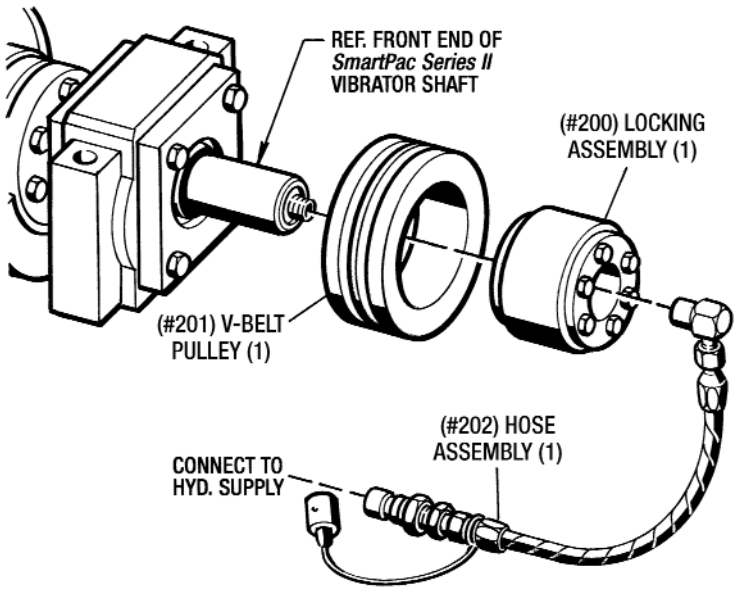
FORCE CONTROL Part Numbers:
L.H. ASSEMBLY - (#02-SP-901-03)
R.H. ASSEMBLY - (#02-SP-900-03)

INCLUDES:

- **Piston Sub-Assembly (#34A)**
  - (1) Piston (#34)
  - (2) Sleeve Bearings (#37)
  - (1) Counter Balance Pin (#100)
  - (4) Bushings (#102)
  - (2) Roll Pins (#106)
- **Piston Bearing Replacement Kit**
  - (1) Bearing Pin (#18)
  - (3) Bearings (#14)
  - (1) Retaining Ring (#20)

Figure 8.2 - Complete Piston Assembly

V-BELT PULLEY, LOCKING ASS'Y. & HOSE ASS'Y. KIT



2 Groove Pulley
(Besser Part No. 646749)
(Force Control Part No. 02-SP-904-03)

4 Groove Pulley
(Besser Part No. 646891)
(Force Control Part No. 02-SP-90X-03)

Figure 8.3 - V-Belt Pulley and Hose Assembly Kit

Repair Parts List *(Figure 8.4)*

AFC SmartPac® Series II (Model PV2-98) Vibrator Shaft

REF. No.	PART NAME	QTY.	REF. No.	PART NAME	QTY.
1	Vibrator Shaft	1	[3]*30a	Spacer, .087" Thick	AR
3	Hex Hd. Screw, 3/8"-16 x 3-1/2" Lg.	8	[3]*30b	Spacer, .087" Thick	AR
4	Shakeproof Lockwasher, 3/8"	8	*31	Oil Seal	2
*5	Grease Fitting, 1/4" Straight	1	*32	Spring	1
*6	Bearing End Closure	1	*35	O-Ring	1
7	Spherical Roller Bearing	2	*36	O-Ring	1
8	Bearing Housing	2	38	Bearing Closure	1
9	Bearing Closure	2	*39	Oil Seal	1
*10	Grease Fitting	4	*40	Retaining Ring	1
11	Rear Hub	1	*41	Rotary Union	1
*12	Locking Ring	2	[3]*42a	Thrust Washer	AR
13	Bearing Retainer	2	[3]*42b	Thrust Washer	AR
*15	Flat Hd.Screw, 3/8"-16 x 1-1/2" Lg.	6	[3]*46	Spacer, .127" Thick	AR
16	Counter Weight		101	Dowel Pin	4
	L.H. Shaft Assembly	1	107	Piston Cartridge	1
	R.H. Shaft Assembly	1	*130	Shim, .002" Thk. Red	AR
17	Sleeve	1	*131	Shim, .005" Thk. Blue	AR
19	Ball Bearing	2	*132	Shim, .010" Thk. Brown	AR
21	Front Hub	1	*133	Shim, .015" Thk. Pink	AR
22	Serial & Patent Name Plate	1	*134	Shim, .020" Thk. Yellow	AR
23	Drive Screw, #10 x 3/8" Lg.	3	*135	Shim, .025" Thk. White	AR
*29	Retaining Ring	1			

* - Indicates parts in the Overhaul Kit. (Use Part Number ***#7P-SP-Customer' Model Number*** to order an Overhaul Kit.)

[3] - See Page 34 *(Figure 8.5)* for quantity used, where used and on what shaft lengths used.

AR - As Required.

