



# Instruction Manual

## Gaulin Homogenizers & H.P. Pumps

### Model MS(P)-18 & 45



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





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**SECTION I**  
**GENERAL INFORMATION**

**Introduction**

In developing this manual we have tried to keep it basic. The drive end, cylinder assemblies, valve assemblies and accessories described in the following pages are standard and will cover most of the machines produced by APV Gaulin in the MS(P)-18 and MS(P)-45 models. However, some of our machines have "special" equipment, such as variable-speed drives and motors, air-operated valve assemblies, automatic HVA assemblies, etc., which this manual will not cover. Any information on this "special" equipment should be attached to the machine or added to the manual prior to shipment.

Also, in developing this manual we have sectioned it so that, if pages are not needed or do not apply to a given machine, they can be removed and disposed.

If any further information is needed regarding the installation or maintenance of your machine, please contact your local APV Gaulin distributor, Regional Manager or the APV Gaulin Service Department.

Complete familiarity with your APV Gaulin homogenizer or high pressure pump and its working parts will give you an increased awareness of its superior construction and wide range of capabilities. 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 Gaulin, Inc.

**Machine Weights and Dimensions**

Model	Dimension Dwg.	Weight (Approx.) (Less Motor)
MS(P)-18	D-17370	5,400 lbs.
MS(P)-45	D-17369	9,000 lbs.

**Utility Requirements**

1. Electrical

It is suggested that a licensed electrician be employed to properly wire in accordance with local codes. See typical wiring diagram, B-18502. The following will require power supply/wiring connection:

- a. Main drive motor (check motor nameplate)
- b. HVA pump motor (if supplied) — 3/4 hp, 3-phase (check voltage)
- c. Lube oil pump motor — 3/4 hp, 3-phase (check voltage)
- d. Low oil pressure cut-out switch
- e. Push/pull switch to start and stop main drive motor and lube oil pump motor
- f. Push/pull switch to start and stop HVA pump motor (if supplied)

## 2. Water

See text in "Installation" section of this manual for details. The following will require water connections:

- a. Lube oil and hydraulic oil coolers
- b. Plunger spray system

## 3. Standard Piping Connections

### a. Sanitary

Model	Suction Connection	Discharge Connection
MS(P)-18	2"	1-1/2"
MS(P)-45	3"	2"

### b. Industrial

MS(P)-18	2" NPT Male	1" NPT Female
MS(P)-45	2-1/2" NPT Male	2" NPT Female

## If Start-Up Is Delayed More Than One Month

Often, APV Gaulin homogenizers and high pressure pumps 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, 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 or damage.

There are many removable parts in the cylinder assembly, as shown on the applicable drawings. 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 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 it against weather, dirt, dampness, etc.

When the machine is installed on location, the APV 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 Gaulin 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 your "Recommended Spare Parts" list or from illustrations in this manual by the CORRECT NAME and use item numbers.

Your specific machine identification data is located on the front of the manual supplied with the machine. Model and serial number will be found on the packing list and at the front of the manual. The serial number will also be found on a nameplate tag at the rear of the plunger well.

## How to Return Materials

Materials or equipment cannot be returned without first obtaining APV Gaulin's 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 APV Gaulin, Inc., without damage.

## How to Read a Model Number

1200	MSP-18	5	T	B	S	-24
(1)	(2)	(3)	(4)	(5)	(6)	(7)

1. Capacity in U.S. gallons per hour, as built.
2. Model designation:  
Homogenizers — MS-18 or MS-45  
Pumps — MSP-18 or MSP-45
3. Cylinder maximum design pressure (x 1000 psig); i.e., 5 = 5000 psig.
4. Pump valve seat design:  
P — integral to cylinder  
T — tapered, pressed in
5. Pump valve design:  
P — poppet valve  
B — ball valve
6. Packing design:  
S — spring-loaded  
A — adjusting-screw
7. Plunger diameter in 1/16 of an inch:  
-24 = 1.50"

## Serial Numbers

The first three or four numbers indicate the month and year of manufacture. The last numbers are the serial number. For example: S/N 386-0101 was manufactured in March of 1986, and the machine serial number is 0101.



## SECTION II INSTALLATION

### **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. An Operation and Service Manual with your packing list and identification sheet will be found with the spare parts in the motor compartment.

### **Location**

Your APV 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.

### **Weight and Dimensions**

The machine weight and dimension information is found in the "General Information" section at the front of this manual

### **Floor Space**

The floor space required for these machines are shown in drawing D-17370 for the model MS(P)-18 and drawing D-17369 for model MS(P)-45, both located at the end of this section. Additional space is required to service the machine. When viewing from the front, the following space is required: 50" on right side, 50" on left side for motor service and removal, 36" at rear for servicing of all equipment (oil change, small motors and pumps, relief valves, etc.) and 36" in front for removal of plunger and packing assemblies.

### **Removal from Skids**

The machine must be lifted off the bolts which pass through the shipping skids. Do not lift the machine by the ends or edges, as permanent damage may result. Lifting or blocking should be done on the reinforced area under the sub-base.

### **Adjustable Feet**

When installing the adjustable, stainless-steel feet, make sure the threads are clean and cover them with a graphite paste or water-resistant grease to prevent rust. Screw them up into the tapped holes under the base. There is approximately one inch 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.

### **Water Supply**

This machine requires water for cooling the power-end oil, the HVA oil (if so equipped) and the plunger packing. It is suggested that a single source of supply be located that is not affected by usage of water 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 turned on automatically when the main motor is started and turned off when the machine is shut down.

The supply line should be split (tee) close to the machine to supply separate lines to the oil coolers and the plunger spray assemblies to allow individual control.

#### 1. Oil Coolers

The oil coolers are located behind the rear panel of the machine and are pre-connected at the Factory. A hand-operated valve must be installed at the inlet to control the flow of water through the coolers. Both the inlet and outlet for the oil coolers are 3/8" NPT, and the location of these fittings is shown on drawings D-17370 for models MS(P)-18 and D-17369 for models MS(P)-45.

The drain from the oil coolers may be piped to a drain in the floor or recycled to a cooling tower, boiler-feed water tank, etc., providing there is no shut-off valve in the discharge line and the water pressure never exceeds the rated pressure of the coolers of 100 psig.

#### 2. Plunger-Spray Water

A hand-operated valve should be installed in the line feeding the plunger-spray system to control the water flow. The connection on the machine is located at the front bottom of the sub-base and is 3/8" NPT. See drawing D-17370 for models MS(P)-18 and drawing D-17369 for models MS(P)-45 for location.

A plunger-well drain connection is provided to drain the plunger water to the floor. The tail piece of this drain line was disconnected for shipping purposes and must be reconnected, prior to starting the machine.

