



Instruction Manual

Gaulin Homogenizers

Model 30CD



Read and understand this manual prior to operating or servicing this product.



TABLE OF CONTENTS

SECTION I	GENERAL INFORMATION	
	Introduction	3
	Damage in Transit	3
	Machine Weights and Dimensions	3
	Uncrating Instructions	3
	Location.....	3
	Removal from Skid/Packing Crate	3-4
	Adjustable Feet	4
	Machine Leveling	4
	Delayed Start-Up	4-5
	How to Order Parts	5
	How to Return Materials	5
SECTION II	INSTALLATION	
	Electrical	7
	Water Supply	7
	Lubricating Oil	7
	Gearbox Oil	8
	Belt Drive Tension & Care	9
	Product Piping	9-10
SECTION III	CYLINDER ASSEMBLY	
	Introduction	13
	Safety Considerations	13
	Design Considerations	13
	Stuffing Boxes	13
	Removal of Stuffing Boxes	14
	Installation of Stuffing Boxes	14-17
	Steam-in-Place (SIP) Flat-Back Packing	17
	Suction Valve Assemblies	17
	Removal of Suction Valve Assemblies	18
	Installation of Suction Valve Assemblies	18
	Discharge Valve Assemblies	18
	Removal of Discharge Valve Assemblies	19
	Installation of Discharge Valve Assemblies	19
	Homogenizer Pressure Gauge	21
	Removal of Pressure Gauge	21
	Installation of Pressure Gauge	21
	Pressure Transmitter	21
	Rupture Disc Assembly	21
	Removal of Rupture Disc Assembly	21
	Installation of Rupture Disc Assembly	21
	Tool List	22
	Cylinder Parts List	23
	Single-Stage Valve Assembly Parts List	25
	Two-Stage Valve Assembly Parts List	25
SECTION IV	HOMOGENIZING VALVE ASSEMBLY	
	Introduction	27
	Removal of Homogenizing Valve	27
	Installation of Homogenizing Valve	27-28

SECTION V	DRIVE ASSEMBLY	
	Skin Removal	29
	Skin Reassembly	29
	Base Disassembly	29-30
	Base Reassembly	30-32
	Drive Assembly Parts List	33
SECTION VI	HOMOGENIZER OPERATION	
	Test Operation	35
	Constant Requirements	35-36
	Starting the Machine	36
	Product Operation	36
	Shut-Down	36
	Cleaning	36
	Recommended Set-Up for Product Testing	37
SECTION VII	RECOMMENDED REGULAR MAINTENANCE	
	Inspection Checklists	38
SECTION VIII	MAINTENANCE PROCEDURES AND TROUBLE-SHOOTING	
	Introduction	39
	Product Pressure Gauge	39
	Plunger Packing	40
	Suction and Discharge Valves	40
	Homogenizing Valve	40
	Capacity Check	40-41
	Power End Lubrication	41
	Power End Tear-Down Inspection	41
	Motor Lubrication	42
	Motor Warranty	42
	Gearbox Lubrication	42
	Gearbox Warranty	42
	Machine Warranty	44
SECTION II	LIST OF ILLUSTRATIONS	
Figure 1	Gearbox	8
Figure 2	Belt Tensioning	9
Dwg. D-19572	Base Outline	11
Figure 3	Use of Packing Removal Tool	15
Figure 4	Stuffing Box Assembly	15
Figure 5	Plunger & Plunger Adapter Coupling Assembly	16
Figure 6	Removal of Suction Valve Assemblies	20
Figure 7	Removal of Discharge Valve Assemblies	20
Dwg. D-19593	Tools	22
Dwg. D-19538	Cylinder Assembly with Single-Step Homogenizing Valve Assembly ...	23
Dwg. C-19230	Two-Stage Homogenizing Valve Assembly	25
Dwg. D-19571, 1 & 2	Drive Assembly	33
Figure 8	Pressure/Amperage Chart	35
Figure 9	Recommended Set-Up for Product Testing	37
Figure 10	Typical Wiring Diagram	43

SECTION 1

GENERAL INFORMATION

Introduction

Complete familiarity with your Gaulin homogenizer and its working parts will give you an increased awareness of its superior design to handle high pressures and allow ease of operation and maintenance. Study this manual carefully. It will help you to install the machine correctly, operate it safely and efficiently, and maintain it properly.

Damage in Transit

Occasionally, a machine suffers damage during transit or unloading procedures. Inspect the exterior of the crate and, if found damaged, open the crate and inspect the machine carefully. If any damage is evident, it is your responsibility to file a claim with the carrier immediately and notify APV Homogenizer.

Machine Weights and Dimensions (Refer to Dwg. D-19572)

Total Weight: 725 lbs. (329 kg.)

Dimensions: 27-3/8"W x 31-1/4"D x 55 9/16"H
(695 mm x 794 mm x 1411 mm)

Uncrating Instructions

Instructions for uncrating your machine are attached to the shipping crate. The top and sides of the crate can be removed, prior to moving the machine to the installation area on the skids provided. Uncrating at the installation area is preferable. Reasonable care must be exercised to avoid damage to the unit during the removal of the crate.

Location

Your Gaulin machine is an integral part of your processing system, and its location as a system component should be carefully planned and selected. Ease and efficiency of operation, as well as proper maintenance, depends largely upon the thought given to final location, before the machine is actually placed in position.

The floor space required for this machine is shown in drawing D-19572. Additional space of 24" (610 mm) on all sides of the unit is required for service and maintenance operations.

Removal From Skid/Packing Crate

1. Remove top crate panel and two long side panels.
2. Remove stainless-steel back skin panel from exposed crate top.

3. Remove all loose-packed objects which include:
 - a. lubrication oil
 - b. door assembly
 - c. base cover
 - d. tool box
 - e. spare seals kit
 - f. gauge in box
 - g. top panel cover
4. Remove two short side panels.
5. Remove two, 1/2-13 UNC nuts from carriage bolts holding unit to skid.
6. With nylon strap around cast-iron base just behind front feet, raise pump assembly to the vertical position.
7. Install four adjustable feet (shipped in the tool box), as described below.
8. Move pump assembly to desired position. Set in place and adjust feet to level machine, as described below.
9. Install rear panel, as described in Section V.

Adjustable Feet

When installing the adjustable feet, make sure the threads are clean and cover them with a graphite paste, Never-Seez™ or water-resistant grease to prevent rust. Screw them up into the tapped holes in the sub-base. There is approximately 1/2" (13 mm) of total adjustment.

Machine Leveling

The unit should be approximately level for best operation. Use the machined surfaces of the cylinder block for leveling side-to-side and front-to-back. A slight tilt down and back is preferred for good lube oil flow in the drive end.

Delayed Start-Up (More Than One Month)

Often, Gaulin homogenizers are not installed and placed in operation immediately after their arrival at the job-site. As soon as possible after its arrival at the plant, the unit should be uncrated, as per instructions. After the spare parts and tools have been checked against the packing list, we suggest that they be stored in a suitable place to prevent loss and damage.

There are many removable parts in the cylinder assembly, as shown on the applicable drawing. If the start-up is to be delayed for more than one month, it is suggested that all cylinder metal parts and gaskets be removed and stored with spare parts and tools. The homogenizing valve should also be disassembled and the parts stored with above. All parts should be wrapped separately to prevent damage.

Parts in the power-end have been cleaned and lightly coated with a lubricant, prior to shipping, as a temporary protection against rust. On delayed start-up it is essential that these parts be thoroughly coated with a corrosion-proof grease or sprayed with a vapor-phase inhibitor. The complete machine should then be covered with a plastic sheet or other suitable cover to protect against weather, dirt, dampness, etc.

When the machine is installed on location, the Gaulin distributor in your area should be contacted and advised of the approximate date of initial start-up, so that assistance and correct assembling instructions can be offered.

How to Order Parts

Contact your local APV Homogenizer distributor. To help them to help you, have the following information available:

1. your machine MODEL and SERIAL NUMBER;
2. the PART NUMBER, as indicated on the "Recommended Spare Parts" list supplied with your machine or by CORRECT NAME/ITEM NUMBERS from illustrations in this manual.

Your specific machine identification data is located at the front of the manual supplied with the machine. Model and serial number will be found on the packing list. The serial number will be found on a nameplate at the rear of the piston well and a second plate is mounted on the frame behind the left side panel door.

How to Return Materials

Materials or equipment cannot be returned without first obtaining APV Homogenizers' written permission. Materials and/or equipment accepted for credit are subject to a service charge, plus all transportation charges. Materials or equipment built to order are not subject to return for credit under any circumstances. Any materials or equipment authorized for return must be securely packed to reach the Factory without damage.

SECTION II

INSTALLATION

Electrical

It is suggested that a licensed electrician be employed to insure wiring is in accordance with local codes. See typical wiring diagram, Figure 10. The main drive motor (check motor nameplate) and the push/pull switch to start and stop the main drive motor will require a power supply/wiring connection.



WARNING: BEFORE CONNECTING THE MOTOR, BE SURE THAT THE PLUNGER AND THE PACKING ASSEMBLIES HAVE BEEN REMOVED FROM THE CYLINDER.

Rotation of the main motor should be clockwise, when viewed from the pulley side. This direction of rotation is required for proper operation of the oil circulation in the drive end. Remove base cover and observe the oil flow.

Water Supply

This machine requires water for cooling the high pressure plunger packing. It is suggested that a single source of supply be located that is not affected by usage in the rest of the plant, as far as volume and pressure are concerned. It is good practice to install a solenoid shut-off valve in the water supply line, so that the water will be automatically turned on when the main motor is started and turned off when the machine is shut down.

A hand-operated valve is provided and should be installed in the line feeding the packing cooling system to control the water flow. The connection on the valve is 1/4" NPT. See drawing D-19538 for tubing (Section III).

If containment is required, a simple loop of tubing, a one to two-gallon (3.785 - 7.570 liter) container of sterile water and a pump may be rigged to circulate a slight flow of water through the system.

Lubricating Oil

This machine uses spherical roller bearings on the eccentric shaft and plain bearings in the connecting rods. An oil disc on the eccentric shaft circulates oil to crossheads and wrist pins.

All oil was drained from the power end after a run-in period at the Factory. Add the oil to the crankcase, until the oil level is 1-3/4" to 2" (45 - 51 mm) from the lowest surface of the sump. **DO NOT USE OIL OTHER THAN THAT SPECIFIED FOR YOUR PARTICULAR MACHINE.** Correct crankcase oil may be purchased from APV Gaulin. Initial quantity is shipped with the machine.

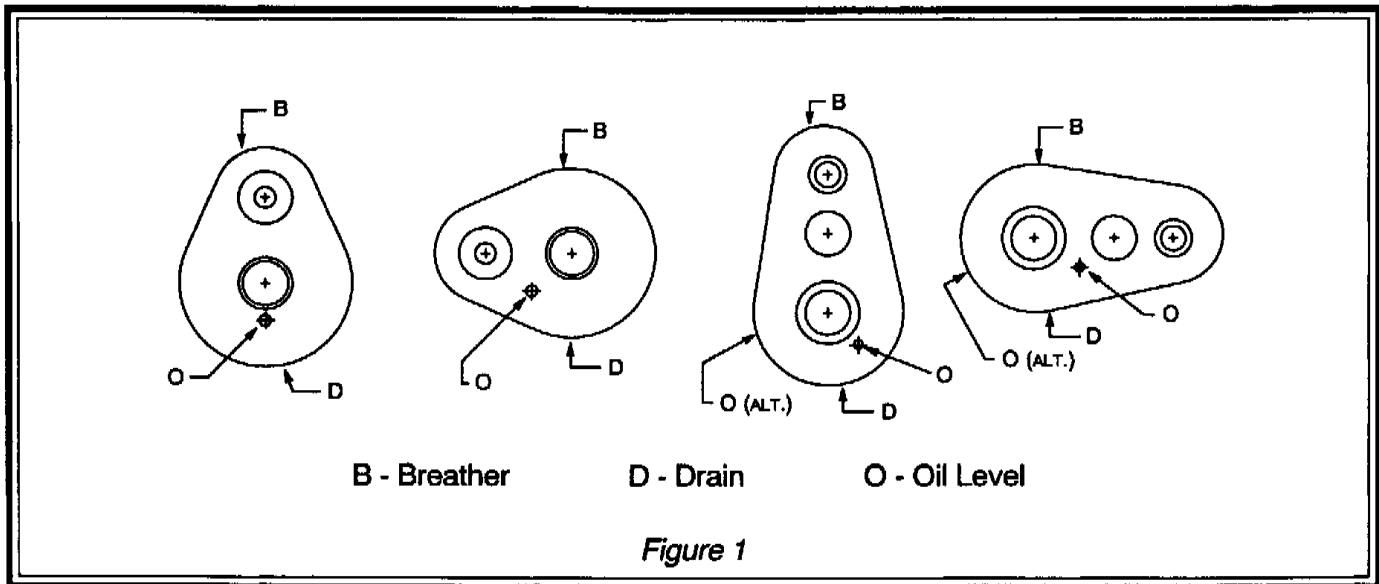
The oil required is a premium-grade, paraffinic-base, A.G.M.A. No. 5 industrial lubricating oil with a defoaming agent and oxidation and corrosion inhibitors. It has a viscosity of 1000/1165 SUS at 100°F. (37.8°C.) and 90 to 105 SUS at 210°F. (99°C.) with a viscosity index of 95, pour point 10°F. (-12.2°C.) and flash point 450°F (214.6°C.) This oil is available in one-gallon (3.785 liter) cans (Part No. 811115) and five-gallon (18.925 liter) cans (Part No. 811100). Oil capacity is approximately 5 pints (2.37 liters).

Gearbox Oil

REDUCERS ARE SHIPPED FROM THE FACTORY WITHOUT OIL. FILL THE REDUCER WITH OIL, AS ABOVE, BEFORE OPERATING THE MACHINE. Federal Gear Div. speed reducers are splash lubricated. The quantity of lubricant is one quart (.946 liters).

Each gearbox has several pipe plugs around the periphery and in the face of the unit. Their location is specifically designed so that at least one of them will give the proper oil level control no matter what position the gearbox is mounted in (see Figure 1). One of the pipe plugs around the periphery of the gearbox must be a breather plug. This breather plug is placed in the street elbow provided.

Operating temperatures as high as 200°F. (93.4°C.) will not damage the unit, provided proper lubrication is maintained. (Too little oil will also generate heat.) Normal maximum temperature is below 150°F. (65.6°C.).



The oil in a new unit should be drained at the end of 50 to 100 hours of operation and the case flushed with a light cleaning oil to remove any particle accumulation. The unit should be refilled with new oil. After the break-in interval, the oil should be changed every 2500 hours of operation or every six months, whichever comes first, under favorable conditions. Under severe atmospheric or dusty conditions or where rapid temperature changes cause condensation to occur, sludge can form, and this will make it necessary to change oil more frequently.