SmartPac® Series II (Model PV2-98) Vibrator Shaft

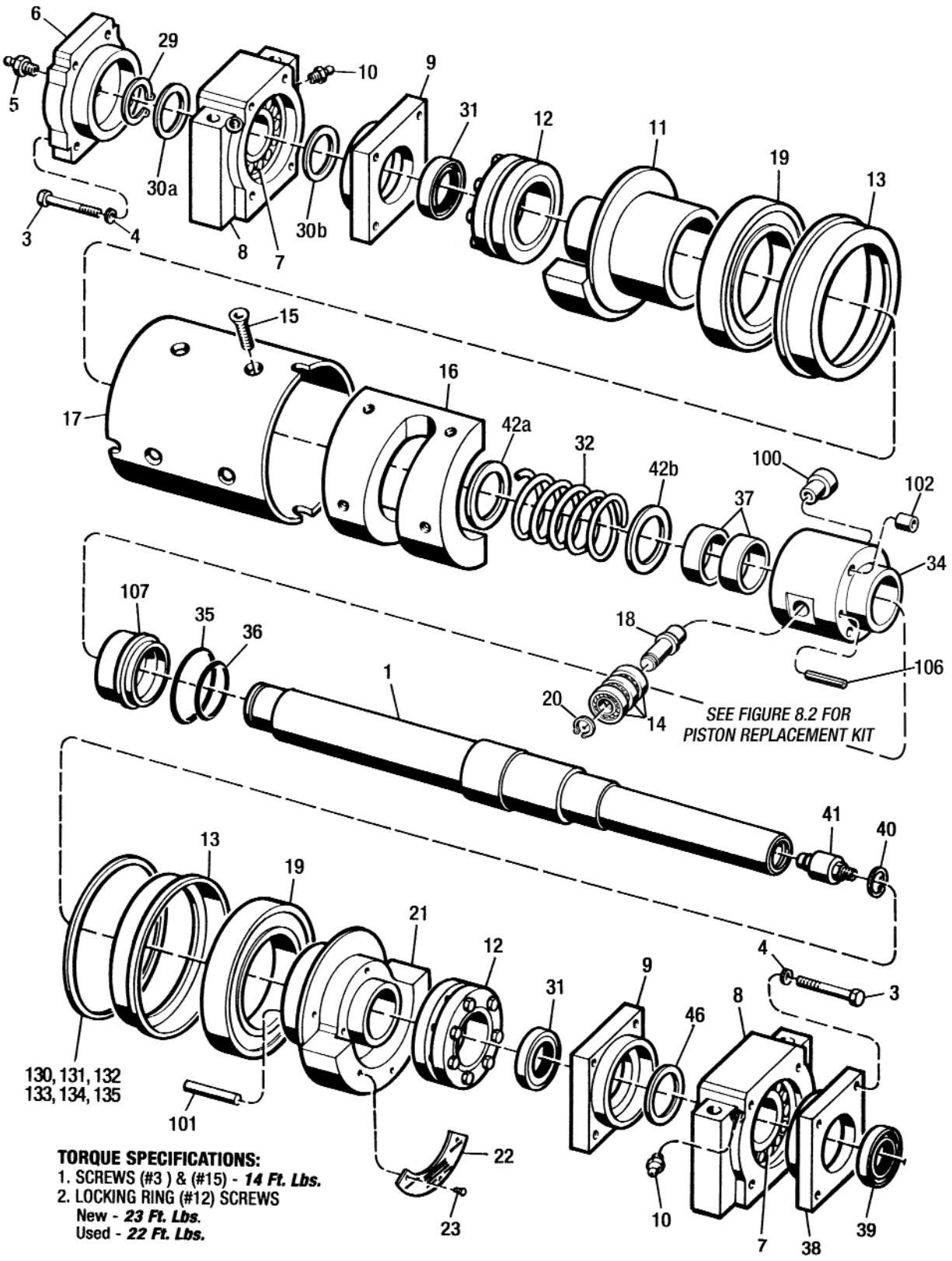


Figure 8.4 - SmartPac Vibrator Shaft Assembly

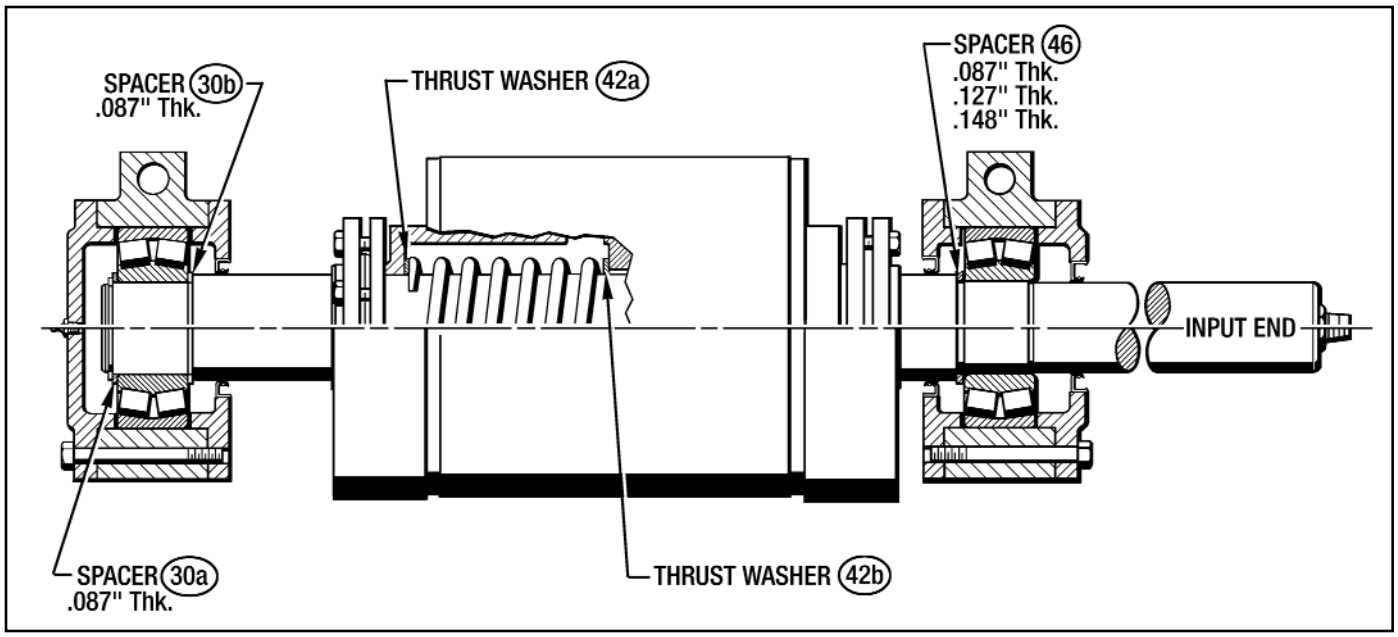


Figure 8.5 - Spacers and Thrust Washer Usage

SPACERS (#30a), (#30b) and (#46)