### Lubricating Oil

This machine uses roller bearings on the driveshaft and sleeve bearings on the eccentric shaft. A combination oil-splash-and-mist lubrication system is used on the gears and roller bearings. Pressure lubrication is used for the sleeve bearings, connecting rods and crossheads.

Add the oil to the crankcase, until the oil level is in the center of the oil level gauge. **DO NOT USE OIL OTHER THAN THAT SPECIFIED FOR YOUR PARTICULAR MACHINE.** Correct crankcase oil may be purchased from APV Gaulin, and the initial quantity is furnished with the machine, when purchased.

The oil required is a premium-grade, paraffinic-base, A.G.M.A. No. 5, industrial oil with a defoaming agent and oxidation and corrosion inhibitors. It has a viscosity of 1000/1165 SUS at 100°F. and 90 to 105 SUS at 210°F. with a viscosity index of 95, pour point 10°F. and flash point of 450°F. This oil is available in 5-gallon cans (part no. 811100) and 55-gallon drums (part no. 811101).

#### OIL CAPACITY CHART

Model	Oil Capacity
MS(P)-18	4 gallons
MS(P)-45	9 gallons

#### HVA System Oil (If Supplied)

Fill the HVA oil tank, located at the rear of the machine, with the specified oil to within 1-1/2" from the top.

Use a premium-grade, paraffinic-base, industrial lubricating oil with a defoaming agent and oxidation and corrosion inhibitors. The viscosity is 400 to 450 SUS at 100°F. and 60 to 70 SUS at 210°F. with a minimum viscosity index of 90, pour point maximum 15°F. and flash point 465°F. minimum. This oil is available in 2-gallon cans (part no. 811802) or in 5-gallon cans (part no. 811800).

**MOTOR WARRANTY:** The motors provided with the machine have been selected to meet load requirements and are covered by a warranty issued by the motor manufacturer. The motors 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 the factory. If any modification or repair not authorized by the manufacturer is undertaken, the warranty is automatically voided.

**WARNING:** Before connecting the motors, be sure that the plunger and packing assemblies have been removed from the cylinder

1. Main Motor

The main drive motor has been sized to meet the requirements of your machine's capacity, operating pressure and your electrical specifications. It must be wired to meet local codes.

Normal rotation of the main motor is counter-clockwise, when viewed from the pulley side. Motors supplied by APV Gaulin will also have the direction of rotation marked on the end-bell of the motor.

If the motor was not supplied by APV Gaulin and is to be mounted on-site, four shock-mount pads have been supplied with the spare parts. These pads should be installed between the feet of the motor and the rocker-arm mounts in the machine.

2. Lube Oil Pump Motor

The power-end lube oil pump motor is located behind the rear panel (see Figure 40). It is a 3/4 hp, 3-phase motor and must be wired to run simultaneously with the main motor. The direction of rotation is indicated on the motor by an arrow.

3. Low Oil-Pressure Safety Cut-Out Switch

This switch is connected to the lubrication system and must be electrically connected to the main motor starter (see drawing B-18502). Its function is to shut the machine down, if the oil pressure drops below the set point. Note that, when starting the machine, it is necessary to hold the pull/start switch until the pressure rises above the set point.

4. HVA Oil Pump Motor (If Supplied)

The HVA oil pump motor is also located behind the rear panel (see Figure 40). It is a 3/4 hp, 3-phase motor and should be wired to the HVA on/off switch provided at the control panel. The HVA pump should be wired independently of the main drive motor. The direction of rotation is indicated on the motor by an arrow.

**WARNING:** The HVA pump shaft seal will be damaged, if the pump is run in the wrong direction.

## Belt Drive Tension and Care

The tension on 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. Also, check sheave alignment prior to start-up.

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 1) indicates improper tension.

Adjust the tension on the motor mounts 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 (approximately 1.65 cm) of span is achieved (see Figure 2). This procedure will serve to tension the belts for normal service.

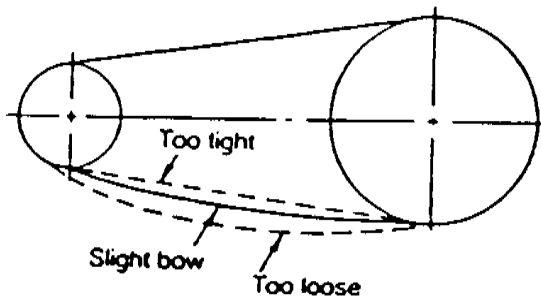


FIGURE 1

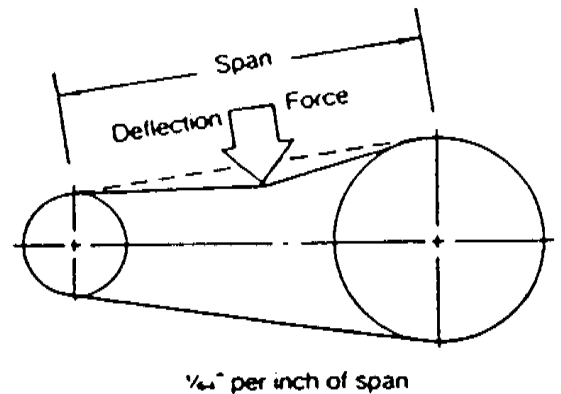


FIGURE 2

## 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.

The inlet system for your machine 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 may fail.

**WARNING:** Your machine is a positive-displacement pump. A three-way valve, designated for a 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 processed material must never be stopped while the machine is in operation.

When processing viscous products, the suction pipe should be considerably larger than the suction inlet connection, and a suitable feed pump should be provided to ensure positive and adequate feed to the suction side of the pump.

To minimize suction-line pulsations it is recommended that an adequately sized suction-line "stand-pipe" be installed in the suction line close to the machine's inlet flange.