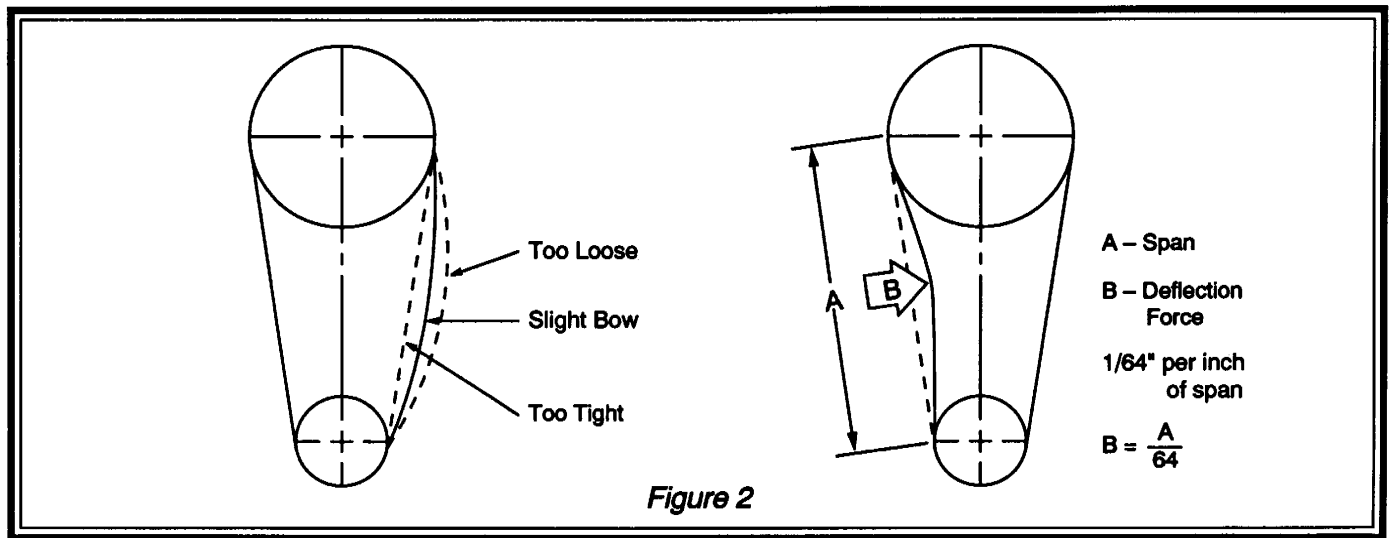
For operation in ambient temperatures between 40° and 100°F. (4.4 - 37.8°C.) use an S.A.E. #90 gear oil. Below 40°F. (4.4°C.) S.A.E. #80 and above 100°F (37.8°C.) S.A.E. #120 gear oil is recommended. Any standard-brand, extreme-pressure lubricant conforming to specification MIL-L-2105C with the above listed viscosity is recommended.

APV Gaulin cannot assume responsibility for damages caused by inadequate lubrication or maintenance. The operator or maintenance engineer must provide adequate lubrication for any gearbox installation by checking speed and temperature rise in operation.

Belt Drive Tension and Care

The tension on the V-belts will normally drop during the first few days of new machine operation or after belt replacement. During the first few days of operation, the belts will seat themselves in the sheave grooves and will require retensioning one or more times. Check belt tension often during the first days of operation and monthly, thereafter.

Observe the belts while operating the machine under its highest load condition (either when starting or under peak load.) Excessive bowing or squealing (see Figure 2) indicates improper tension. Adjust the tension on the turnbuckle to tighten the belts until, when placing a straight edge squarely across the backs of the belts at a central point between the sheaves and using moderate hand pressure, a deflection of 1/64" per inch of span is achieved. This procedure will serve to tension the belts for normal service. Torque the turnbuckle clevis bolts firmly to minimize noise (see formula in Figure 2 below).



Product Piping

It is essential that adequate product piping to the machine be provided. The suction (inlet) piping size must never be smaller than the suction (inlet) connection and should be as short as possible. When processing viscous products, a suitable feed pump or pressurized feed tank should be provided to ensure positive and adequate feed to the suction side of the pump.

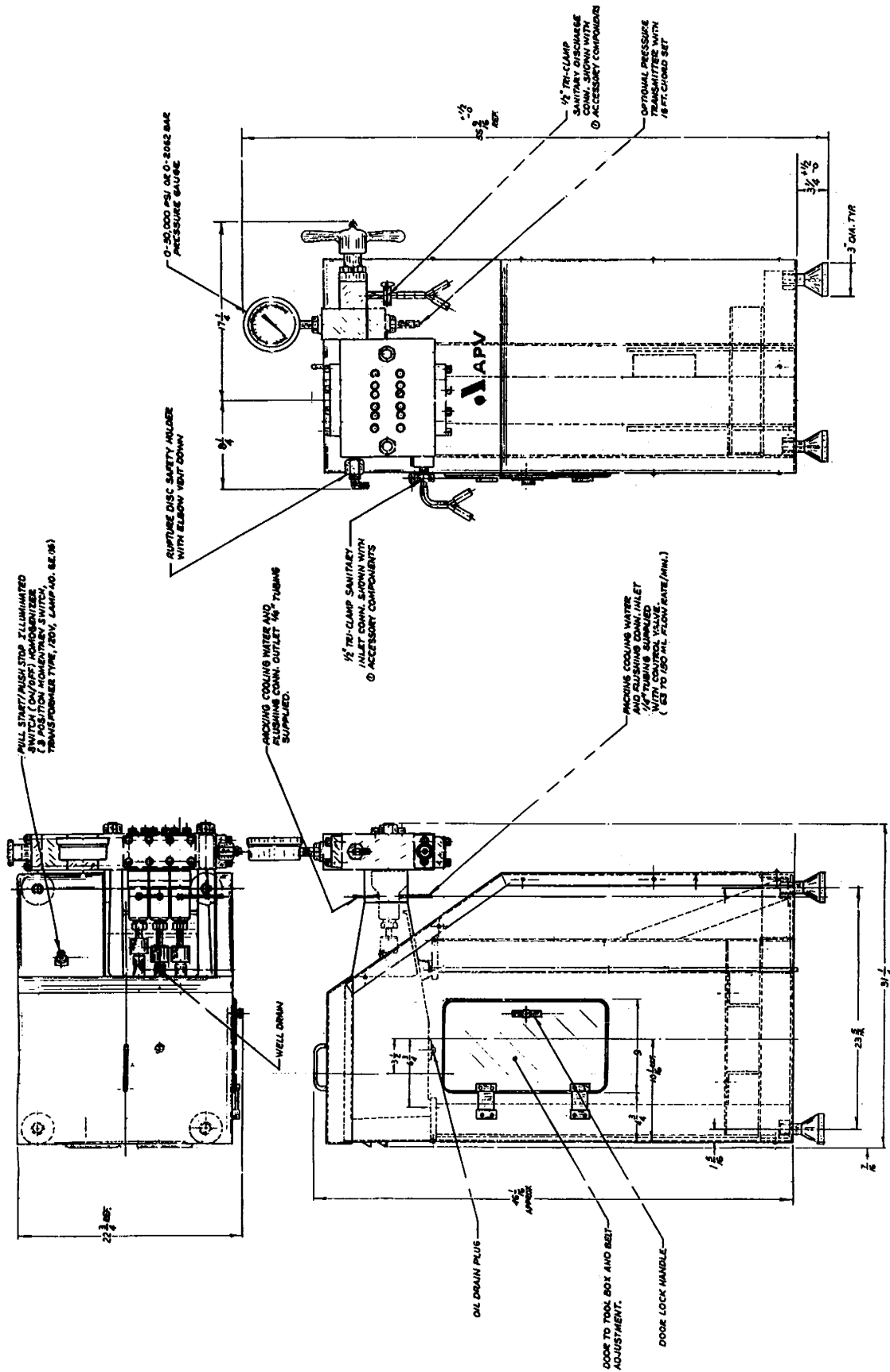
The inlet system for your homogenizer must provide a constant flow of liquid to the cylinder at a pressure sufficiently above the product's vapor pressure to prevent flashing as the liquid enters the pumping chambers. If air bubbles are entrained in the liquid or if flashing occurs in the cylinder, excessive vibration may occur in both inlet and outlet lines; volumetric efficiency will drop, and various pump and system components will fail. Small amounts of air or cavitation will result in shortened life of packing, valve seats and seals. Larger quantities of air or more severe cavitation can cause pitting of liquid-end components and catastrophic failure of the liquid pumping cylinder, crankshaft, bearing and drive-train components. The presence of air entering suction line piping can cause loud knocking in both the cylinder block and the homogenizing valve, as well as erratic fluctuation of the pressure gauge.

When constructing a piping system, the following guidelines should be considered.

1. Pipelines should not be rigidly anchored to equipment but supported so that they “float.” Pipelines expand and contract with temperature changes; and, if rigidly anchored they can damage the system.
2. The lines must be adequately supported to prevent strain on the fittings, valves and equipment connections. Proper supports are an important part of every piping system. The following general rules should be followed.
 - a. Whenever possible, avoid turns, tees and short-radius elbows.
 - b. Straight piping runs should be supported at least every ten feet.
 - c. Supports should be used on each side of every valve, as close to the connection as possible.
 - d. There should be support at each change of the pipeline direction.
3. Where pipelines pass through the walls, floors or ceilings, clearance should be provided around the pipe to allow it to move during expansion and contraction.
4. When pumping solutions of the viscosity near that of water at low temperatures (150°F./65.6°C.), a simple tubing inlet may be used if the lift is no more than from floor level. The pump will prime itself, as long as the valves are in good condition.
5. For best operation all suction piping connections should be airtight. Avoid sudden section changes in suction piping, which may hold pockets of air.



WARNING: YOUR MACHINE IS A POSITIVE-DISPLACEMENT PUMP. A THREE-WAY VALVE, DESIGNED FOR CONTINUOUS, OPEN POSITION, IS REQUIRED FOR ALTERING THE FLOW DIRECTION OF PROCESSED MATERIAL AT THE DISCHARGE DIRECTLY FROM THE UNIT. NEVER USE A FLOW CONTROL VALVE. THE FLOW OF THE PROCESSED MATERIAL MUST NEVER BE SHUT OFF WHILE THE MACHINE IS PUMPING.



DATE	BASE OUTLINE (AUG 59)
DRAWN BY	W. J. BROWN
CHECKED BY	W. J. BROWN
APP. NO.	1
REV. NO.	019572

NO.	REV.	BY	DATE
1		W. J. BROWN	8/27/59
2		W. J. BROWN	9/1/59
3		W. J. BROWN	9/1/59
4		W. J. BROWN	9/1/59
5		W. J. BROWN	9/1/59
6		W. J. BROWN	9/1/59
7		W. J. BROWN	9/1/59
8		W. J. BROWN	9/1/59
9		W. J. BROWN	9/1/59
10		W. J. BROWN	9/1/59

Drawing D-19572

SECTION III

CYLINDER ASSEMBLY

Introduction

To help understand the following cylinder instructions, please refer to the cylinder drawing, D-19538, and the tool list drawing, D-19593.

Safety Considerations

Your homogenizer is a positive-displacement, high pressure, reciprocating pump. When operating, the pressure in the pumping chambers varies from near zero during the suction stroke to full pressure during the discharge stroke. This cycle happens once every revolution in each of the pumping chambers.

This type of loading can lead to fatigue failures in the parts exposed to the fluctuating pressures. It is extremely important, therefore, that all fasteners be tightened properly to avoid fatigue failure. Please use the torque wrench provided to insure proper tightening. A properly torqued bolt will only feel the steady preload and will not fail in service. A loose bolt will experience alternating stresses and will eventually fail. The cylinder bolt torque requirements are 75 - 80 ft.-lbs. (102 - 109 N•m).

The cylinder block is precision-machined from 15-5PH, forged stainless-steel that is heat-treated to the H1150M maximum toughness. The pumping chambers are formed from hemispherical shapes interconnected by radial holes for minimum stresses under the fluctuating loading. These areas must be protected from scratches and corrosion pitting, which can initiate cracks in the block. Use only the supplied tools to disassemble the cylinder. Keep the cylinder clean and free from acids and salts which can corrode the cylinder material.

The socket-head cap screws used in the cylinder assembly are made from 17-4PH stainless steel, heat-treated to H1075 for the best combination of strength and toughness. All fasteners have been lubricated at assembly. Clean threads in stainless steel are subject to galling and seizure. A small amount of lubricant, such as Never-Seez™, dabbed on the first few threads of a new or clean screw will do the job.



WARNING: DO NOT USE SUBSTITUTE MATERIALS FOR THESE FASTENERS. NEVER ASSEMBLE CLEAN, DRY, STAINLESS-STEEL, THREADED FASTENERS.

Design Considerations

The cylinder assembly has been designed for ease of assembly and disassembly. All parts may be removed from the cylinder block without removing it from the drive end.

Stuffing Boxes

The stuffing boxes are easily serviced. They have a floating plunger and coupling adapter and use various types of single and multiple-piece packing arrangements, depending upon the application. The plungers are made of a solid ceramic with round ends and a smooth finish to provide extended packing life. A positive, low-pressure water cooling system prevents packing overheating. A steady trickle of water is adequate for proper lubrication and cooling. The general flow rate is 63 to 150 ml/min.



WARNING: TO PREVENT ANY POSSIBLE INJURY, BEFORE WORKING ON ANY PORTION OF THE MACHINE, INSURE THAT THE ELECTRICAL SUPPLY TO THE MACHINE IS DISCONNECTED.

Removal of Stuffing Boxes

For item numbers listed in this procedure, refer to drawings D-19538, D-19593 and Figure 3.

1. Remove top cover and hang it on the back by the hook provided inside the cover.
2. Using the palm of your hand on top of the pulley belts to rotate them safely, rotate the drive pulley to position the plunger (41) into the full forward position of the stuffing box (45).
3. Remove all packing cooling tubing (30) and connectors (28) from the top and bottom of the stuffing boxes. This will allow easy removal of the stuffing box assembly.
4. Do not remove the front socket head cap screws (46), until you have rotated the plunger adapter coupling (43), so that the slotted section is in the vertical position. If you cannot rotate the plunger adapter coupling, fit the socket (T12) and extension (T10) together and slide onto the socket head cap screw and rotate to loosen up. The vertical position of this coupling will permit easy removal of the stuffing box assembly from the plunger adapter (42).
5. Using the torque wrench (T2) and the hex driver (T4), break loose four front socket head cap screws (46) that secure the stuffing box to the cylinder and set them aside.
6. From the bottom, hold the stuffing box in your left hand. Using the palm of your right hand, rotate pulley and push it straight back. As you continue to push, the stuffing box (45) and plunger (41) will start to clear the cylinder block. Make sure the plunger has completely cleared the cylinder block, then lift the stuffing box assembly straight up, disconnecting it from the plunger adapter.
7. Take the stuffing box to a bench for further disassembly. Be careful not to drop and lose the face seal O-ring (52) or the plunger and coupling assembly.
8. Remove the plunger and coupling assembly and set aside.
9. Remove rear packing seal nut (51). If too tight to free up by hand, using wrench (T11).
10. Using packing removal tool (T1), install stud end of the tool into the front of the stuffing box. Rap tool until the packing adjusting ring, packing and plunger ring have slid out. See Figure 3.
11. Inspect all parts and replace as required.

Installation of Stuffing Boxes

See drawings D-19538, D-19593 and Figures 3 and 4. The stuffing box must be packed first, and the O-rings must be installed to proper parts before starting. Use a good lubricant, such as petroleum jelly, on all O-rings prior to installation.