SHAFT CENTER DISTANCE LENGTH	.087" THICK SPACER (#30a)	.087" THICK SPACER (#30b)	SPACER (#46)
454 mm	(1)	NONE	NONE
18.047"	NONE	(1)	(1).087" Thk.
504 mm	(1)	NONE	NONE
20.047"	NONE	(1)	(1).127" Thk.
530 mm	(l)	NONE	NONE
21.047"	NONE	(1)	(1).087" Thk.
554 mm	(1)	NONE	NONE
22.047"	NONE	(1)	(1).148" Thk.
27.480"	NONE	NONE	NONE

THRUST WASHER (#42a) and (#42b)

SHAFT CENTER DISTANCE LENGTH	11,000 Lbs.		13,000 Lbs.		15,000 Lbs.	
	(#42a)	(#42b)	(#42a)	(#42b)	(#42a)	(#42b)
454 mm	NONE	(1)	NONE	(1)	NONE	(1)
18.047"	NONE	(1)	NONE	(1)	NONE	(1)
504 mm	NONE	(1)	NONE	(1)	NONE	(1)
20.047"	NONE	(1)	NONE	(1)	NONE	(1)
530 mm	NONE	(1)	NONE	(1)	NONE	(1)
21.047"	NONE	(1)	NONE	(1)	NONE	(1)
554 mm	NONE	(1)	NONE	(1)	NONE	(1)
22.047"	NONE	(1)	NONE	(1)	NONE	(1)
27.480"	(1)	(1)	(1)	(1)	(1)	(1)

Repair Parts List *(Figure 8.6)*
SmartPac® Series II (Model PV2-98) Control Unit

KEY	*BESSER* PART No.	PART NAME	QTY.	KEY	*BESSER* PART No.	PART NAME	QTY.
1	111641	5-Way Air Valve	7	8	114292	Breather	1
2	114604	Valve Assembly	2	9	114844	BKS-S33M-00 Connector	1
3	114198	Filter Assembly	1	10	114909	Q5 N5 Tandem Cylinder Ass'y.	1
4	113931	Transducer	1	11	106152	LFG-2 - 030-P Gauge	2
5	115211	BLT-5-Feet-Std.	2	12	115209	NAN-400-NO4 Silencer	1
6	115210	Magnet	1	13	115257	VXX-5524-UG-120 5-Way Air Valve	1
7	114195	Filter	1	14	115258	R26-04-000 Regulator	2

NOTE: Contact ***Besser Company*** to order any replacement parts for this *SmartPac* Control Unit.