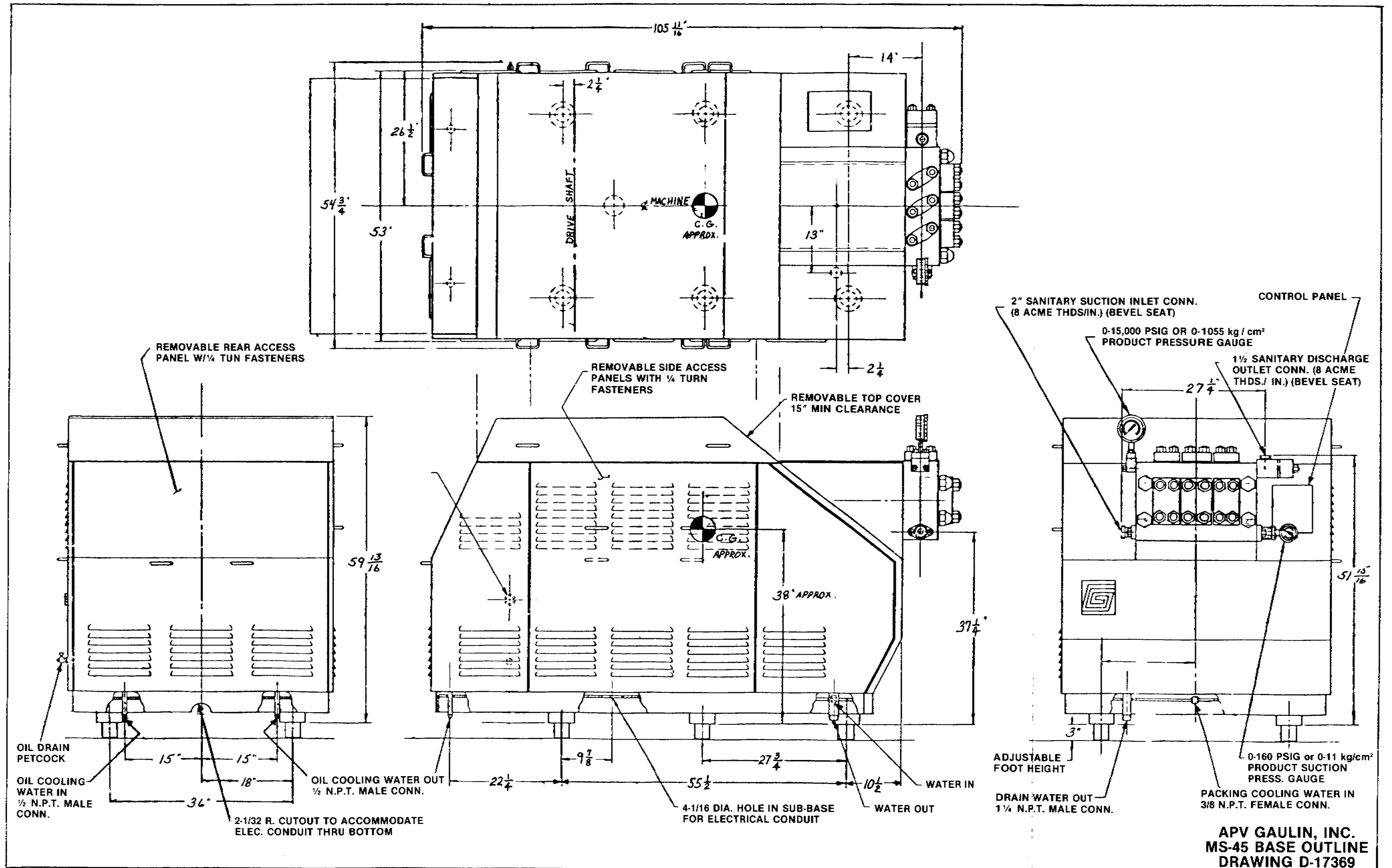
A suction (inlet) pressure gauge is recommended for use with the machine and is supplied as standard operating equipment. The necessary mounting fitting is also supplied for the inlet manifold.