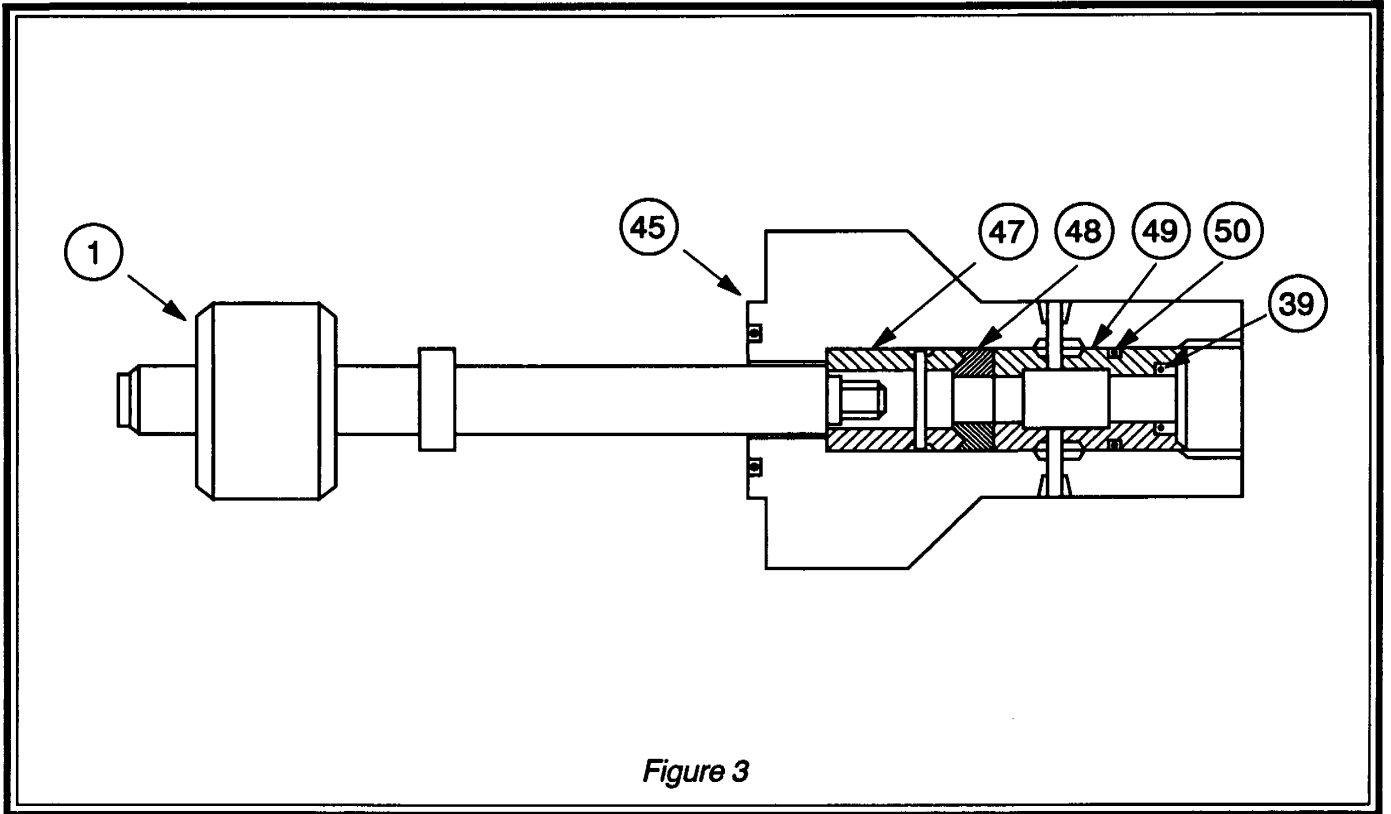


Figure 3

1. Assemble the O-ring (50) to the packing support ring (49). Slide plunger secondary seal (39) into the back of the packing support ring (49).
2. Stack the packing support ring (49), packing (48) and plunger ring with packing guide seating tool (T13) on the bottom, as shown in Figure 3. Using a good lubricant, such as petroleum jelly or equivalent, on the packing lips at both the inside and outside diameters, slide the stuffing box over the set. Push straight downward until the set has bottomed. Remove the seating tool and install the packing seal nut (51) finger-tight.

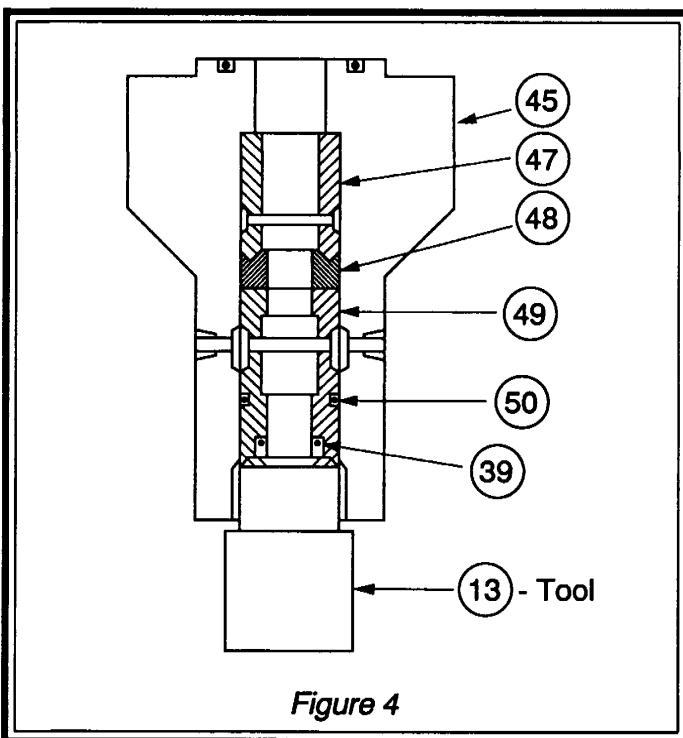


Figure 4

3. If the plunger (41) and the plunger adapter coupling (43) need to be assembled, take the plunger and slide it into the coupling, making sure that the plunger has completely bottomed into the coupling. Tighten the cap screws (44) securely, so that the plunger cannot be pulled free. Slide the plunger end into the back of the stuffing box, as shown in Figure 5.
4. Lay the stuffing box primary O-ring (52) into the front face seal groove. Coat O-ring with petroleum jelly to help it to stay in place while assembling to the cylinder.

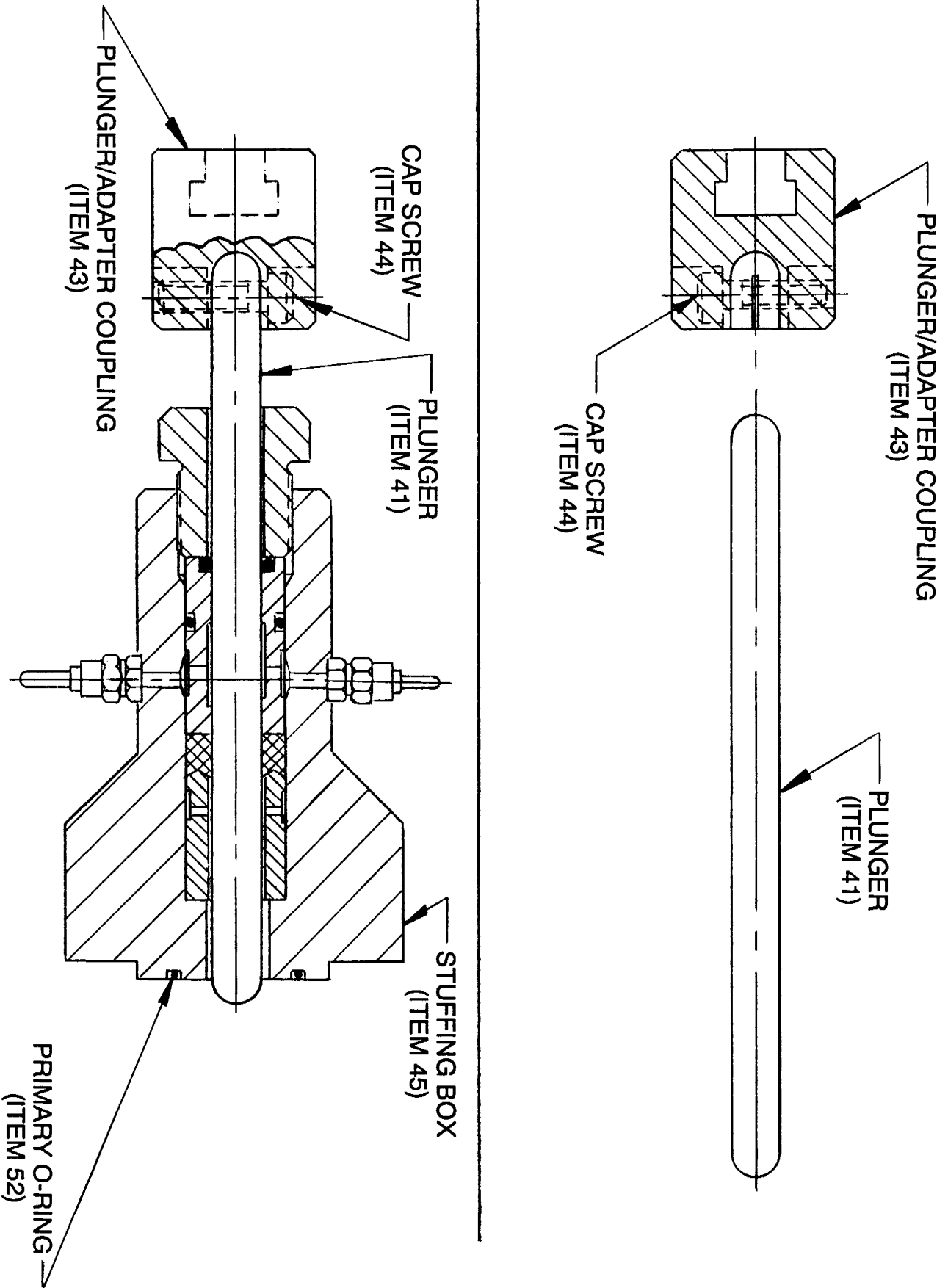


Figure 5

5. Make sure that the plunger does not stick out of the stuffing box face during assembly to the cylinder. Take the stuffing box assembly with the plunger adapter coupling slot facing up slide it over the plunger adapter. While still holding the assembly, start to push the pulley with the palm of your hand, until the stuffing box slides forward into the cylinder groove. Install the cap screws (46) and make finger-tight. Rotate the pulley backwards until the plunger is in the full forward position.
6. Rotate the plunger adapter coupling to make sure it is free. This indicates proper alignment. Torque the front stuffing box cap screws, alternating from cap screw to cap screw, one to two turns, until reaching a point where the final torque can be applied.
7. Check the plunger and coupling for proper operation. Rotate the coupling 360° two or three times. Check the plunger and make sure it moves completely back and forth through a complete stroke. If any interference exists, repeat operations 3. through 6.



WARNING: BEFORE RUNNING MACHINE, ROTATE DRIVE PULLEY MORE THAN FIVE FULL TURNS TO CHECK THAT ALL PLUNGERS ARE FULLY ENGAGED IN PLUNGER ADAPTERS.

8. After all stuffing boxes have been assembled, recheck torque of front stuffing box cap screws (75 - 80 ft.-lbs./102 - 109 N·m).
9. Reassemble all packing cooling tubing (30) and connectors (28) to top and bottom of the stuffing boxes.

Steam-in-Place (SIP) Flat-Back Packing (Sterile Applications)

After the packing has been installed into the stuffing boxes, a pre-run is recommended to qualify the packing and minimize any leakage through the primary packing into the cooling water. The packing stuffing box, end-cooling water supply must be turned on. The water flow rate should be approximately 60 to 150 ml per minute.

1. Run at 5,000 psig (345 bar) for 10 minutes.
2. Run at 10,000 psig (690 bar) for 10 minutes.
3. Run at 15,000 psig (1035 bar) for 10 minutes.
4. Run steam at 250 to 260° F. (121 to 126°C.) for 30 minutes at zero operating pressure. Allow the cylinder adequate time to cool back to approximately room temperature. Run the packing test again at 5,000, 10,000 and 15,000 for 5 minutes each. This completes the packing qualification.

Suction Valve Assemblies

See Drawings D-19538 and D-19593. Each suction valve assembly consists of a one-piece bottom plug and valve seat (13) with O-ring, self-energizing seals. The smaller seal (15) must contain full pressure in one direction, so it is backed by a tough back-up ring (16) to reduce extrusion. The suction valve (17) is a hard ceramic ball. The lift of this valve is limited by a loosely-fitted stop (18) above the ball. The three valve assemblies are held in place by a single, flat plate (12), fastened by eight socket-head cap screws (21) for maximum preload and safety.

Removal of Suction Valve Assemblies

1. Using the torque wrench (T2) and the hex driver (T4), break loose the eight socket-head cap screws (21) holding the bottom plate (12) to the cylinder.
2. Using speed handle (T3) and the hex driver (T4), remove eight screws and bottom plate.
3. Place the threaded end of the pulling tool stem through the slide hammer and thread the stem into the bottom plug (13). See Figure 6. Rap the slide hammer to pull the bottom plug. Be ready to catch the ceramic ball valve (17) and ball stop (18) as the plug is removed. If the ball stop does not drop out, it may be pulled out with the magnetic end of the pulling tool. If the ball stop hangs up, use a screwdriver in the slot to rotate and loosen it.
4. These parts may now be inspected and replaced, as required.
 - a. Inspect O-rings and back-up rings for signs of extrusion or wear.
 - b. Inspect seats for smoothness or signs of erosion where they contact the ball valve.
 - c. Inspect ball valves for chipping, roundness and smoothness.
 - d. Inspect valve stops for signs of wear. Note the diameter of the dent where the ball valve contacts. If more than about 1/16" (1.6 mm), replace it.

Installation of Suction Valve Assemblies

1. Check condition and position of O-rings and back-up rings on bottom plug.
2. Screw the pulling tool (T1) stem into the bottom plug. Lubricate the O-rings with water.
3. Hold the plug upright, place the ball valve (17) in the seat and place the valve stop (18) on top of the plug.
4. Push parts stack up into the cylinder, flush with the surface, and unscrew the tool. The compressed O-rings will hold the plug in place.
5. When all plugs are installed, hold the bottom plate in place and install the eight socket-head cap screws (21), using the speed handle (T3) and the hex driver (T4).
6. Using torque wrench (T2) and hex drive (T4), torque all screws to 75 - 80 ft.-lbs (102 - 109 N•m).

Discharge Valve Assemblies

See Drawings D-19538, D-19593 and Figure 7. A discharge valve assembly consists of a one-piece top plug and valve seat (3) with O-ring, self-energizing seals. Both O-rings (8 & 4) must contain full pressure in one direction, so they are backed by a tough back-up ring (9 & 5) to reduce extrusion. The discharge valve (6) is a hard, smooth, round, ceramic ball. A bullet-shaped stop (7) is located above the valve and is held in position by a spacer (10) to limit the lift of the ball. The stop is fitted with an O-ring (19) and back-up ring (20) to contain full pressure. The three valve assemblies are held in place by a single, flat plate and fastened by eight socket-head cap screws (11) for maximum preload and safety.