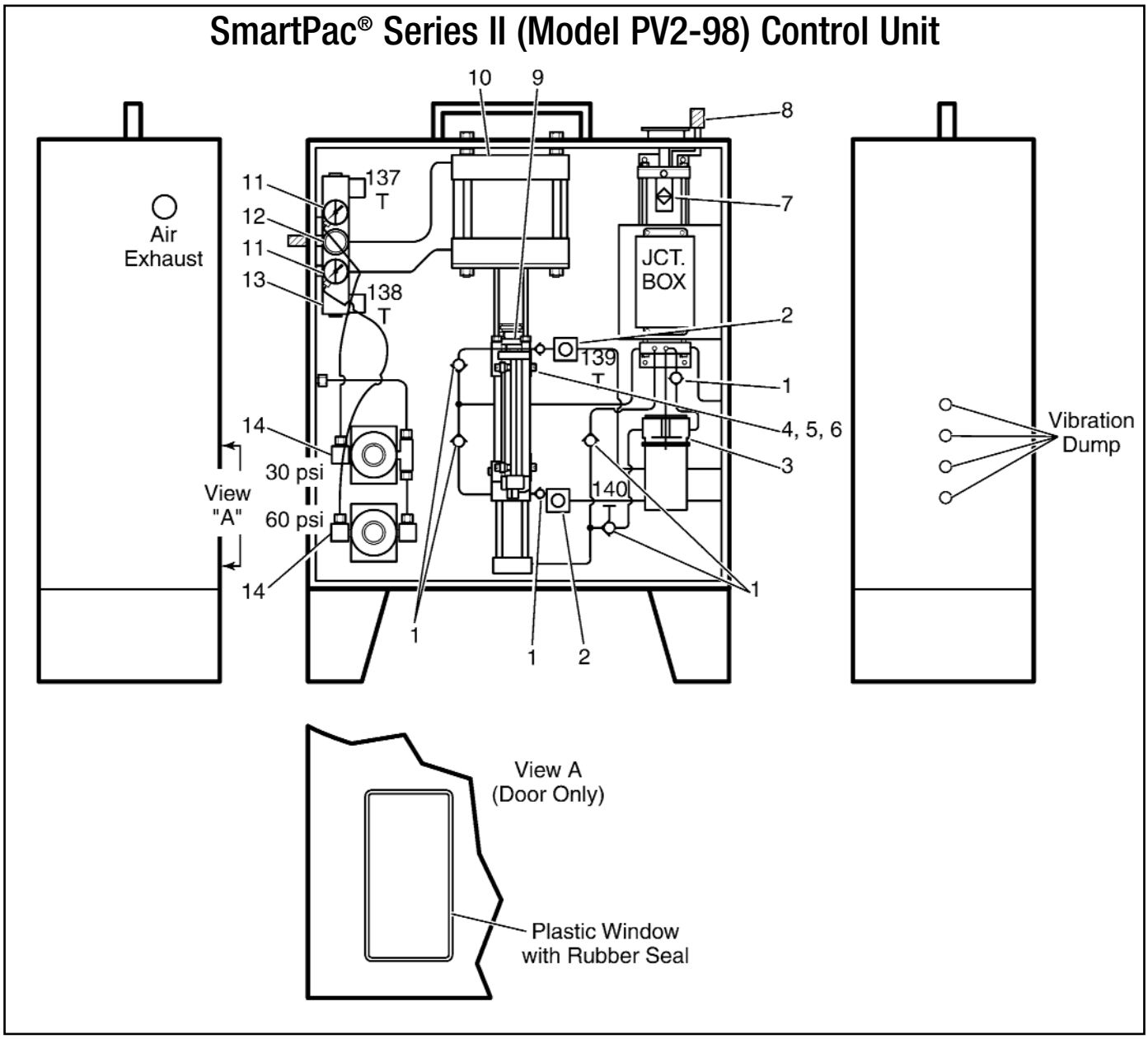


Figure 8.6 - SmartPac Control Unit

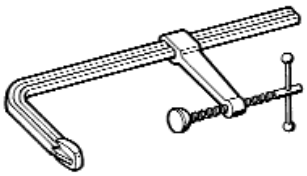
8-4 ASSEMBLY TOOL KIT for *SmartPac* VIBRATOR SHAFT

(Besser Part No. _____) (Force Control Part No. 02-SP-902-03)

1. **(2) Heavy Duty L-Clamps** *(12" to 16" Opening)*

   Wilton #6316 (or equivalent) Can be purchased at any welding supply house.

   Function - Used to compress *SmartPac* Assembly to remove and install the Rear Hub (#11).



2. **Bearing Press Tool #601-SP-013**

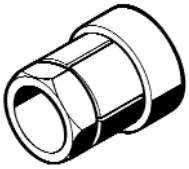
   Function - Used to install the (3) Bearings (#14) onto the Piston Bearing Assembly.

3. **Tapered Assembly Tool #601-SP-014**

   Function - Used to ease installation of parts onto the Vibrator Shaft.

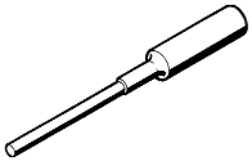
4. **Trantorque and Ring Assembly #601-SP-021**

   Function - Used as a positive stop when testing the newly installed piston for leaks.



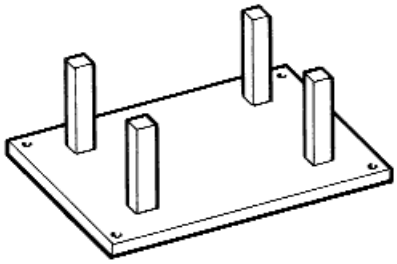
5. **Dowel Pin Remover #601-SP-018**

   Function - Used to remove the (4) Dowel Pins (#101) from the Front Hub (#21) and the (2) Dowel Pins (#106) from the Piston (#34).



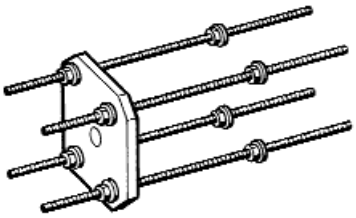
6. ***SmartPac* Support Fixture #601-SP-019**

   Function - Used to support the *SmartPac* Vibrator Shaft Assembly to align the Rear Hub (#11) with the Front Hub (#21).



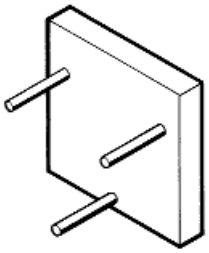
7. **Front Bearing Puller #601-SP-020**

   Function - Used to remove the Front Main Shaft Bearing from the Vibrator Shaft.



8. Bearing and Bearing Retainer Removal Tool #601-SP-023

Function - Used to remove the large Ball Bearing (#19) and the Bearing Retainer (#13) from the Front Hub (#21) & the Rear Hub (#11).



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9. Arbor Press Tool #601-SP-024

Function - Used to install the large Ball Bearing (#19) and the Bearing Retainer (#13) on to the Front Hub (#21) & the Rear Hub (#11).

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10. Bearing Removal Tool #601-SP-025

Function - Used to remove the large Ball Bearing (#19) from the Bearing Retainer (#13).

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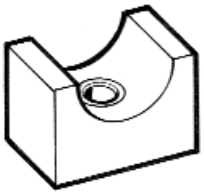
11. Piston Cradle Assembly #601-SP-027

Function - Used to support and cradle the Piston Assembly for Disassembly and Reassembly Procedure



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12. Green Loctite #609

13. Blue Loctite #242

Section 9 - FACTORY REBUILD & RAPID EXCHANGE SERVICE

9-1 FACTORY REBUILD AND RAPID EXCHANGE SERVICE

A **Rapid Exchange Service** is offered by **Force Control** exclusively through the **Besser Company.**

Features and Advantages of the Rapid Exchange Service:

1. *SmartPac* Shafts are rebuilt with genuine O.E.M. parts to assure maximum life.
2. Emergency 24 hour or same day service available.
3. Full factory warranty - Our commitment to quality.
4. Factory tested - For maximum performance**.**
5. Re-conditioned cores are factory rebuilt to latest revisions.