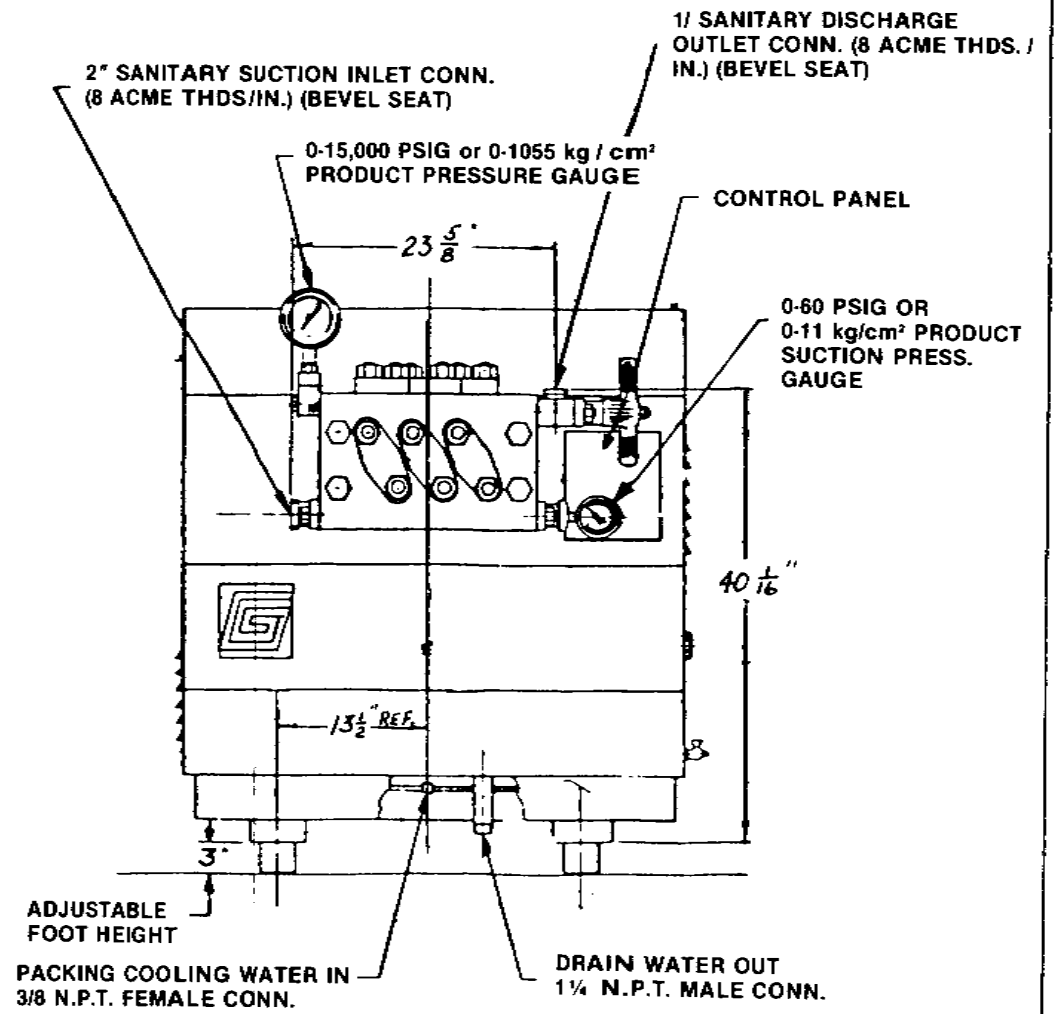
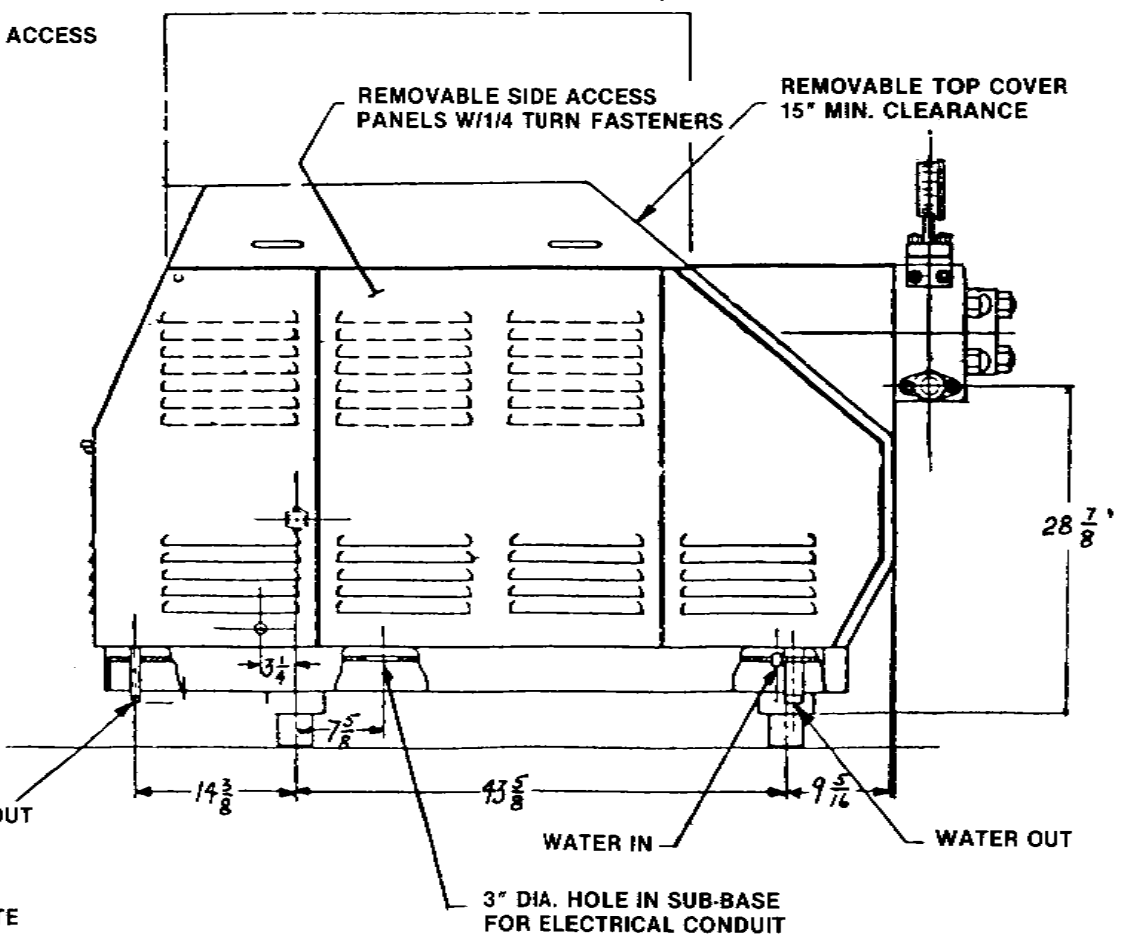
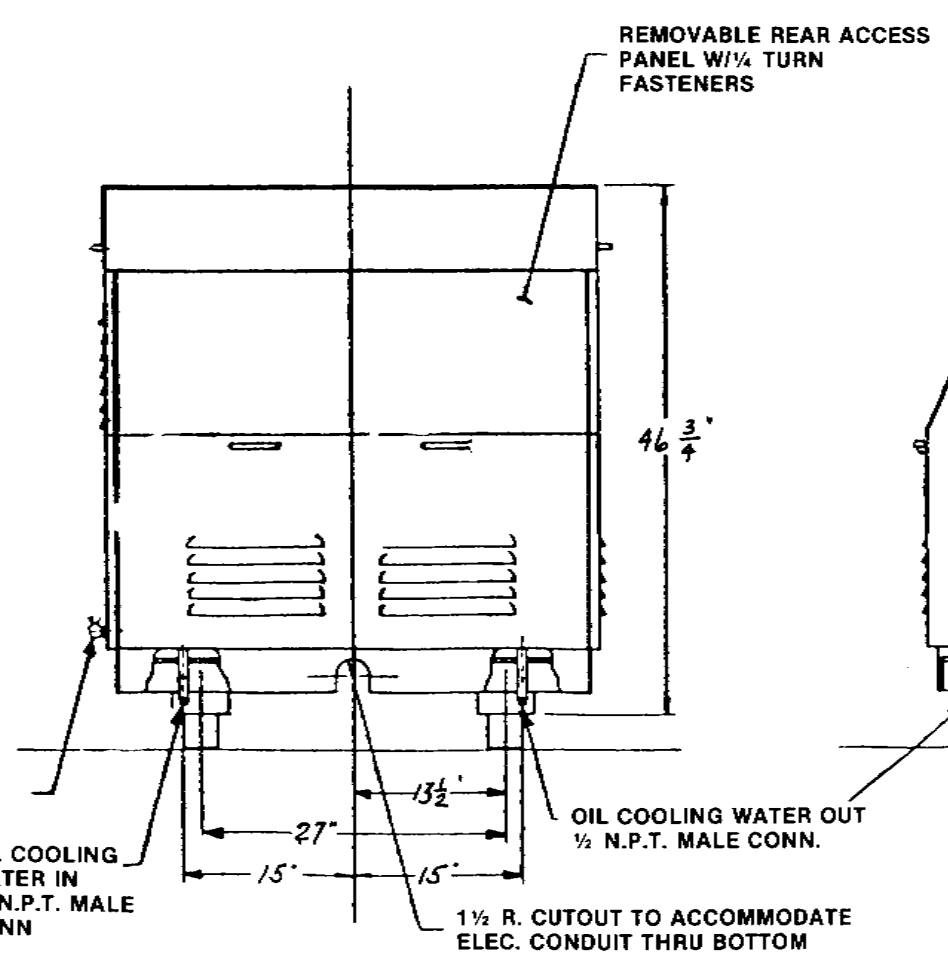
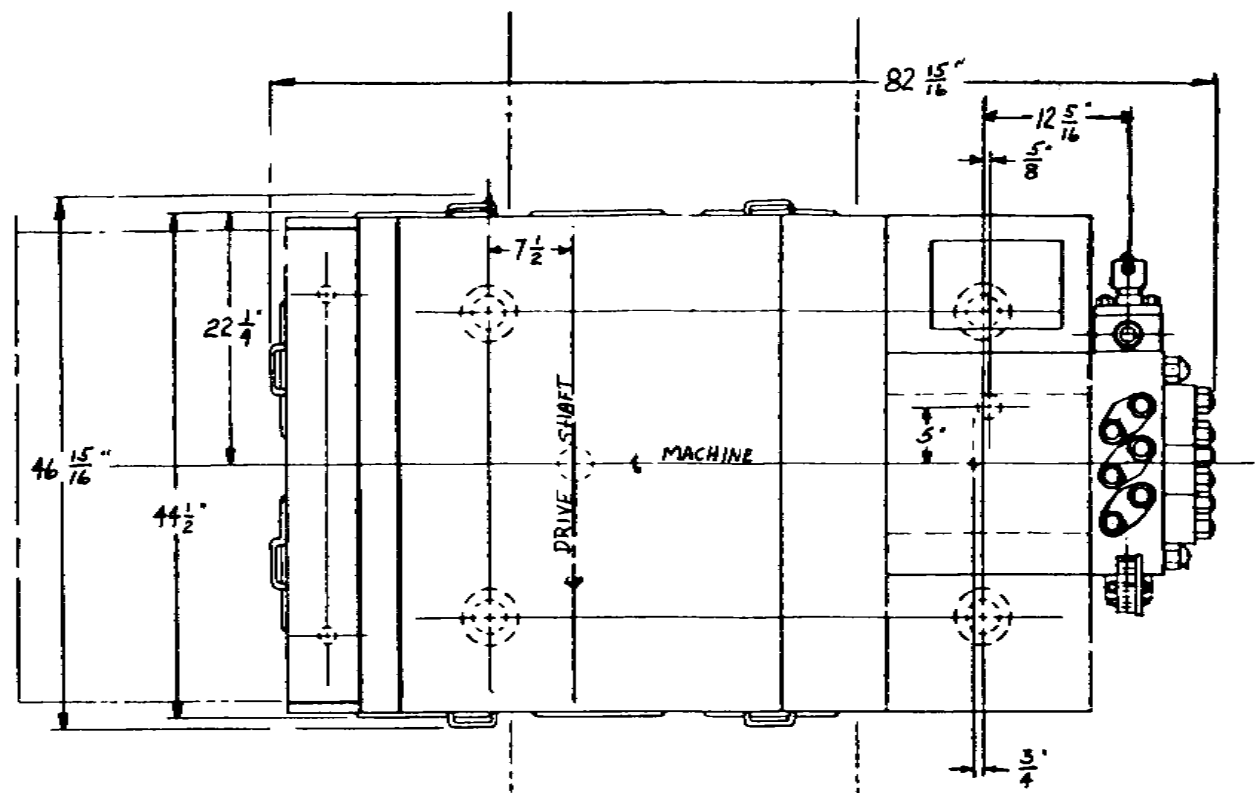
It is also recommended that a suitable pulsation dampener is installed in the outlet line. APV Gaulin offers a pipeline pulsation dampener ideally suited for homogenizer installation.