Removal of Discharge Valve Assemblies

1. Using the torque wrench (T2) and the hex driver (T4), break loose the eight socket-head cap screws (11) holding the top plate.
2. Using the speed handle (T3) and the hex driver (T4), remove the eight screws and top plate.
3. Using the magnetic end of the pulling tool (T1), remove three stop spacers from the top plugs.



WARNING: DESIGN OPERATING PRESSURE OF THE 30CD HOMOGENIZER IS 15,000 PSI (1035 BAR). DO NOT EXCEED THIS PRESSURE FOR STEADY RUNNING.

4. Place the threaded end of the pulling tool through the slide hammer and thread it into the top plug. See Figure 7. Rap the slide hammer gently to pull the top plug assembly.
5. Unscrew pulling tool and, using the 1/8" (approximately 3.17 mm) hex key of the Allen Jackey set (T7), push the ball valve (6) and discharge valve stop (7) out of the plug (3).
6. These parts may now be inspected and replaced as required.
 - a. O-rings and back-up rings should be inspected for signs of extrusion and wear.
 - b. Valve seats should be inspected for smoothness and signs of erosion.
 - c. Ball valves should be inspected for chipping, roundness and smoothness.
 - d. Valve stops should be inspected for signs of wear. Note the diameter of the dent where the ball valve contacts. If more than about 1/16" (1.6 mm), replace it.

Installation of Discharge Valve Assemblies.

1. Check condition and position of O-rings (4) and back-up rings (5) on top plug.
2. Lubricate O-rings with rubber lubricant or petroleum jelly and push top plugs into cylinder.
3. Drop ball valves into top plug holes.
4. Check condition and position of O-ring (8) and back-up ring (9) on discharge valve stop (7). Lubricate O-ring with rubber lubricant and push it into top plug hole.
5. Place stop spacer (10) in hole and push down, flush with top plug.
6. With three plugs installed, place top plate and install eight socket-head cap screws (11), using the speed handle (T3) and the hex driver (T4).
7. Using wrench (T2) and hex driver (4), torque all screws to 75 - 80 ft. lbs. (102 - 109 N•m).

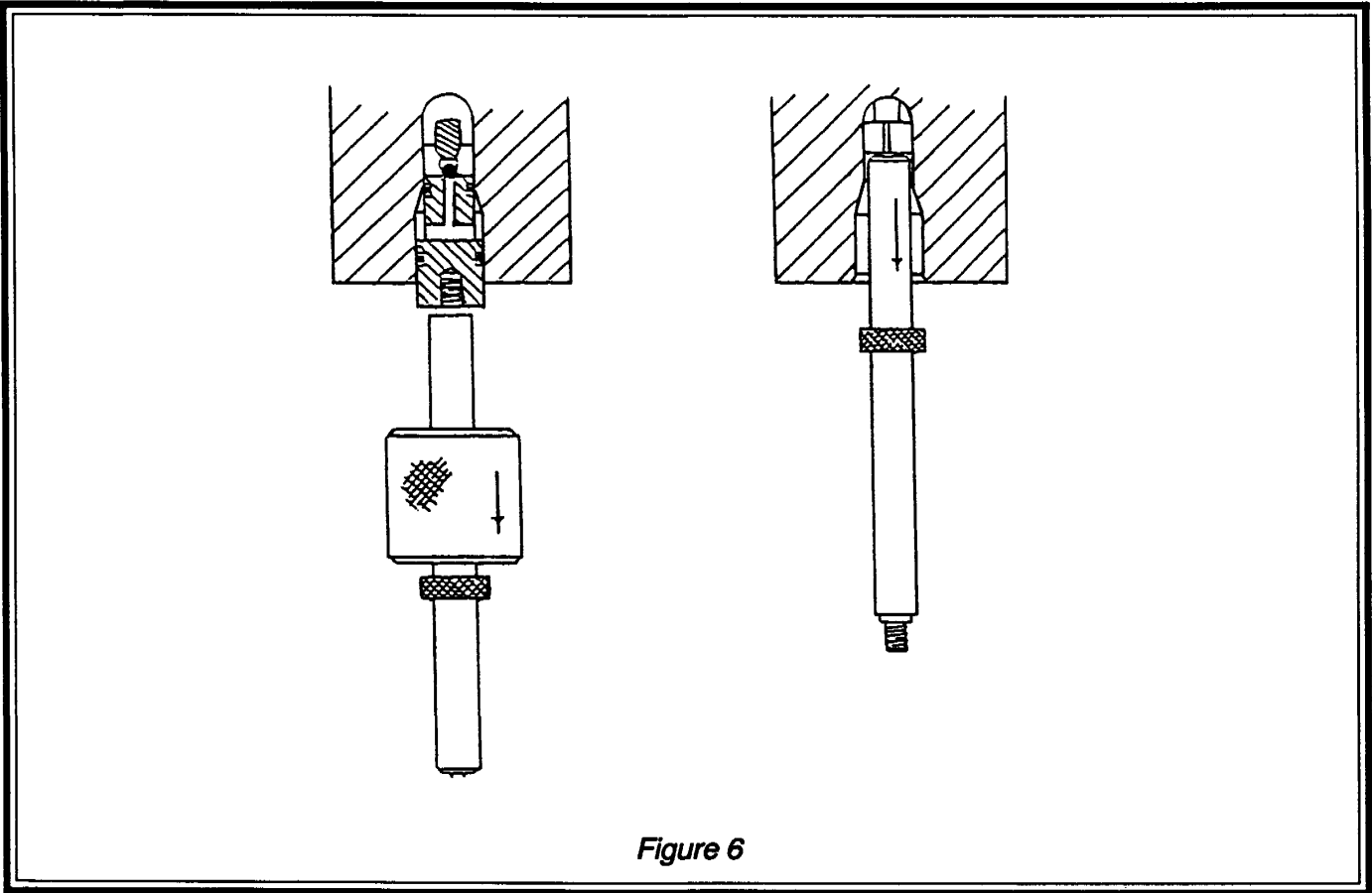


Figure 6

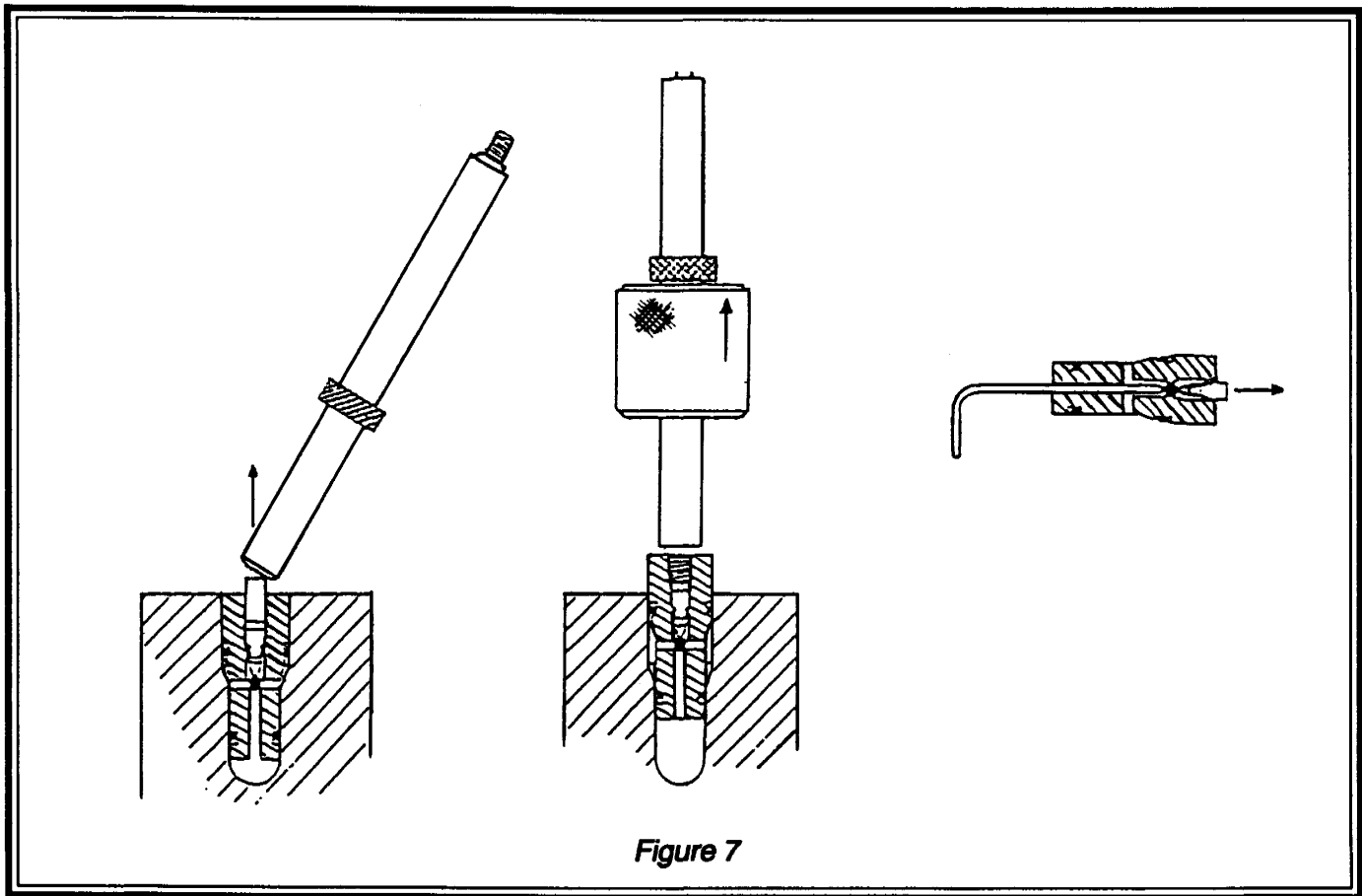


Figure 7

Homogenizer Pressure Gauge

See Drawing D-19538 and D-19593. The pressure gauge (31) shipped with your machine is a delicate instrument and subject to damage through careless handling. Specially designed for high pressure application, it is a diaphragm-type and liquid-filled to dampen pressure spikes.

Removal of Pressure Gauge

Unscrew the pressure gauge retaining screw and remove gauge with the O-ring (35) and back-up ring (36) from the gauge block (75). If the O-ring and back-up ring have not been removed with the gauge, remove them separately and inspect for extrusion.

Installation of Pressure Gauge

Lubricate O-ring (35) and back-up ring (36) with petroleum jelly or lubricant. Install onto bottom of the pressure gauge (32) in the sequence shown on drawing D-19538. Install the pressure gauge into the gauge block. Tighten the gauge retaining screw.

Pressure Transmitter

Identical to the removal and installation of the pressure gauge.

Rupture Disc Assembly

See Drawing D-19538. A rupture disc assembly is fitted to protect the cylinder from over-pressure. The assembly is integrated into the cylinder block and terminates in a tubing connection to direct and contain blow-off in the event of over-pressure. The hat-shaped rupture disc (55) will burst at 24,600 psi (1697 bar). Damage to the disc such as scratches or pitting will result in premature failure. The torque required to seal and hold the disc is approximately 250 ft.-lbs. (339 N•m).

Removal of Rupture Disc

1. Remove the homogenizing valve assembly, including the gauge block (75) and any other components at the discharge end of the cylinder assembly.
2. Unscrew rupture disc nut (58) using socket (T18), drive handle (T20) and a three-foot length of pipe over the drive handle. Loosen the rupture disc nut by lifting upward (counter-clockwise).
3. Remove top plate (2), cap screws (11) and three discharge valve assemblies.
4. Slide out the spacer (57), rupture disc ring (56) and rupture disc (55) by inserting 1/8" diameter by 16" long (3.18 mm x 406.4 mm) tubing down the discharge port, until it touches the rupture disc. Push against the rupture disc until all parts are removed from the rupture disc port.
5. Inspect the disc for scratches and corrosion. Replace, if required.

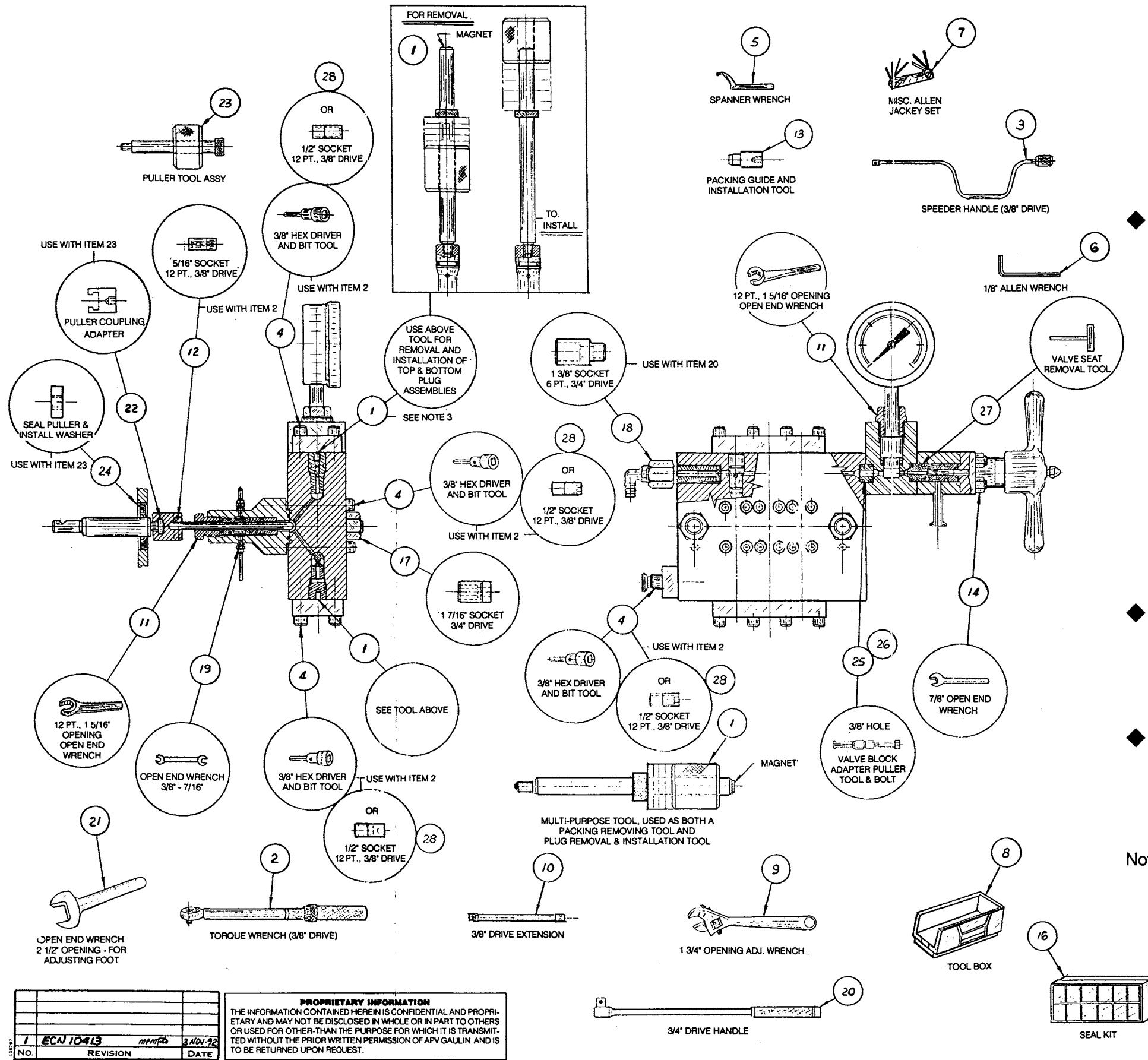
Installation of Rupture Disc

1. Install rupture disc (55), rupture disc ring (56) and spacer, one piece at a time, making sure that the rupture disc (55) is assembled as shown on Drawing D-19538.
2. Install rupture disc nut (58) and torque to approximately 250 ft.-lbs. (334 N•m).