Before returning any units to **Force Contro**l, contact the **Besser Company Central Order Department** for shipping instructions and order processing. The Besser Company will arrange proper authorization with Force Control for ***Same Day Shipment*** of a Re-conditioned Core directly to you and the return of your old Core.

These Re-conditioned Cores are shipped in a **Returnable Shipping Container** for you to ship your old failed core directly to Force Control for a **"Core Credit".**

Neither Force Control or the Besser Company can be responsible for any units returned without following the procedures outlined.

If you are not using one of the Returnable Shipping Containers extra care must be given to the packaging of returned units. Firmly attach the shaft assembly to a suitable skid. Shipment damaged units always delay repairs. It is usually impossible to recover damage costs from the carrier. Whenever possible describe the problems you are having with the failed unit on your shipping papers.

Contact: ***Besser Central Order Department*** for complete return address.

Return to: ***Force Control Industries, Inc.***

Section 10 - SYSTEM DIAGRAMS

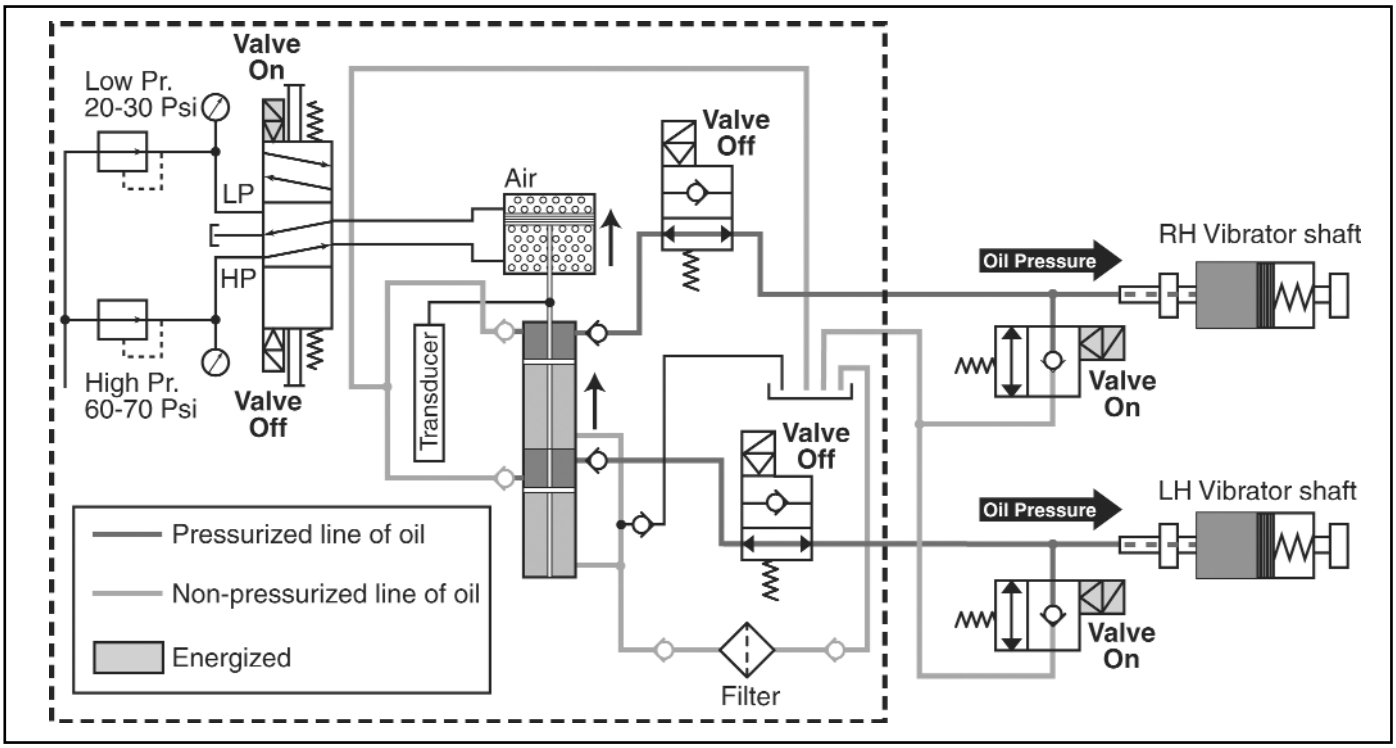


Figure 10.1 - Air-Hydraulic System Diagram - Vibration On/Full Stroke (Amplitude)