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, 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.







APV GAULIN, INC.  
MS-18 BASE OUTLINE  
DRAWING D-17370

**SECTION III**  
**CYLINDER ASSEMBLY — PS, TPS, TBS, TBA DESIGNS**

**Introduction**

The cylinder block is precision-machined from a single block of forged, precipitation-hardened, stainless steel selected for maximum pressure requirements. Other materials, such as 316 stainless steel and other special compositions may be used, as determined by the application or by customer option.

The following instruction foldout pages apply to various cylinder designs that are available with the MS(P) models. After checking the model number on your "Machine Identification Sheet" to determine the cylinder design supplied with your machine, locate the appropriate instruction foldout. All other foldouts may then be discarded.

**NOTE:** On double-packed cylinder designs (TPSX and TBSX) you will need the appropriate TPS or TBS foldout AND the double-packed cylinder instruction foldout.

LIST OF TOOLS

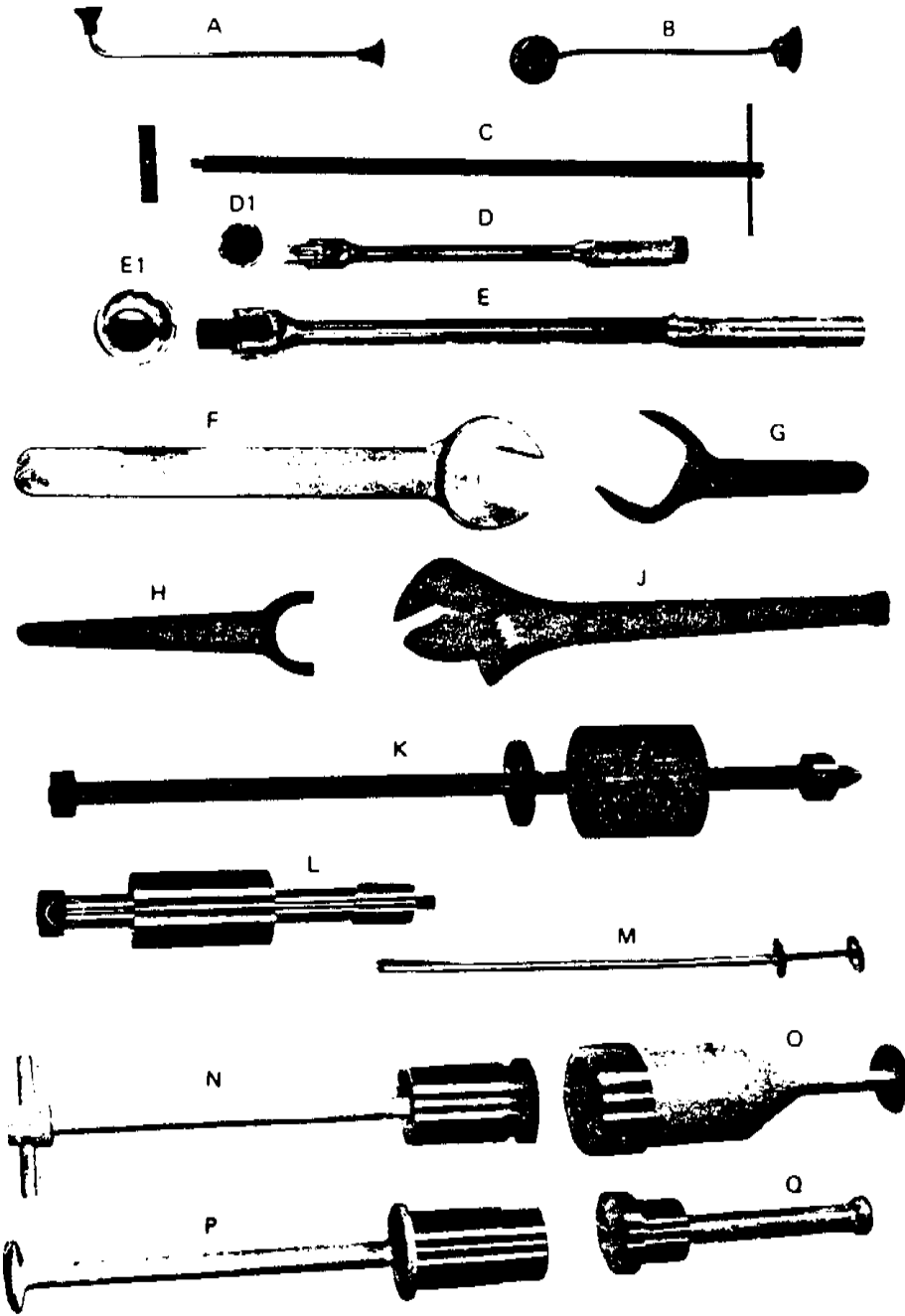


Figure 3

Illustrated above are some of the special tools for use with APV Gaulin equipment. The list will help you identify those particular tools furnished with your machine. Please consult the Packing List in the manual supplied with the machine for the complete description of tools applicable to your machine.

- |    |   |   |   |
|----|---|---|---|
| A  | BALL VALVE REMOVAL TOOL                                 | H | CROSSHEAD BEARING WRENCH                              |
| B  | POPPET VALVE REMOVAL TOOL                               | J | MISCELLANEOUS ADJUSTABLE WRENCH                       |
| C  | BALL VALVE GUIDE REMOVAL TOOL                           | K | VALVE SEAT REMOVAL TOOL ASSEMBLY                      |
| D  | 1/2" DRIVE HANDLE                                       | L | DISCHARGE & SUCTION VALVE STOP RETAINER, REMOVAL TOOL |
| D1 | 1/2" DRIVE SOCKET INLET, GAUGE & GAUGE BLOCK VALVE BODY | M | VALVE & STOP REMOVAL TOOL                             |
| E  | 3/4" DRIVE HANDLE                                       | N | PACKING REMOVAL TOOL ASSEMBLY                         |
| E1 | 3/4" DRIVE SOCKET, FRONT & UPPER CAP                    | O | PACKING ASSEMBLY TOOL                                 |
| F  | CROSSHEAD EXTENSION & VALVE BODY STUD NUT WRENCH        | P | REAR PACKING ASSEMBLY TOOL (ASEPTIC)                  |
| G  | BAFFLE GLAND & PACKING ADJUSTING SCREW WRENCH           | Q | PACKING REMOVAL TOOL (PACKING ADJUSTING SCREW-TYPE)   |
|    |   | R | BAFFLE PACKING REMOVAL TOOL (Not Shown)               |

## "PS" CYLINDER DESIGN INSTRUCTIONS

(See Figures 3, 4, 5, 6 and 47)

### Cylinder Disassembly

1. Remove the gauge stud nuts (43), gauge (41) and gauge gaskets (42).
2. Remove gauge block stud nuts (40), gauge block (37) and gauge block gaskets (39).
3. Remove inlet stud nuts (18) from inlet connections (17 and 31).
4. Remove inlet connections (17 and 31) and inlet connection gaskets (16).
5. Remove upper cap stud nuts (1), upper caps (2) and upper cap gaskets (3).
6. Remove discharge valve springs (5).
7. Remove front cap stud nuts (30).
8. Remove front caps (29) and front cap gaskets (28).
9. Remove packing adjusting springs (24).
10. Attach wrench (F) to the flats of each crosshead extension (88). Loosen and remove plungers (11) with plunger wrench (J).
11. Remove packings (25) by using packing removal tool (N). First, remove knurled nut from tool. Slide tool through packing assembly. Replace knurled nut on back side of cylinder and remove each packing assembly, consisting of plunger ring (26), packing (25) and packing adjusting ring (27).
12. Lift and remove suction valves (20) and discharge valves (8) with valve removal tool (B).

### Cleaning

Clean all parts thoroughly. Use brushes, but do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

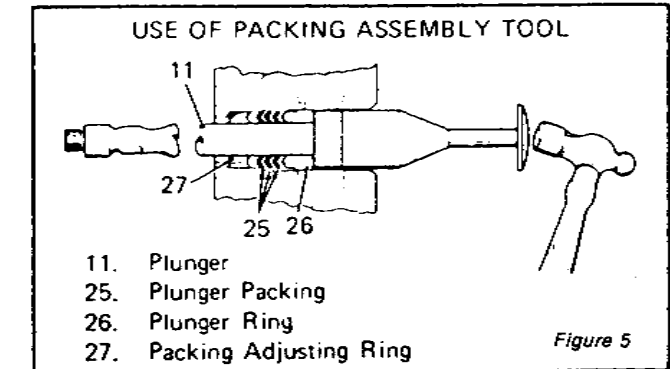
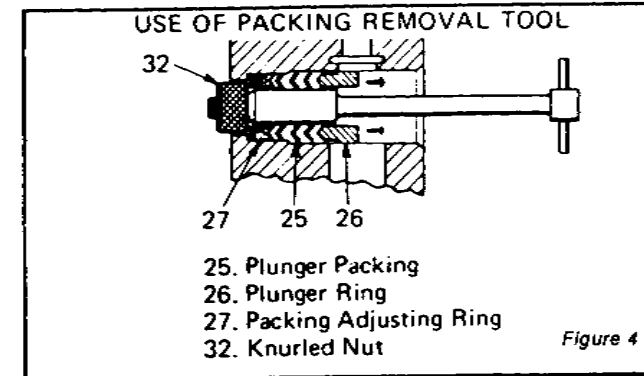
### Cylinder Reassembly

NOTE: Before assembly, all threads and nut faces should be coated with an acceptable lubricant that is compatible with the product to be processed.