Tool List

- T1 Puller Assembly Tool
Stem
Slide Hammer
Magnet
Socket-Head Set Screw
- T2 Torque Wrench, 3/8" (9.5 mm) drive
- T3 Speeder Handle, 3/8" (9.5 mm) drive
- T4 Hex Driver and Bit, 3/8" (9.5 mm)
- T5 Spanner Wrench, 2-3/4" to 4-3/8" x 11-3/8" long
(70 to 111 x 289 mm long)
- T6 Allen Wrench, 1/8" (3 mm)
- T7 Allen Jackey Set
- T8 Tool Box, Plastic
- T9 Adjustable Wrench, 15" (381 mm) long
- T10 Extension, 3/8" (9.5 mm) drive x 6" (152 mm) long
- T11 Open-End Wrench, 1-15/16" (49 mm) opening, 12 point
- T12 Socket, 5/16" (8 mm) opening, 12 point
- T13 Packing Guide and Installation Tool
- T14 Open-End Wrench, 7/8" (22 mm) opening x 8-1/4" (210 mm) long
- T15 Rubber Lubricant, one pint
- T16 Seal Kit Sub-Assembly
- T17 Socket, 1-7/16" (37 mm) opening, 3/4" (19 mm) drive
- T18 Socket, 1-3/8" (35 mm) opening, GPT., 3/4" (19 mm) drive
- T19 Open-End Wrench, 3/8" - 7/16" (9.5 - 11 mm)
- T20 Drive Handle, 3/4" (19 mm) drive
- T21 Open-End Wrench, 2-1/2" (63.5 mm) opening
- T22 Puller Adapter Tool
- T23 Puller Tool Assembly
Puller Rod
Slide Hammer
Set Screw
- T24 Seal Puller & Installation Washer
- T25 Valve Block Adapter Puller Tool, 3/8" (9.5) hole maximum
- T26 Bolt, 5/8" (16 mm) - 18 UNF - 2A x 2" (51 mm) long
- T27 Valve Seat Removal Tool Assembly
Rod
Handle
- T28 Socket 1/2" (12.7 mm) opening, 12 point, 3/8" (9.5 mm) drive.

- Notes: 1. See applicable section for proper use of tools.
 2. (◆) symbol indicates special tools required for servicing power end assembly.
 3. When servicing, the discharge valve stop in the cylinder assembly (7) must be removed with the magnet on the end of the puller tool, before puller tool can be used.



NO.	REVISION	DATE
1	ECN 10413	3 NOV 92

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APV Gaulin, Inc. Wilmington, Mass., U. S. A.		
TITLE	TOOL LIST (30CD-3)	
DR. N. P. Milo	DATE	5 June 92
DWG. NO. D-19593	REV.	1

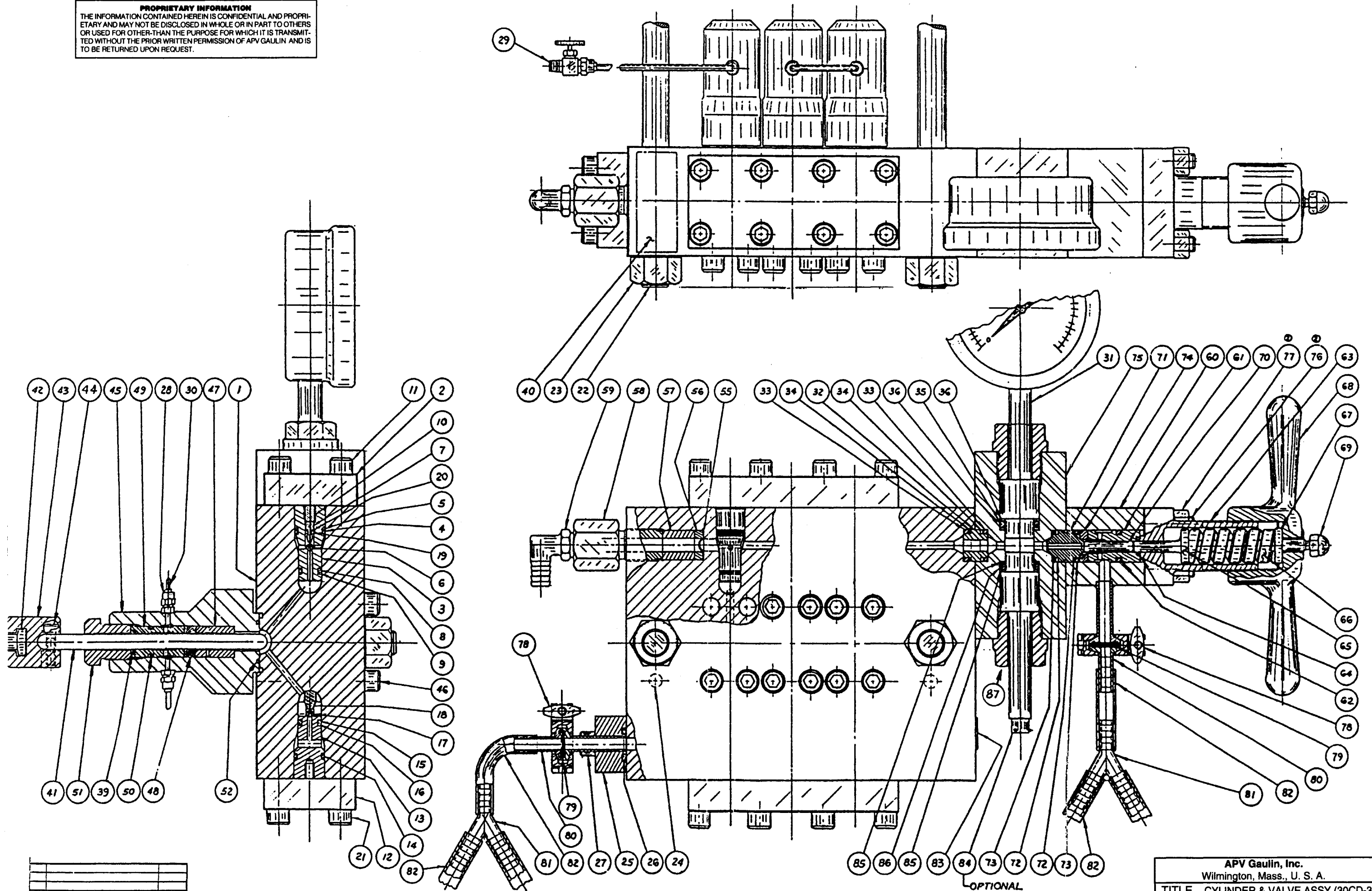
Drawing D-19593

CYLINDER AND SINGLE-STAGE HOMOGENIZING VALVE ASSEMBLY PARTS LIST

Item	Description	Qty.	Item	Description	Qty.
1	Cylinder Block	1	44	Plunger & Adapter Coupling Socket	
2	Top Cap Plate	1		Head Cap Screw	3
3	Top Plug/Discharge Seat	3	45	Stuffing Box	3
4	Top Plug O-Ring	3	46	Stuffing Box Socket Head Cap Screw	12
5	Top Plug Back-Up Ring	3	47	Plunger Ring	3
6	Discharge Ball Valve	3	48	Plunger Primary Packing	3
7	Discharge Valve Stop	3	49	Packing Support Ring	3
8	Discharge Valve O-Ring	3	50	Packing Support Ring O-Ring	3
9	Discharge Valve Back-Up Ring	3	51	Packing Seal Nut	3
10	Discharge Stop Spacer	3	52	Stuffing Box Primary O-Ring	3
11	Top Cap Plate Socket Head Cap Screw	8	53	N/A	
12	Bottom Cap Plate	1	54	N/A	
13	Bottom Plug/Suction Seat	3	55	Rupture Disc	1
14	Bottom Plug O-Ring	3	56	Rupture Disc Ring	1
15	Suction Valve O-Ring	3	57	Spacer	1
16	Suction Valve Back-Up Ring	3	58	Rupture Disc Nut	1
17	Suction Ball Valve	3	59	Elbow	1
18	Suction Valve Stop	3	60	Valve Body	1
19	Discharge Valve Stop O-Ring	3	61	Valve Guide	1
20	Discharge Valve Stop Back-Up Ring	3	62	Valve Guide O-Ring	1
21	Bottom Cap Plate Socket Head Cap Screws	8	63	Handwheel Support	1
22	Cylinder Stud	2	64	Handwheel Support O-Ring	1
23	Cylinder Stud Nut	2	65	Valve Rod	1
24	Cylinder Dowel	2	66	Handwheel Spring	1
25	Inlet Connection	1	67	Hard Washer	12
26	Inlet Connection O-Ring	1	68	Handwheel	1
27	Inlet Connection Socket Head Cap Screw	2	69	Acorn Nut	1
28	Male Tubing Connector	6	70	Valve	1
29	Needle Valve	2	71	Valve Seat	1
30	Tubing, 1/4" (6.35 mm) o.d., clear	15 ft.	72	Valve Seat Back-Up Ring	2
31	Pressure Gauge	1	73	Valve Seat-O-Ring	2
32	Valve Block Adapter	1	74	Impact Ring	1
33	Valve Block Adapter O-Ring	2	75	Gauge Block	1
34	Valve Block Adapter Back-Up Ring	4	76	Valve Body Stud	4
35	Pressure Gauge O-Ring	1	77	Valve Body Stud Nut	4
36	Pressure Gauge Back-Up Ring	2	78	Clamp (Tri-Clamp®)	2
37	N/A		79	Gasket (Tri-Clamp®)	2
38	N/A		80	Hose Adapter (Tri-Clamp®)	2
39	Plunger Secondary Seal	3	81	Y-Connector	2
40	Sticker (Warning Decal)	1	82	Tubing, 1/2" (12.70 mm) o.d., clear	16 ft.
41	Plunger	3	83	Patent Identification Sticker	1
42	Plunger Adapter	3	84	Pressure Transmitter (Optional)	1
43	Plunger & Adapter Coupling	3	85	Pressure Transmitter Back-Up Ring (Optional)	2
			86	Pressure Transmitter O-Ring (Optional)	1
			87	Pressure Transmitter Screw	1

Drawing D-19538

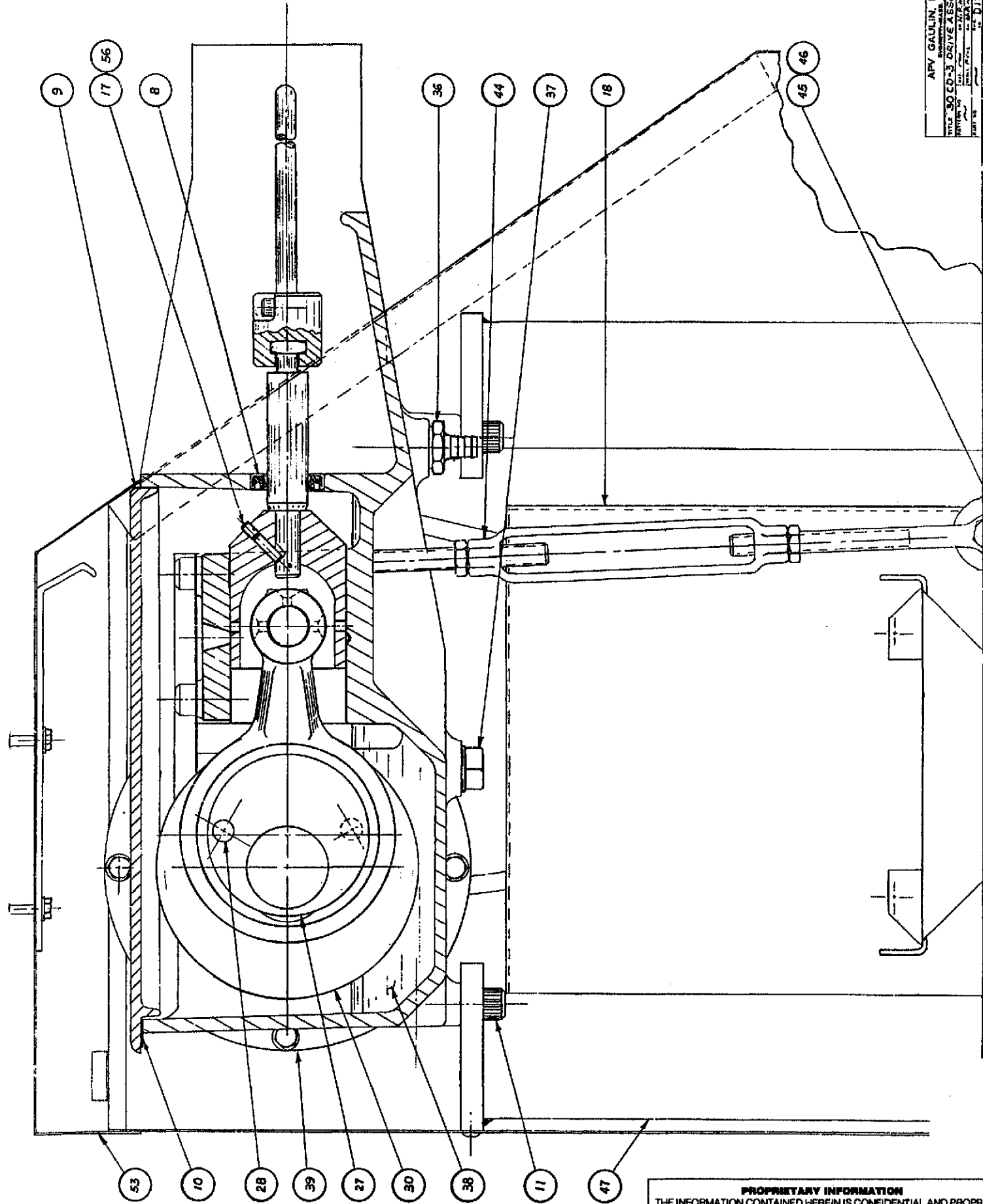
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1	CN 10315	1/28/92