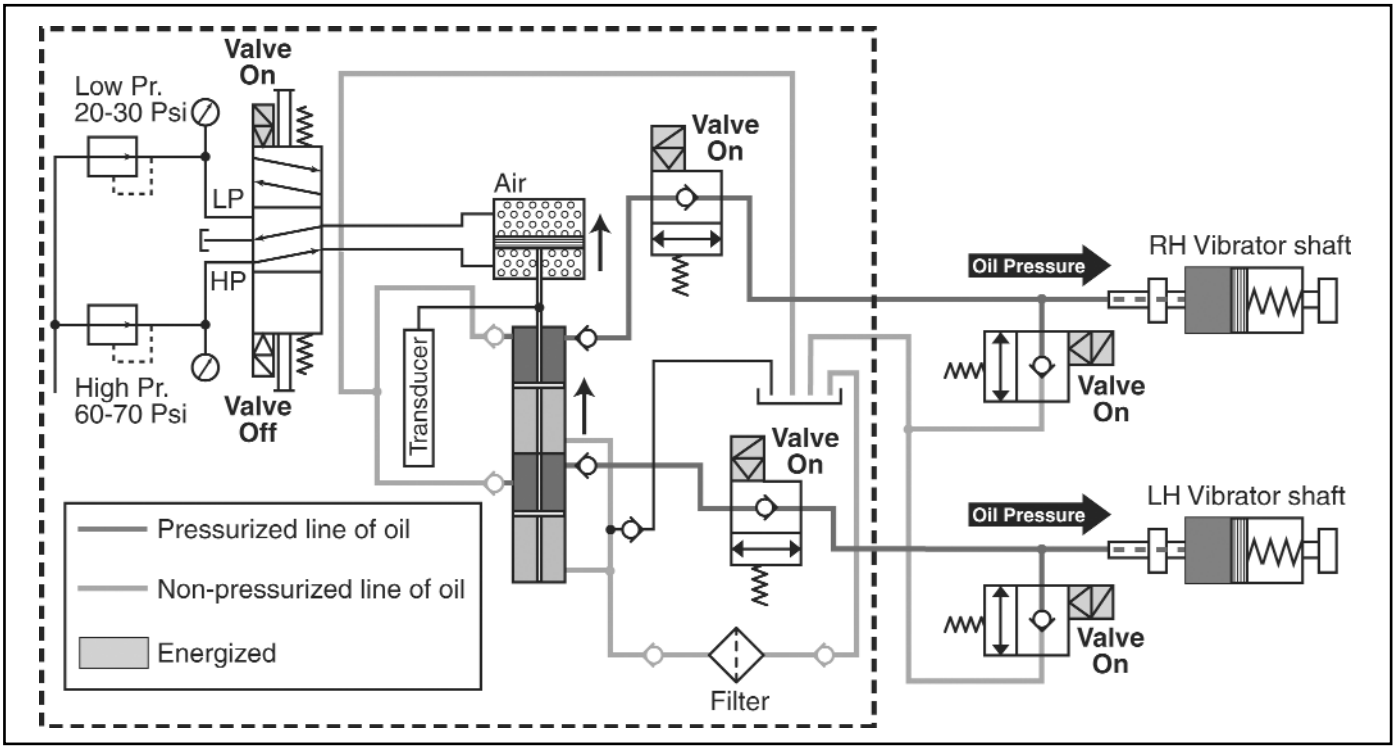


Figure 10.2 - Air-Hydraulic System Diagram - Vibration On/Half Stroke (Amplitude)

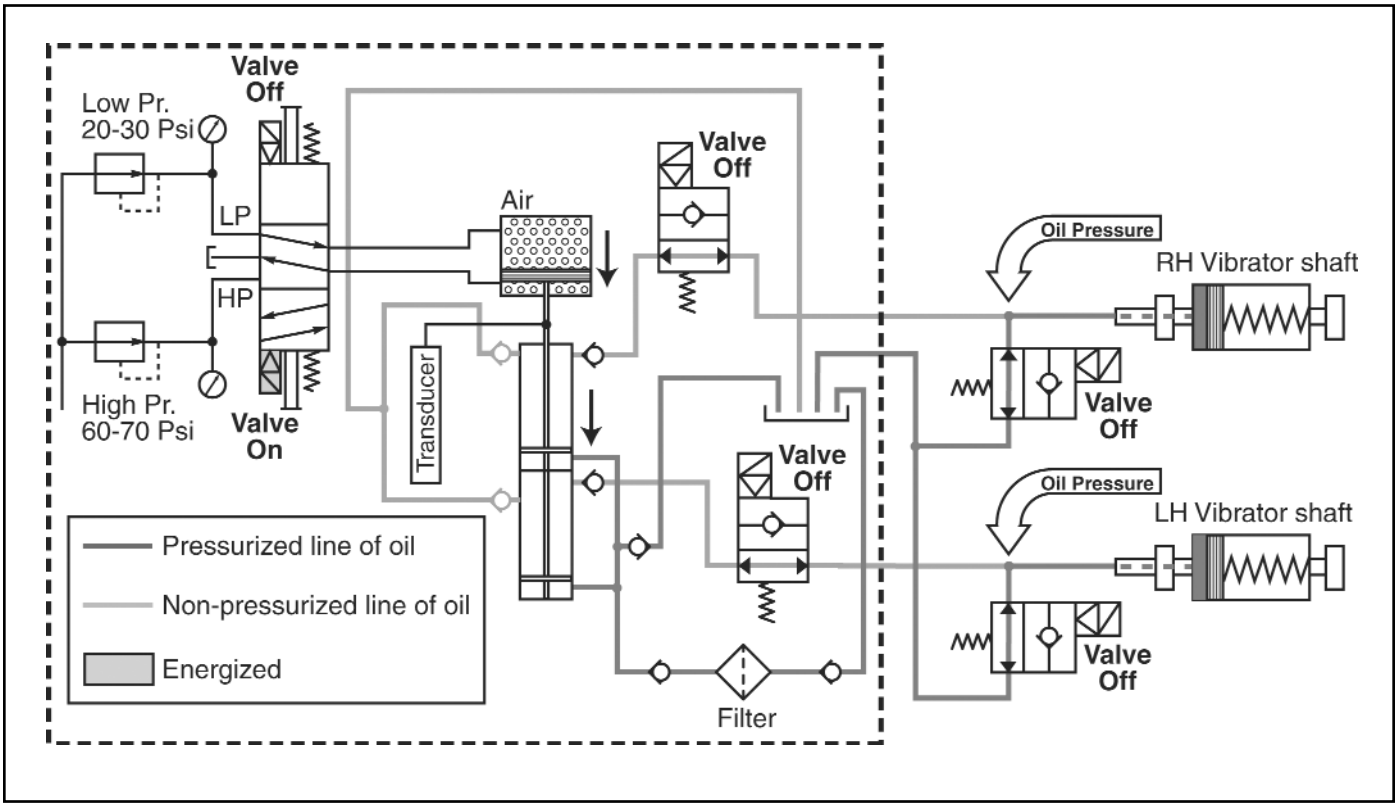
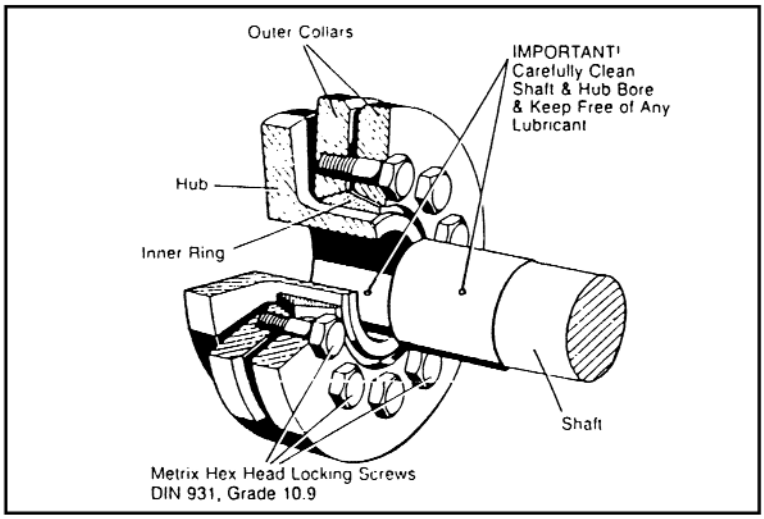