1. Install suction and discharge valves (20 and 8) with valve removal tool (B).
2. Install discharge valve springs (5) on center of discharge valves (8).
3. Attach upper cap gaskets (3) onto upper caps (2).
4. Install upper caps (2) with gaskets (3), making sure that stems on the underside of caps enter discharge valve springs (5).
5. Install and tighten upper cap stud nuts (1).
6. Assemble plunger and packing assemblies as follows: As a unit, assemble packing adjusting ring (27), plunger packing (25) (please refer to packing list or Machine Identification Sheet to determine number of pieces of plunger packing required for your machine) and plunger ring (26) onto plunger (11). Repeat with all plungers.
7. Carefully insert plunger and packing assemblies through the front of the cylinder bores and thread and tighten plunger (11) into crosshead extensions (88) with wrenches provided.
8. Using packing assembly tool (O) and hammer, gently tap packing assemblies into cylinder bores until solid seating is obtained.
9. Install packing adjusting springs (24).
10. Replace front cylinder cap gaskets (28) on front caps (29). Place on cap studs (23) and replace front cap stud nuts (30). Tighten firmly and evenly by hand before securing with wrench (E and E1). Be sure that front caps are not tipped. They must be parallel with the front of the cylinder or the studs may bend in operation and fail from metal fatigue. Front cap stud nuts (30) must be sufficiently tight to compress the gasket and prevent leakage. This procedure must be followed, double-checking the tightness of the nuts on the cylinder, gauge and homogenizer valve assemblies.

11. Install gauge block gasket (39) and assemble gauge block (37) onto gauge block studs (46). Tighten securely with gauge block stud nuts (40).
12. Install gauge gasket (42) and gauge (41) to gauge block (37). Tighten gauge stud nuts (43) uniformly.
13. Replace inlet connection gaskets (16) on inlet connections (17 and 31).
14. Install and tighten inlet connections and connection stud nuts (18).

NOTE: Inlet gaskets, connection and caps can be installed on either left or right side of cylinder.



### PS CYLINDER PARTS

1 Upper Cap Stud Nut	6	26 Plunger Ring	3
2 Upper Cap	3	27 Packing Adjusting Ring	3
3 Upper Cap Gasket	3	28 Front Cap Gasket	3
5 Discharge Valve Spring	3	29 Front Cap	3
8 Discharge Poppet Valve	3	30 Front Cap Stud Nut	6
10 Cylinder	1	31 Inlet Gauge Connection	1
11 Plunger	3	37 Gauge Block	1
14 Upper Cap Stud	6	38 Gauge Stud	2
15 Connection Stud	4	39 Gauge Block Gasket	1
16 Connection Gasket	2	40 Gauge Block Stud Nut	2
17 Inlet Connection (Tri-Clamp or Standard)	1	41 Gauge with Flange	1
18 Connection Stud Nut	4	42 Gauge Gasket	1
20 Suction Poppet Valve	3	43 Gauge Stud Nut	2
23 Front Cap Stud	6	46 Gauge Block Stud	2
24 Packing Adjusting Spring	3	47 Infeed Pressure Gauge	1
25 Plunger Packing (See Machine Identification Sheet)	Varies	48 Infeed Pressure Gauge Gasket	1
		49 Infeed Gauge Clamp	1

WHEN ORDERING PARTS, SPECIFY MODEL NO., SERIAL NO.  
PART NAME AND QUANTITY

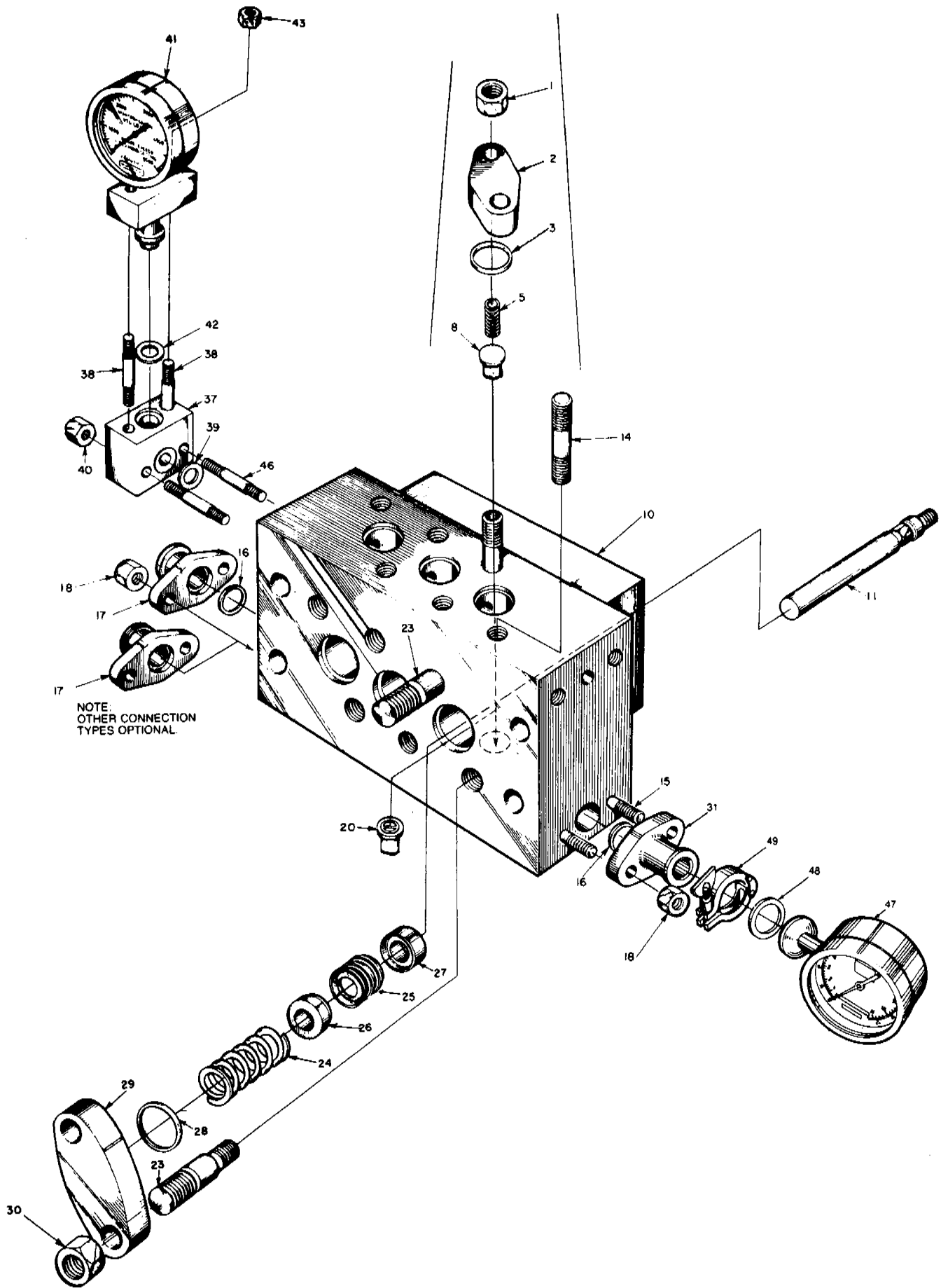


Figure 6

PS CYLINDER



## "TPS" CYLINDER DESIGN INSTRUCTIONS

(See Figures 3, 7, 8, 9 and 47)