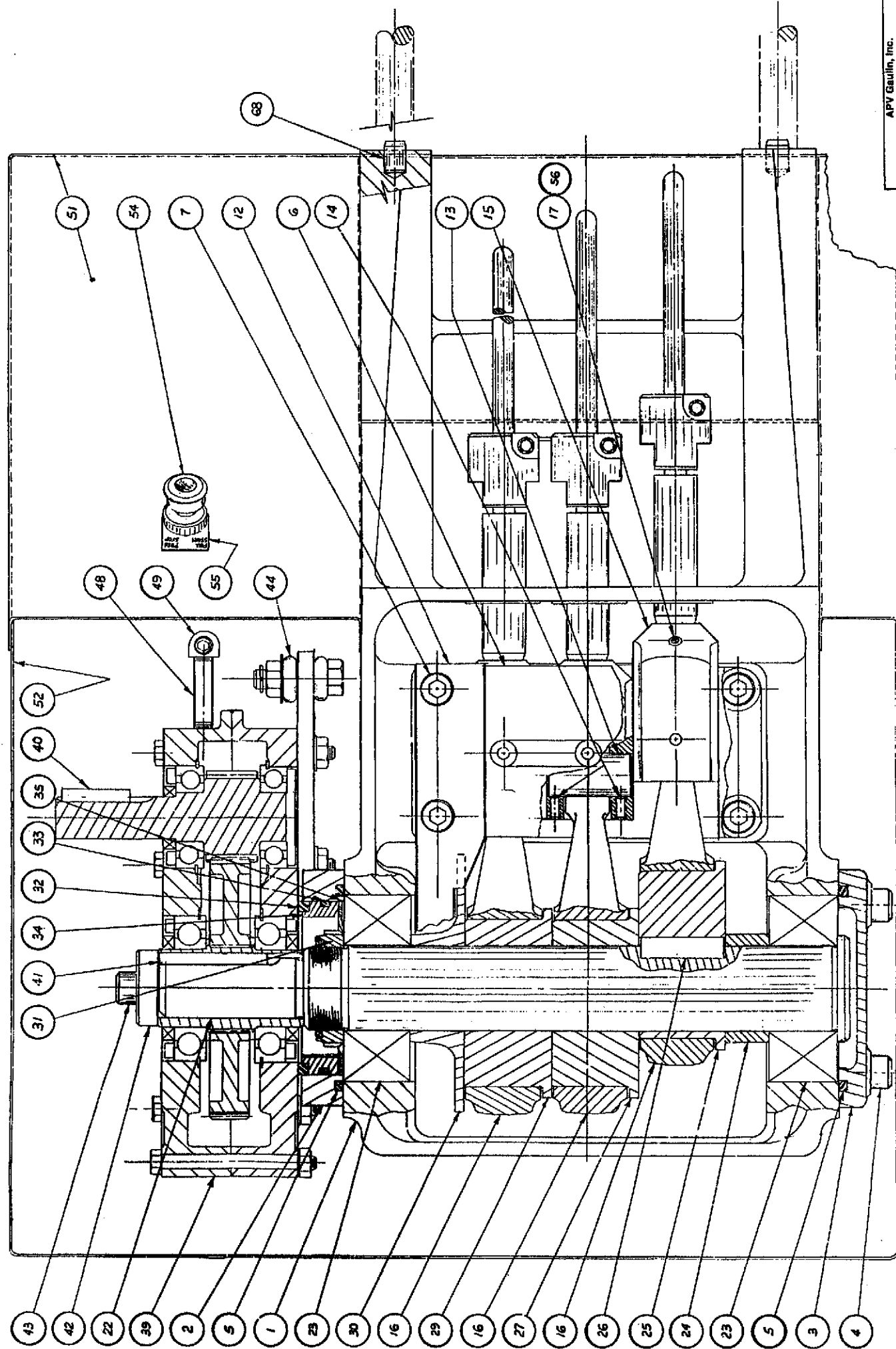
MANUFACTURE P-5198

APV Gaulin, Inc. Wilmington, Mass., U. S. A.	
TITLE CYLINDER & VALVE ASSY.(30CD-3)	
DR. N. P. Milo	DATE 10 APR 92
DWG. NO. D-19538	REV. 1



APV GAULIN, INC.
 WILMINGTON, MASS., U. S. A.
 TITLE DRIVE ASSEMBLY (30CD-3)
 DR. N. P. MRO. DATE 20 MAR 62
 DWG. NO. D-19571-2 REV. 0

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APV Gaulin, Inc.
 Wilmington, Mass., U. S. A.
 TITLE DRIVE ASSEMBLY (30CD-3)
 DR. N. P. MRO. DATE 20 MAR 62
 DWG. NO. D-19571-2 REV. 0

SECTION IV HOMOGENIZING VALVE ASSEMBLY

Introduction

The CD-type homogenizing valve assembly has been designed for ease of disassembly and long life. The valve seat is made from a very hard, ceramic material. The seat plugs into the cylinder and the valve body, and it is sealed by self-energizing O-rings. The O-rings are backed by tough back-up rings to reduce extrusion.

The valve is held by the valve guide and is pressed against the seat by a handwheel, which may be adjusted to vary a spring force acting on the valve rod. A ceramic impact ring surrounds the valve and valve seat for maximum resistance to erosion. The valve, seat and impact ring are all reversible to permit two wear surfaces. The valve guide is fitted with two, low pressure, O-ring seals to prevent leakage. The discharge connection is 1/2" (12.7 mm) Tri-Clover and may be pointed up or down as required.

Removal of Homogenizing Valve

Refer to Dwg. D-19538 for single stage, C-19230 for two-stage.

1. Remove the handwheel (68), valve rod (65), spring (66), hardened washer (67) and acorn nut (69) as an assembly by rotating the handwheel counter-clockwise. To take this sub-assembly apart, remove the acorn nut (left-hand thread).
2. Disconnect piping from the discharge connection.
3. Using the open-end wrench (T14), remove the four hex nuts (76) that secure the handwheel support (63).
4. Remove the valve body (60) by unplugging it from the valve seat (71).
5. Push the impact ring (74), valve (70) and valve guide (61) out toward the handwheel end to prevent running the large O-ring (62) over the discharge hole, which could damage the O-ring.
6. Pull the gauge block sub-assembly off the valve block adapter (32). Using the valve seat removal tool (T27), push it through the valve block adapter port, until it touches the valve seat. Push lightly and catch the valve seat in your hand.
7. Inspect all seals and parts for damage. Replace, as required.
8. For removal of the valve block adapter (32) from the cylinder, use the valve block puller tool (T25) connected to bolt (T26). Slide the tool into the valve block adapter orifice. Rotate the puller tool bolt clockwise into the puller tool, so that it is seated behind the valve block adapter. Gently pull straight out.
9. Inspect the seal and parts for damage. Replace, as required.

Installation of Homogenizing Valve

Lubricate all seals with rubber lubricant (15) or petroleum jelly prior to installation.

1. Install back-up rings (72) to both ends of the valve seat (71).

2. Install O-rings (73) to both ends of the valve seat.
3. Plug the homogenizing valve seat (71) into the cylinder block.
4. Install the large O-ring (62) on the valve guide (61). Push the valve guide into the valve body (60) with the O-ring facing toward the back.
5. Install the impact ring (74) and valve (70) from the opposite end of the valve body.
6. Push the valve body assembly over the studs (77) and onto the homogenizing valve seat and seals with the discharge connection facing down or up, depending on your piping arrangement.
7. Prior to installation of the handwheel support, lubricate O-ring (64) and install in back end groove of the valve guide.
8. Install handwheel support (63) and the four valve body stud nuts (76). Make finger-tight.
9. Install the valve rod (65) through the handwheel support and allow it to pass through O-ring (64), until the valve rod touches the valve (70). Tighten the four valve body stud nuts, using the open-end wrench (T14).
10. Install the spring (66), sliding it over the valve rod (65). Lubricate hard washer (67) with lubricant or petroleum jelly and install.
11. Lubricate handwheel support threads with grease or Never-Seez™ .
12. Install the handwheel (68) onto the handwheel support and over the valve rod. Rotate the handwheel clockwise, until a resistance is felt.



WARNING: DO NOT TIGHTEN THE HANDWHEEL COMPLETELY WITHOUT PRODUCT FLOW. DAMAGE TO THE SEAT MAY RESULT.

13. Install the acorn nut (69) on the exposed end of the valve rod (65). Tighten counter-clockwise (left-handed thread).
14. Back off the handwheel 1/2 turn.
15. Reconnect discharge piping.

SECTION V DRIVE ASSEMBLY



WARNING: WHEN HANDLING SKINS, WEAR SUITABLE GLOVES TO AVOID CUTS FROM SHARP EDGES OF THE STAINLESS-STEEL SHEET MATERIAL.



WARNING: TO PREVENT ANY POSSIBLE INJURY, INSURE THAT THE ELECTRICAL SUPPLY TO THE MACHINE IS DISCONNECTED, BEFORE WORKING ON ANY PORTION OF THE MACHINE.

Skin Removal

Refer to Drawing D-19571, Sheets 1 through 3.

1. Take off the top cover, using the handle provided.
2. Lift the door off its hinges.
3. Remove ten screws holding the back section to the front panel.
4. Remove two screws at the rear, top screw last.
5. The front panel usually does not have to be removed. However, it is attached to the sub-base at the front by two screws and to the pump base by two other screws.

Skin Reassembly

1. To mount the front panel, install the two screws into the sub-base weldment at the front.
2. Install the two screws into the pump base casting at the outside of the well.
3. Set the front, lower corners of the rear skin section into the lower corners of the front panel. Install two screws, loosely.
4. Lift the rear panel section and install the top screw at the rear of the welded sub-base.
5. Install the eight remaining front-edge screws and the lower back screw. Tighten all screws.
6. Hang the door back on its hinges.
7. Replace top cover.

Base Disassembly

The base may be easily disassembled for inspection and replacement of parts. See Section VIII for recommended teardown inspection details.

1. Remove top cover, door and rear skin panel section, as described previously.

2. Drain oil from pump base.
3. Loosen torque arm assembly (44), holding gearbox (39) and remove belts.
4. Remove breather plug from elbow (49) and replace with a solid 1/4" (6.35 mm) NPT plug.
5. Disconnect the torque arm (44) from the gearbox (39).
6. Remove the socket-head cap screw (43) and eccentric shaft cap (42) securing the gearbox to the shaft.
7. Pull the gearbox/pulley assembly from the pump drive shaft.
8. Remove four socket-head cap screws (4) and the bearing cap assembly (2), which includes the face seal (32), seal guide (34), O-ring (33) and wave spring (35).
9. Remove four socket-head cap screws (7), which secure the crosshead cover (6) and the oil channel (12).
10. Remove the plunger adapters from crossheads (15) by loosening three sets of screws (17 & 56).
11. Stand up each connecting rod (16) in turn. Loosen the two set screws (14) holding each wrist pin (13) and remove the wrist pins and crossheads.
12. Place a block of wood between one connecting rod and the inside of the back of the base casting pump to prevent rotation. Using the spanner wrench (T5), remove the bearing locknut (31) from the drive shaft.
13. Remove four socket-head cap screws (4) and the closed bearing cap (3).
14. Using a large, soft-faced mallet, remove the pump drive shaft, bearing (23), key (26) and spacer (24). These parts may then be separated at the bench.
15. Lift the connecting rods (16) and eccentric cams (25, 27, 29) up and out of the base casting. These parts may then be separated at the bench.
16. Remove the remaining shaft bearing, using a mallet and a block of wood on the outer race of the bearing only. Pounding on the inner race could damage the bearing.
17. Check the condition of the baffle seals (8) in the back of the well. Change as required.
18. Clean all parts in a suitable solvent and perform inspections, as described in Section VIII.

Base Reassembly

Refer to Drawing D-19571, Sheets 1 and 2.

1. Install the eccentric drive shaft bearing (23) in the gear side of the pump base. Use a soft-faced mallet on the outer race only. Pounding on the inner race may damage the bearing.
2. Put this assembly together on the bench:
 - a. Set the eccentric (driver) cam (25) with the flange side of the keyway down.

- b. Place a connecting rod (16) over the eccentric.
- c. Place the eccentric (center-driven) cam (27) with the two cam dowels (28), flange side down, on top of the first eccentric with one dowel engaged and the bores in line. A 1-3/4" to 1-15/16" - diameter (44 - 49 mm) mandrel, about 8" (203 mm) long, can be placed in the bores to keep the eccentrics in line until the pump shaft is inserted.
- d. Place another connecting rod (16) over the second cam.
- e. Place the third (end-driven) cam (29), flange down on the dowel of the middle cam with the bores in line.
- f. Place the third connecting rod (16) on the third cam.
- g. Place the oil disc (30), flange down, on top of the assembly with the bores in line.

Place this assembly in the base with the oil disc on the gear side of the pump assembly.

3. Put this assembly together on the bench:

- a. Stand pump drive shaft on end, flange down. Coat shaft lightly with Never-Seez™ .
- b. Slide one bearing (23) over the eccentric shaft (22).
- c. Add the shaft spacer (24) on top of the bearing.
- d. Install the key (26) in the shaft.

Take assembly to the pump and insert the shaft through the center of the cams/connecting rods.

- 4. Using the soft-faced mallet on the outer race only, drive the bearing squarely into the pump base.
- 5. Install the O-ring (5) in the bearing cap (3). Finally, torque the socket-head cap screws (4) to 75 - 80 ft.-lbs. (102 - 109 N•m), using the hex driver (T4) and the torque wrench (T2).
- 6. Install the bearing locknut (31) on the pump drive shaft. Using the spanner wrench (T5) and a suitable pipe extension, torque to about 200 ft. lbs. (267 N•M). Use a wood block between one connecting rod and the inside of the back of the base casting to prevent rotation.
- 7. Install the open bearing cap (2) with the O-ring on the gear side of the pump base. Torque socket-head cap screws (4) to 75 - 80 ft. lbs. (102 - 109 N•m), using the hex driver (T4) and the torque wrench (T2).
- 8. Install the wave spring (35), seal guide (34), O-ring (33) and face seal (32).
- 9. Install the crossheads (15) and wrist pins in the end of each connecting rod. Check that the ends of the wrist pins are below flush with the side surfaces of the crossheads. Tighten the two socket set screws (14) in each crosshead.
- 10. Install the plunger adapters in each crosshead (15) and tighten the socket set screws.
- 11. If they require replacement, install new baffle seal (8), lip toward the drive end over the plunger adapters. Drive the up flush to the well wall of the base casting. Use puller tool (T23) and seal puller (T24) to remove and install baffle seals.

12. Install the crosshead cover (6) and the oil channel (12), using the socket-head cap screws (7). With the hex driver (T4) and the torque wrench (T2), tighten the screws to 75 - 80 ft.-lbs. (102 - 109 N•m).
13. With the spanner wrench (T5) engaged in the shaft keyway, rotate the eccentric shaft to check for free operation and proper function of the oil disc and oil channel to eliminate contact.
14. Lightly coat the exposed end of the drive shaft with Never -Seez™ and install the gearbox (30) over the shaft. Line up the keyway and install the key (41). Put the socket-head cap screw (43) through the shaft cap (42) and into the shaft end. Using the hex driver (T4) and the torque wrench (T2), tighten to 75 - 80 ft.-lbs. (102 - 109 N•m).
15. Install the driven pulley and key on the gearbox input shaft. Check alignment to motor pulley with straight edge. Adjust as necessary.
16. Reconnect the torque arm (44) (turnbuckle).
17. Install the drive belts and adjust tension, as described in Figure 2.
18. Install magnetic plug (37) in drive base and add oil to a level of 1-3/4" to 2" (44 - 51 mm) deep, measured in the deepest area of the crankcase. See Section II for type and quantity of oil.
19. With plungers removed, connect electric supply and run machine, check for proper rotation and oil flow to crosshead area.
20. Install base cover plate (9).
21. Check tightness of socket-head cap screws (11) holding base to sub-base and motor mounting nuts and bolts.