Figure 10.3 - Air-Hydraulic System Diagram - Vibration Off

INSTALLATION AND REMOVAL INSTRUCTIONS FOR LOCKING RINGS (#12)

INSTALLATION AND REMOVAL INSTRUCTIONS FOR SHRINK DISCS

Shrink Discs are supplied ready for installation. However, prior to tightening of locking screws it is necessary to remove wooden spacers located between outer collars, which are used during shipment of Shrink Discs.



INSTALLATION
Important:
Never tighten locking screws before shaft installation, since inner ring of Shrink Discs as well as hub can be permanently contracted even at relatively low tightening torques.

1 Clean hub O.D. and Shrink Disc bore and lightly lubricate hub O.D. before assembly of Shrink Disc on hub.
2 Carefully clean shaft and hub bore from any lubricant prior to mounting hub onto shaft. THIS STEP IS VERY IMPORTANT, since it will greatly affect the torque transmitting capability of a Shrink Disc connection.
3 After checking correct position of Shrink Disc and hub, handtighten 3 or 4 equally spaced locking screws and make sure that outer collars of Shrink Disc are in a parellel position. Afterwards handtighten rest of locking screws.
4 Use torque wrench and equally tighten all screws one after another in a clock or counterclockwise sequence by approx. 1/4 turns (even if initially some screws will require a very low tightening torque) until specified tightening torque M_A is reached.
NOTE: To compensate for bolt setting during installation, a 5% higher than specified tightening torque is recommended for final tightening round.
5 Reset torque wrench and make sure that no screw will turn at specified tightening torque M_A.

NOTE: It is not necessary to check tightening torque again after installation is completed or equipment has been in operation.

REMOVAL
1. Loosen locking screws in several stages by using approx. 1/2 turns, following either a clock or counterclockwise sequence till Shrink Disc can be moved on hub. DO NOT remove locking screws completely.
2. Make sure any rust buildup in front of hub is removed before hub is pulled from shaft.

RE-INSTALLATION OF SHRINK DISC
In relatively clean operating conditions, Shrink Discs can be re-used without prior cleaning. Severe conditions, however, require thorough cleaning and re-lubrication with the following or similar lubricants:

Tapers of inner rings and outer collar bores:
Molykote 3321 R-spray or
Molykote G RAPID-spray or paste

Screwthreads and head contact area:
Multipurpose grease like Molykote BR-2

Damaged O-rings should be replaced.

LOCKING SCREW-TIGHTENING TORQUES "MA"

screw size	M5	M6	M8	M10	M12	M16	M20	M24	M27
s mm	8	10	13	17	19	24	30	36	41
MA [Nm]	5	12	30	59	100	250	490	840	1250
MA [ft.-lbs]	3.6	8.7	22	44	74	185	362	620	922

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INSTALLATION AND REMOVAL INSTRUCTIONS FOR LOCKING ASSEMBLY (#200)

INSTALLATION AND REMOVAL INSTRUCTIONS FOR SERIES B-115.0 LOCKING ASSEMBLIES

Series B-115.0 locking assemblies fit straight-thru hub bores. Their unique design assures a concentric fit without the use of pilot bushings or a pre-centering hub section.

INSTALLATION

Locking assemblies are supplied ready for installation. However, if for some reason they have to be disassembled, make sure that in addition to lined-up slits in all collars, near and far-side clamp collars are not reversed. They are assembled correctly only if there are no holes or threads behind taps in clamp collar item no. 1. Likewise, there must be no threads behind taps in center collar item no. 3 as illustrated in fig. 2. The frictional torque capacity of these devices is based on a coefficient of friction of 0.12 for lightly oiled screw, taper, or shaft and bore contact areas. **Therefore, it is important not to use Molybdenum Disulfide, e. g. , Molykote, Never-Seeze or similar lubricants in any locking assembly installation.**

1. Make sure shaft and bore contact areas are clean and lightly oiled.
2. Loosen all locking screws by a minimum of 2 turns and transfer at least 2 screws to push off threads in clamp collar item no. 1 and center collar item no. 3 in order to disengage tapers for easy installation of locking assembly (see fig. 2).
3. After installation of locking assembly, relocate locking screws used for separation of collars.
4. Hand tighten connection and assure that collar item no. 1 is parallel with face of part to be attached to shaft.
5. Use torque wrench and set it approximately 5% higher than specified tightening torque Ma. Torque screws in either a clockwise or counter clockwise sequence, using only 1/4 turns (It is not necessary to tighten in a diametrically opposite pattern) for several passes until 1/4 turns can no longer be achieved.
6. Still apply overtorque for 1 to 2 more passes. This is required to compensate for a system-related relaxation of locking screws since tightening of a given screw will always relax adjacent screws. Without overtorquing, an infinite number of passes would be needed to reach specified tightening torque.
7. Reset torque wrench to specified torque and check all locking screws. No screw should turn at this point, otherwise repeat step "6" for 1 or 2 more passes. It is not necessary to re-check tightening torque after equipment has been in operation.

NOTE: In installations subjected to extreme corrosion, the slits in clamp collars item "1" and "2" as well as in center collar item "3" should be sealed with a suitable caulking compound or otherwise.

LOCKING ASSEMBLY METRIC SIZES	SCREW SIZE Metric Din 912 Grade 12.9	Tight Torque M_a ft.-lb.
70 x 110 to 90 x 130	M 10	60
100 x 145 to 160 x 210	M 12	105
170 x 225 to 200 x 260	M 14	166
220 x 285 to 260 x 325	M 16	257
280 x 355 to 340 x 425	M 20	500
360 x 455 to 600 x 695	M 22	675

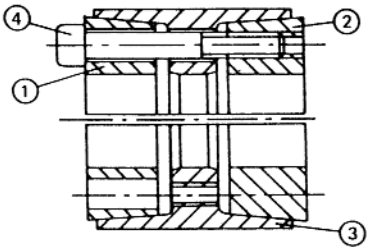

Figure 1

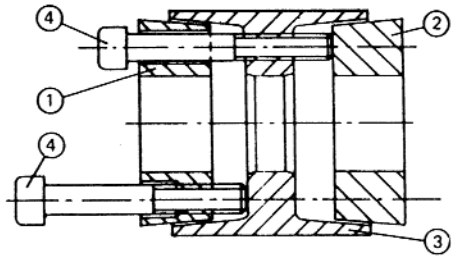

Figure 2

REMOVAL (refer to fig. 2)

IMPORTANT! Make sure ends of locking screws used for removal are ground flat and ends are slightly chamfered to eliminate damage to screw - and collar threads during push-off.

1. Check to assure that axial movement of clamp collars - necessary for release of connection - is not restricted.
2. Remove all locking screws and transfer some into all push-off threads in clamp collar item "1".
3. Release collar "1" by progressively tightening all push-off screws. Typically, the push-off screws appear to be completely tight after just one pass of tightening without any noticeable separation. Although it seems that screws can not be tightened further, several more rounds of torquing in a clockwise (or counter clockwise) sequence actually add more push-off force to the system and ultimately release part of the front collar. Afterwards, only the screws which are still tight, should be tightened further until complete dismounting is achieved.
4. Transfer locking screws used for dismounting of collar "1" to all push-off threads in center collar item "3". Release collar "2" by repeating procedures outlined in step 3.

HEX BIT SOCKET SIZES RECOMMENDED FOR ASS'Y & REMOVAL

SCREW SIZE	M8	M10	M12	M14	M16	M18	M20	M22
S (mm)	6	8	10	12	14	14	17	17
DRIVE	1/4"	3/8"		1/2"			3/4"	

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Manual Revision & Printing History

SmartPac Vibrator Shaft (Model PV2-98)

REVISION NUMBER	REVISION DATE (Mo./Yr.)	PRINTING DATE (Mo./Yr.)	REVISION/ACTION DESCRIPTION	REVISION INITIATED BY: (Name)	REVISION MADE BY: *(Name)*
502-SP-002-00	--------	12/02			
502-SP-002-01	4/03	--------	Added alignment and balancing section to Section 7	Mark House	Brooks
	2/04	--------	Removed all information concerning any Piston Disassembly and Reassembly. Piston can only be ordered as a complete assembly.	Tim Vonderhaar	Brooks
			Added important Mounting Bolt information in Installation Section, also Besser Part Numbers for special mounting bolts.	Mike Sharratt	Brooks
	4/04		Added important information about cleaning concrete dust and debris between moving surfaces before installing unit on machine in Section 5.	Ken Baker	Brooks
502-SP-002-02	8/04	--------	More Piston Bearing Changes.	Ken Baker	Brooks
502-SP-002-03	3/05		Reverted back to Ball Bearing type Piston Bearings. Changed Disassembly, Reassembly and Repair Parts. Expanded Factory Rebuild & Rapid Exchange Service to its own Section 9	Joe VonDerHaar	Brooks
502-SP-002-04	9/06		Change max speed from 3100 RPM to 2900 RPM. Changed order of installation checklist (Attach Hoses first). Added Adjust motor to checklist.	Jerry Perkins	Watkins

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