DRIVE ASSEMBLY PARTS LIST

DRAWING D-19571, SHEETS 1 & 2

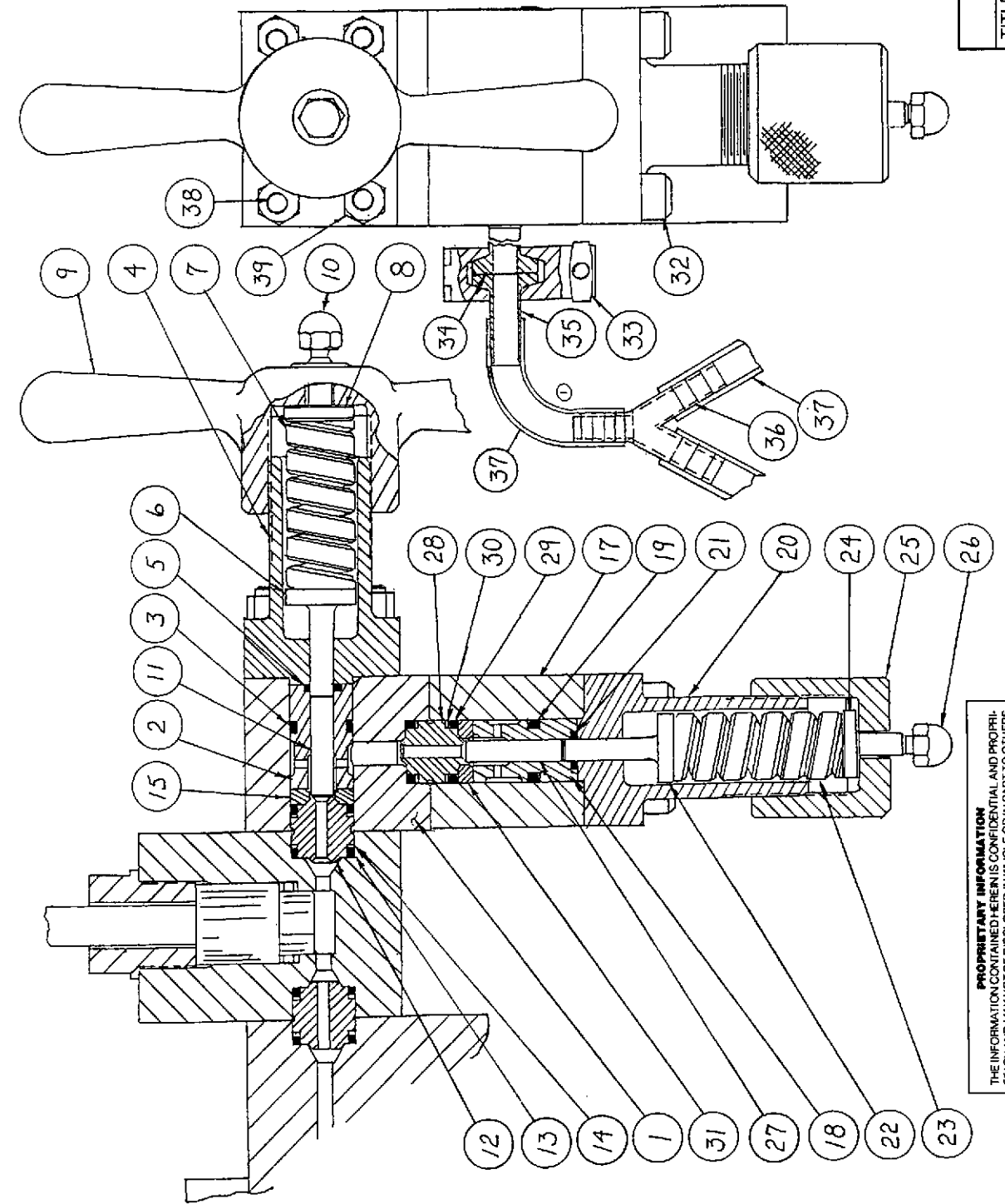
Item	Description	Qty.	Item Description	Qty.
1	Base	1	35 Eccentric Shaft Seal Wave Spring	1
2	Bearing Cap, Open	1	36 Well Drain Adapter	1
3	Bearing Cap, Closed	1	37 Base Drain Plug	1
4	Bearing Cap Socket-Head Screw	8	38 Oil	1 qt.
5	Bearing Cap O-Ring	2	39 Gearbox	1
6	Crosshead Cover	1	40 Gearbox Output Key	1
7	Crosshead Cover Socket-Head Cap Screw	4	41 Gearbox Input Key	1
8	Baffle Seal	3	42 Eccentric Shaft Cap	1
9	Base Cover	1	43 Shaft Cap, Socket-Head Cap Screw	1
10	Base Cover Gasket	5 ft.	44 Torque Arm Assembly	1
11	Base Socket-Head Cap Screw	4	45 Torque Arm Assembly Hex-Head Cap Screw	2
12	Oil Channel	1	46 Torque Arm Assembly Hex Nut	2
13	Wrist Pin	3	47 Sub-Base	1
14	Wrist Pin Set Screw	6	48 Nipple	1
15	Crosshead	3	49 Elbow	1
16	Connecting Rod	3	50 Foot	4
17	Plunger Adapter Set Screw (Primary)	3	51 Panel Front	1
18	Belt Guard	1	52 Panel Rear	1
19	N/A		53 Top Cover	1
20	N/A		54 Switch Assembly	1
21	N/A		55 Legend Plate	1
22	Eccentric Shaft	1	56 Plunger Adapter Lock Set Screw	3
23	Eccentric Shaft Bearing	2	57* Nameplate	2
24	Eccentric Shaft Spacer	1	58* Nameplate Pins	8
25	Driver Cam	1	59* APV Logo Decal	1
26	Driver Cam Key	1	60* Motor Bolts	4
27	Center-Driven Cam	1	61* Motor Nuts	4
28	Cam Dowel	2	62* Hex Head Cap Screw	2
29	End-Driven Cam	1	63* Hex Head Cap Screw	2
30	Oil Disc	1	64* Lockwasher	3
31	Eccentric Shaft Bearing Lock Nut	1	65* Gearbox/Rotation Direction Sticker	1
32	Eccentric Shaft Face Seal	1	66* Gasket	4 ft.
33	Eccentric Shaft Seal O-Ring	1	67* Service Manual	2
34	Eccentric Shaft Seal Guide	1	68 Dowel Pins (shown for clarity)	2

Drawing D19571, 1 & 2

TWO-STAGE HOMOGENIZING VALVE ASSEMBLY
DRAWING C-19230

APV Gaulin, Inc.
 Wilmington, Mass., U. S. A.
 TITLE TWO-STAGE VALVE ASSY. (30CD-3)
 DR. N. P. Mfg. DATE 20 MAY 92
 DWG. NO. D-19230 REV. 0

First-Stage Assembly			Second-Stage Assembly		
Item	Description	Qty.	Item	Description	Qty.
1	Valve Body	1	20	Handwheel Support O-Ring	1
2	Valve Guide	1	21	Valve Rod	1
3	Valve Guide O-Ring	1	22	Handwheel Spring	1
4	Handwheel Support	1	23	Hard Washer	1
5	Handwheel Support O-Ring	1	24	Handwheel	1
6	Valve Rod	1	25	Acorn Nut	1
7	Handwheel Spring	1	26	Homogenizing Valve	1
8	Hard Washer	1	27	Homogenizing Valve Seat	1
9	Handwheel	1	28	Valve Seat O-Ring	2
10	Acorn Nut	1	29	Valve Seat Back-Up Ring	2
11	Homogenizing Valve	1	30	Impact Ring	1
12	Homogenizing Valve Seat	1	31	Socket-Head Cap Screw	4
13	Valve Seat O-Ring	2	32	Clamp (Tri-Clamp®)	1
14	Valve Seat Back-Up Ring	2	33	Gasket (Tri-Clamp®)	2
15	Impact Ring	1	34	Hose Adapter (Tri-Clamp®)	1
16	Valve Body	1	35	Y Connector	1
17	Valve Guide	1	36	Tubing 1/2" (12.7 mm) o.d.	1
18	Valve Guide O-Ring	1	37	Valve Body Stud	4
19	Handwheel Support	1	38	Valve Body Nut	4



PROPRIETARY INFORMATION
 THE INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND PROPRIETARY AND MAY NOT BE DISCLOSED IN WHOLE OR IN PART TO OTHERS OR USED FOR OTHER THAN THE PURPOSE FOR WHICH IT IS TRANSMITTED WITHOUT THE PRIOR WRITTEN PERMISSION OF APV GAULIN AND IS TO BE RETURNED UPON REQUEST.

Drawing C-19230

2. Do not start machine under pressure.
3. Do not apply pressure until machine is pumping smoothly with air expelled from cylinder and infeed lines.
4. Uninterrupted product supply is required. Machine should not be operated with pressure applied while product runs out. This may damage the homogenizing valve.

Starting the Machine

Start the homogenizer on water or buffer solution; allow the machine to run until full flow has been achieved.

Product Operation

Water-like products may be processed without using a feed pump by lifting from or above floor level. High viscosity products may require a feed pump. See Figure 9 for a typical processing set-up. Products may be processed at selected pressures by adjusting the handwheel.

Before starting the machine, adjust the flow of cooling water. A slow trickle is adequate. For containment situations the sterile water may be circulated from and to a container by means of an auxiliary pump.

Open the homogenizing valve by rotating the handwheel counter-clockwise, until little resistance is felt. Start the pump motor. When all air has been purged from the flow, pressure may be increased by rotating the handwheel clockwise. Pressure should be steady. If not, see Section VIII. Do not operate at high pressure (above 2000 psi/138 bar) with a fluctuating gauge, since damage may result.



WARNING: DO NOT OVERTIGHTEN THE HANDWHEEL WITHOUT PRODUCT BEING PUMPED, AS DAMAGE TO THE KNIFE-EDGED VALVE MAY OCCUR.

Before the product runs out, decrease pressure by rotating the handwheel counter-clockwise. Finally, stop the pump motor.

Shut-Down

1. If an air-operating back-pressure valve is used, shut off the air supply.
2. Reduce the product pressure to the minimum point.
3. Turn off the machine.

Cleaning

Depending on product and containment requirements, cleaning may be done by flushing or circulating solutions such as hot or cold water or chemical cleaning solutions at little or no pressure.

Water at temperatures to 200°F. (93°C.) may be circulated without damage to seals or packing. For higher temperatures such as steam cleaning, other packing and seal materials may be required.

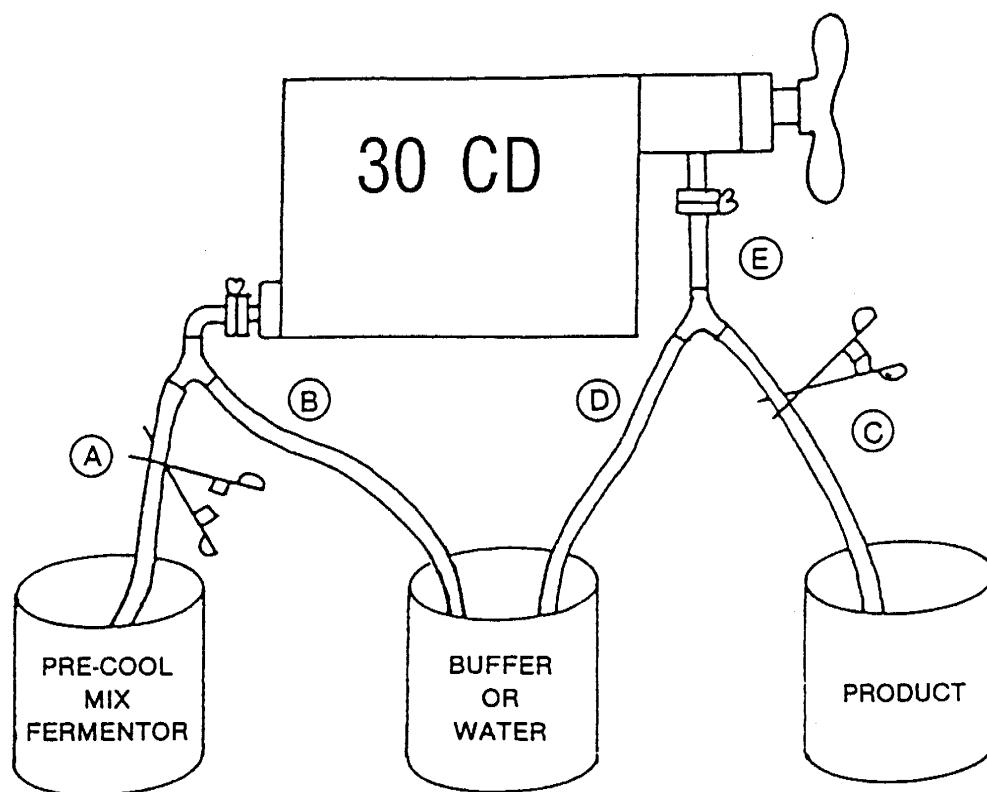
Chemical solutions containing acids, caustic bases or halides (chlorine, bromine, iodine, etc.) must be flushed and neutralized and not allowed to remain in the pump. Acids and bases can cause electrolytic corrosion. Halides can cause intergranular corrosion and promote stress corrosion cracking. See "Safety Considerations" in Section III.

More thorough cleaning may require sterilizing, such as with formaldehyde soak, followed by complete disassembly of the liquid-contacting parts. See Section III. Individual parts may then be autoclaved, discarding seals and packing, if required.

RECOMMENDED SET-UP FOR PRODUCT TESTING (FOR ONE PASS ONLY)

Set-Up

1. Use 3/8" (9.5 mm) i.d., clear tubing, silicon or Tygon™ 3/8" (9.5 mm), nylon Y fittings.
2. Keep tubes as short as practical.
3. Use hemostats for clamps. Use only two to prevent shutting off flow at either discharge or suction.
4. Set containers on floor. Pump will lift and prime.



Operation

1. Start up, as shown. Prime and deaerate.
2. Loosen clamp at A to just remove air, then clamp.
3. Run pressure up to 15,000 psi (1035 bar).
4. Switch clamp from A to B.
5. When product is noted at E, switch clamp from C to D.
6. As fermenter empties, switch clamp from B to A.
7. When product runs out at E, switch clamp from D to C.
8. Reduce pressure and flush pump.
9. Shut off pump.

Figure 9

SECTION VII RECOMMENDED REGULAR MAINTENANCE SCHEDULE

DAILY INSPECTION

1. Check oil level by lifting top stainless-steel cover and base cover plate. See Dwg. D19571.
2. Check water lubrication system for plungers. A slow trickle of water is adequate.
3. Check for leaks from cylinder or base assemblies. Inspect all gaskets, O-rings and back-up rings for extrusion.
4. Check gauge block for oil leaks. See Section III to add oil.
5. With machine running, listen for abnormal sounds.

MONTHLY INSPECTION

1. Check oil level and color. Black oil should be drained and replaced. Check oil drain plug for leaks.
2. Check tightness of drive end socket-head cap screws with torque wrench and hex driver set at 75 - 80 ft.-lbs. (102 - 109 N·m).
3. Check tightness of crosshead/extension set screws.
4. Check lip seals at rear of well area for leaks. Replace as required.
5. Check belt tightness and adjust, if required.
6. Check tightness of torque arm assembly bolts and nuts. Keeping these fittings tight will reduce noise.

SIX-MONTH OR YEARLY INSPECTION

1. Drain base oil.
2. Repeat all monthly checks.
3. Lubricate motor bearings according to the manufacturer's instructions.
4. Depending on severity of service, consider tear-down inspection of drive end. Replace worn parts, as required.

SECTION VIII MAINTENANCE PROCEDURES AND TROUBLE-SHOOTING

Introduction

The purpose of this section is to provide maintenance procedures and to assist maintenance personnel in the diagnosis of equipment problems. Detailed disassembly and reassembly procedures can be found as follows:

Cylinder Parts	Section III
Homogenizing Valve Parts	Section IV
Drive End Parts	Section V

Product Pressure Gauge

The pressure gauge is the best indicator of overall performance. Closely study the action of the needle. When the homogenizer is performing properly, there should be three slight pulses in synchronization with the pumping action of the plungers. If the pulsations are more severe than normal, suspect the following:

1. **One high pulse and two lower pulses** may indicate that one discharge valve is malfunctioning. The bad valve belongs to the plunger that is moving forward during the high pulse indication. It is leaking during the pumping stroke of the two other plungers. Remove the valve and inspect the ball for chipping, the seals for extrusion and leaking, the seat for erosion or other damage. Replace parts as required.
2. **Two high pulses and one low pulse** may indicate that a suction valve is malfunctioning. The bad valve belongs to the plunger that is moving forward during the low pulse. The valve is leaking back to the suction manifold during the pumping stroke. Remove the valve and inspect the ball for chipping, the seals for extrusion and leaking, the seat for erosion or other damage. Replace parts as required.
3. **Relatively steady pulses but a wandering needle** on the pressure gauge indicate a worn or leaking homogenizing valve. Remove the seat and valve and look for wear or damage. Replace parts as required or reverse parts for new wear surfaces.
4. **A pressure spike accompanied by a loud knock and followed by a drop in pressure** indicates a slug of air in the suction line.
5. **Constant hammering** is caused by air entrained in the product. Deaerate the product by one pass at a lower pressure, where knocking is slight.
6. **Particles in the pumped product**, including bits of packing or seals, may hold valves open for a time before being flushed along. Indications are as for malfunctioning valve, which returns to normal operation. Routine inspection of seals whenever disassembling cylinder parts should prevent this. Remove all loose pieces from slightly extruded seals and replace extremely damaged seals.
7. **Failure of the homogenizing pressure gauge to return to zero**, when backing off the homogenizing valve and shutting the pump down indicates gauge failure. The gauge should be replaced.
8. **Failure of the homogenizing pressure gauge to register or rise with increasing adjustment to the homogenizing valve** (as indicated by normal drive-end noise when loading up) may be due to air in product or no product flow. Check flow prior to increasing handwheel adjustment. If proper flow exists, but gauge will not rise, several other conditions may exist; i.e., leakage at suction or discharge ball valves, or the homogenizing valve or seat are damaged. After checking these components, if the gauge still will not rise, replace the pressure gauge. If the pressure will not rise, after installing a new gauge, contact the Gaulin Service Department

Plunger Packing

The packing has demonstrated satisfactory long life. This is mainly due to the hard, smooth, solid ceramic plungers and the packing cooling and lubricating water system.

The plungers may pick up a small amount of bronze from the packing support rings, due to minor misalignment and worn-out packing. When this pick-up becomes heavy, it may be removed by immersing the plungers in acid for a suitable time. The inert ceramic plunger will be restored to "like new" condition. Inspect them for roundness and smoothness. Replace, if required.

Inspect the packing for damage and/or extrusion. Extreme extrusion at the heel of the packing on the inner diameter indicates that the bronze packing support ring should be replaced.

Suction and Discharge Valves

Proper condition of the pump valves may be indicated as described above in the pressure gauge section. Hard, smooth, round, ceramic balls are used against relatively soft seats. Initially, the seating surface was formed by pressing a Tungsten carbide ball into a sharp-cornered hole to produce a smooth and accurate seat. If cracks, scratches or erosion paths form radial lines in the seat, the valve will leak. Minor damage may be repaired by reswaging with a 1/4"-diameter Tungsten carbide ball. Do not use a ceramic ball, since it may chip, crack or disintegrate with too much force. If damage is more severe, replace the plug/seat.

The lift of the valves is controlled by stops in both the suction and discharge assemblies. Wear and damage will increase the lift and deteriorate the efficiency of the pump. Inspect stops and replace them, if the spot of ball contact greatly exceeds about 1/16 of an inch (1.6 mm) of diameter.

Homogenizing Valve Assembly

Proper condition of the homogenizing valve assembly may be indicated, as described above in the pressure gauge section.

All wear parts are made from solid ceramic. The design of these parts provides two wear surfaces for each part for maximum life. In addition, the valve and seat may be reground, in most cases, to "like new" condition. Consult APV Homogenizer Parts Department for this service.

Normal valve wear will be seen as a narrow ring on the the face of the valve. When this ring or any portion of it becomes too deep, reverse the installation of the valve in the assembly.

Normal seat wear will be seen as radial lines across the narrow edge of the seat, where it contacts the valve. When this wear is too deep or chipping happens, reverse the installation of the seat in the valve assembly.

Normal wear on the impact ring appears as a ring on the inside diameter, about one-third of the axial distance into the ring. When this wear is extreme, reverse the installation of the impact ring in the valve assembly.

The ceramic material used in the valve assembly is hard and tough but not infinitely so. Operating personnel should be cautioned not to tighten the homogenizing valve handle to extremes with no liquid passing through the valve. This tightening can cause extremely high, local forces on the very narrow edge of the valve seat, resulting in chipping or cracking.

Capacity Check

Capacity measurements should be made with cold water only. The larger the volume of water pumped, the more accurate the results. A minimum of two gallons (four minutes) should be pumped. Connect hoses to suction and discharge fitting.

1. Drop both hoses in a container of water at floor level. Have an empty container of known volume handy to collect test-pumped volume.

2. Start the machine and run until all air is expelled.
3. With no pumping pressure, direct discharge into the collecting container and start stop watch.
4. When the collecting container has filled to marked level, stop watch and direct flow back to the original container of water. Note the time (in minutes and seconds).
5. Empty the collecting container into the original container and re-run procedures 2., 3. and 4. with the maximum pressure on the gauge.
6. The capacity may be calculated as follows

$$\text{Capacity (gph or lph)} = \frac{\text{Gallons or liters pumped} \times 60}{\text{time in minutes} + \frac{\text{time in secs.}}{60}}$$

Example: 3 gallons in 5 minutes, 43 seconds:

$$\text{Capacity} = \frac{3 \times 60}{5 + \frac{43}{60}} = \frac{180}{5 + .71} = \frac{180}{5.71} = 31.5 \text{ gph}$$

If the capacity at pressure is less than 30 gph or more than 15% less than capacity at no pressure, the problem may lie in the condition of the packing, pump valves or belt slippage.

Power End Lubrication

See Section II for proper oil and oil level information.

Power End Teardown Inspection

The power end has been conservatively designed for long life and minimum maintenance. With proper lubrication and periodic checking of fastener tightness, no other maintenance should be required.

However, if unusual noise, hot running or other obvious indications arise, the base assembly may be taken apart and reassembled as described in Section V.

The following areas should be inspected.

1. Crosshead Cover - for signs of wear. Extreme wear may be caused by wrong direction of rotation (no oil to crossheads) or contaminated oil (abrasives in oil). A worn cover may be repaired by surface-grinding to a flat surface.
2. Crossheads - for signs of wear. Extreme wear may be caused as in 1. above. Side wear may take place, if the two set screws holding the wrist pin both loosen. Crossheads may not be repaired easily without affecting alignment. Replace, if required.
3. Plunger Adapters - for signs of wear or scoring on the large diameter, which passes through lip seals.
4. The Connecting Rods - for wear in both journal and wrist pin areas. Check for scoring and wear caused by contaminated oil or poor lubrication. Check that all oil holes are clear of obstruction. Some roughness may be smoothed; but, if knocking has been noted, replace the loose-fitting connecting rods.
5. Wrist Pins - for wear and scoring. Replace, as indicated, or rotate pins to a fresh wear position (if the wear pattern does not appear over more than half of the surface).

6. Cams - for wear and scoring. Caused by the aforementioned lubrication problems. Inspect the dowels, dowel holes and keyway. The center cam has two press-fit dowels which slip-fit into the two other cam dowel holes. The cams cannot be easily reworked. Replace the worn cams.
7. Eccentric Shaft - for signs of rust or wear. When reassembling, be sure to lightly coat eccentric shaft with Never -Seez™, before adding bearings and cams.
8. Bearings - for wear or damage. The bearings are conservatively sized for this machine. If oil has become contaminated, damage may result. Clean bearings and feel the rolling action. A gritty or bumpy feeling indicates worn-out bearings.
9. Gearbox - do not disassemble. Feel action of gearbox by turning input shaft. A gritty or rough-turning feeling may indicate worn or damaged gears or bearings. The entire gearbox should be replaced, if damaged.
10. Seals and O-Rings - Should be replaced whenever dismantling the drive end, unless they are in "like-new" condition.
11. Wave Spring - The face seal loading wave spring is made with a split. Inspect for wear or breakage and replace, as required.
12. Bearing Lock Nut - Inspect fiber ring at end of thread. This ring helps lock the locknut in place and should be good for many tightenings. A worn or damaged nut should be replaced.
13. Drive Belts & Pulleys - Inspect for wear and/or damage. Replace as required.

Motor Lubrication

Motor bearings should be lubricated only as instructed by the motor manufacturer. Too much lubrication is more damaging than too little. Remove plugs on top and bottom of both bearings. With the manufacturer's recommended grease, pump grease into bottom and allow old grease to flow out top. Install bottom plugs but leave top ones out until motor has run long enough to be at maximum operating temperature. Excess grease will have then expanded and run out top opening. Reinstall top plugs.

MOTOR WARRANTY: The motor provided with the machine has been selected to meet load requirements and is covered by a warranty issued by the motor manufacturer. The motor should be lubricated in accordance with the manufacturer's recommendations. Although unlikely, should difficulty arise, contact the local representative of the motor manufacturer, our representative or APV Homogenizers headquarters. If any modification or repair not authorized by the manufacturer is undertaken, the warranty is automatically voided.

Gearbox Lubrication

See Section II.

GEARBOX WARRANTY: The gearbox provided with the machine has been selected to transmit the torque to the pump drive end. Although unlikely, should difficulty arise, contact the local representative of the gearbox manufacturer, our representative or APV Homogenizer headquarters. If any modification or repair not authorized by the manufacturer is undertaken, the warranty is automatically voided.

TYPICAL WIRING DIAGRAM

Combination pull-start/push-stop, three-position, momentary contact switch, transformer-type Quick-disconnect terminals

Illuminated device, energizing coil "M", completing circuit between points 1 & 2, starting motor

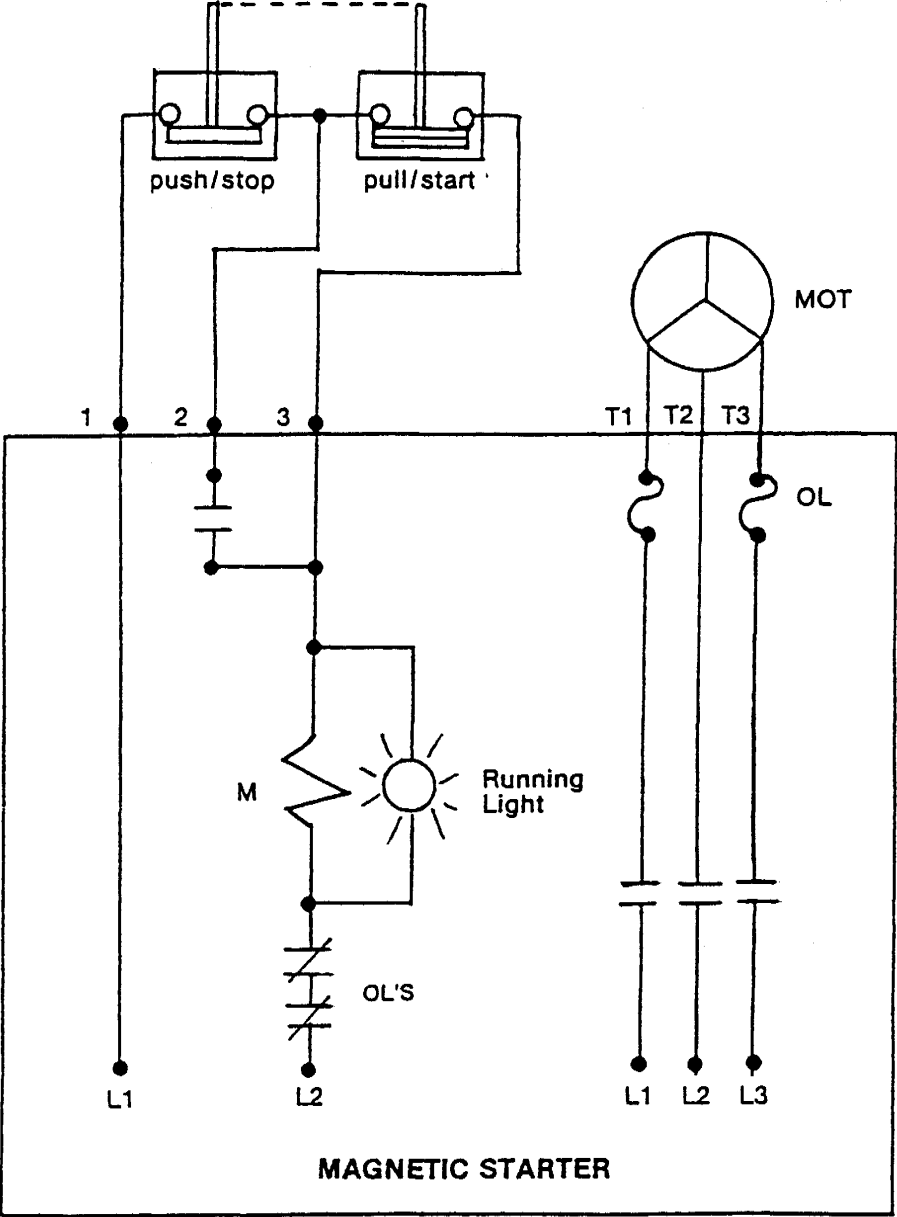


Figure 10



Your local contact:



APV, An SPX Brand
Phone: (920) 648-8311
Email: answers.us@apv.com

For more information about our worldwide locations, approvals, certifications, and local representatives, please visit www.apv.com.

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