### Cylinder Disassembly

1. Remove the gauge stud nuts (43) and remove gauge (41) and gauge gaskets (42).
2. Remove the gauge block stud nuts (40), gauge block (37) and gauge block gaskets (39).
3. Remove inlet stud nuts (18) from inlet connections (17 and 31).
4. Remove inlet connections (17 and 31) and inlet connection gaskets (16).
5. Remove upper cap stud nuts (1), upper caps (2) and upper cap gaskets (3).
6. Remove discharge valve springs (5).
7. Remove front cap stud nuts (30).
8. Remove front caps (29) and front cap gaskets (28).
9. Remove packing adjusting springs (24).
10. Attach wrench (F) to the flats of each crosshead extension (88). Loosen and remove plungers (11) with plunger wrench (J).
11. Remove packings (25) by using packing removal tool (N). First, remove knurled nut from tool. Next, slide tool through packing assembly, consisting of plunger ring (26) packing (25) and packing adjusting ring (27).
12. Lift and remove suction valves (20) and discharge valves (8) with valve removal tool (B).

### Cleaning

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

### Cylinder Reassembly

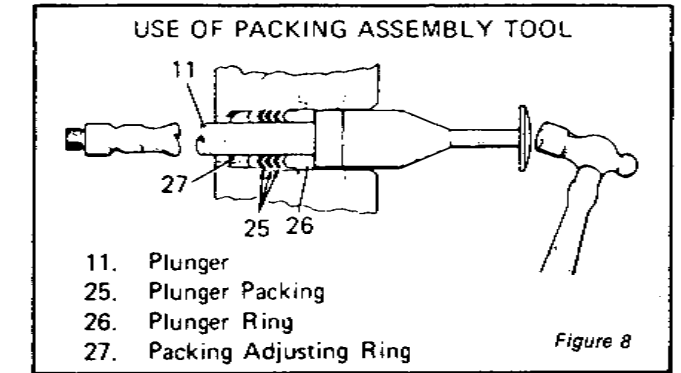
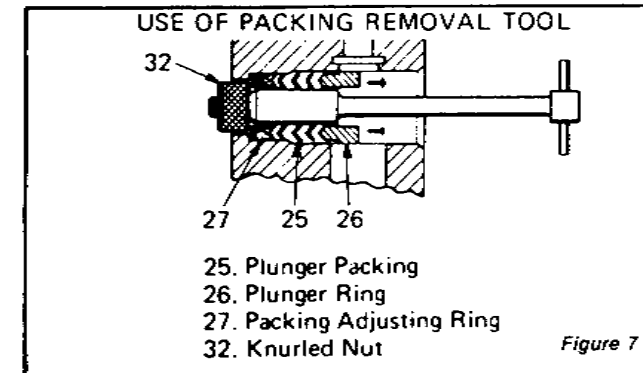
NOTE: Before assembly, all threads and nut faces should be coated with an acceptable lubricant which is compatible with the product to be processed.

1. Install suction and discharge valves (20 and 8) with valve removal tool (B).
2. Install discharge valve springs (5) on center of discharge valves (8).
3. Attach upper cap gaskets (3) onto upper caps (2).
4. Install upper caps (2) with gaskets (3), making sure that stems on the underside of caps enter discharge valve springs (5).
5. Install and hand-tighten upper cylinder cap nuts (1).
6. Assemble plunger and packing assemblies, as follows. As a unit, assemble packing adjusting ring (27), plunger packing (25) (please refer to packing list or Machine Identification Sheet to determine number of pieces of plunger packing required for your machine) and plunger ring (26) onto plunger (11). Repeat with all plungers.
7. Carefully insert plunger and packing assemblies through the front of the cylinder bores and thread and tighten plunger (11) into crosshead extensions (88) with wrenches provided.
8. Using packing assembly tool (O) [Tool (P) for TPSX design] and hammer, gently tap packing assemblies into cylinder bores, until solid seating is obtained.
9. Install packing adjusting springs (24).
10. Install front cap gaskets (28) on front caps (29). Place on cap studs (23) and replace front cap stud nuts (30). Tighten firmly and evenly by hand before securing with wrench (E and E1).

Be sure that front caps are not tipped. They must be parallel with the front of the cylinder, or the studs may bend in operation and fail from metal fatigue. Front cap stud nuts (30) must be sufficiently tight to compress the gasket and prevent leakage. This procedure must be followed, double-checking the tightness of the nuts on the cylinder, gauge and homogenizer valve assemblies.

11. Install gauge block gasket (39) and gauge block (37) onto gauge block studs (46). Tighten securely with gauge block stud nuts (40).
12. Install gauge gasket (42) and gauge (41) to gauge block (37). Tighten nuts uniformly.
13. Replace inlet connection gaskets (16) on inlet connections (17 and 31).
14. Install and tighten inlet connections and connection stud nuts (18).

NOTE: Inlet gaskets, connection and caps can be installed on either left or right side of cylinder.



### TPS (TPSX) CYLINDER PARTS LIST

1	Upper Cap Stud Nut	6	25	Plunger Packing (See Machine Identification Sheet)	Varies
2	Upper Cap	3		(Primary & Secondary on TPSX design)	
3	Upper Cap Gasket		26	Plunger Ring	3
5	Discharge Valve Spring	3		(Primary & Secondary on TPSX design)	
8	Discharge Poppet Valve	3	28	Front Cap Gasket	3
9	Tapered Discharge Valve Seat	3	29	Front Cap	3
10	Cylinder	1	30	Front Cap Stud Nut	6
11	Plunger	3	31	Inlet Gauge Connection	1
14	Upper Cap Stud	4	37	Gauge Block	1
15	Connection Stud	4	38	Gauge Stud	2
16	Connection Gasket	2	39	Gauge Block Gasket	1
17	Inlet Connection (Tri-Clamp or Standard)	1	40	Gauge Block Stud Nut	2
18	Connection Stud Nut	4	41	Gauge with Flange	1
19	Tapered Suction Valve Seat	3	42	Gauge Gasket	1
20	Suction Poppet Valve	3	43	Gauge Stud Nut	2
23	Front Cap Stud	6	46	Gauge Block Stud	2
24	Packing Adjusting Spring	3	47	Infeed Pressure Gauge	1
	(Primary & Secondary on TPSX design)		48	Infeed Pressure Gauge Gasket	1
			49	Infeed Gauge Clamp	

WHEN ORDERING PARTS, SPECIFY MODEL NO., SERIAL NO.,  
PART NAME AND QUANTITY

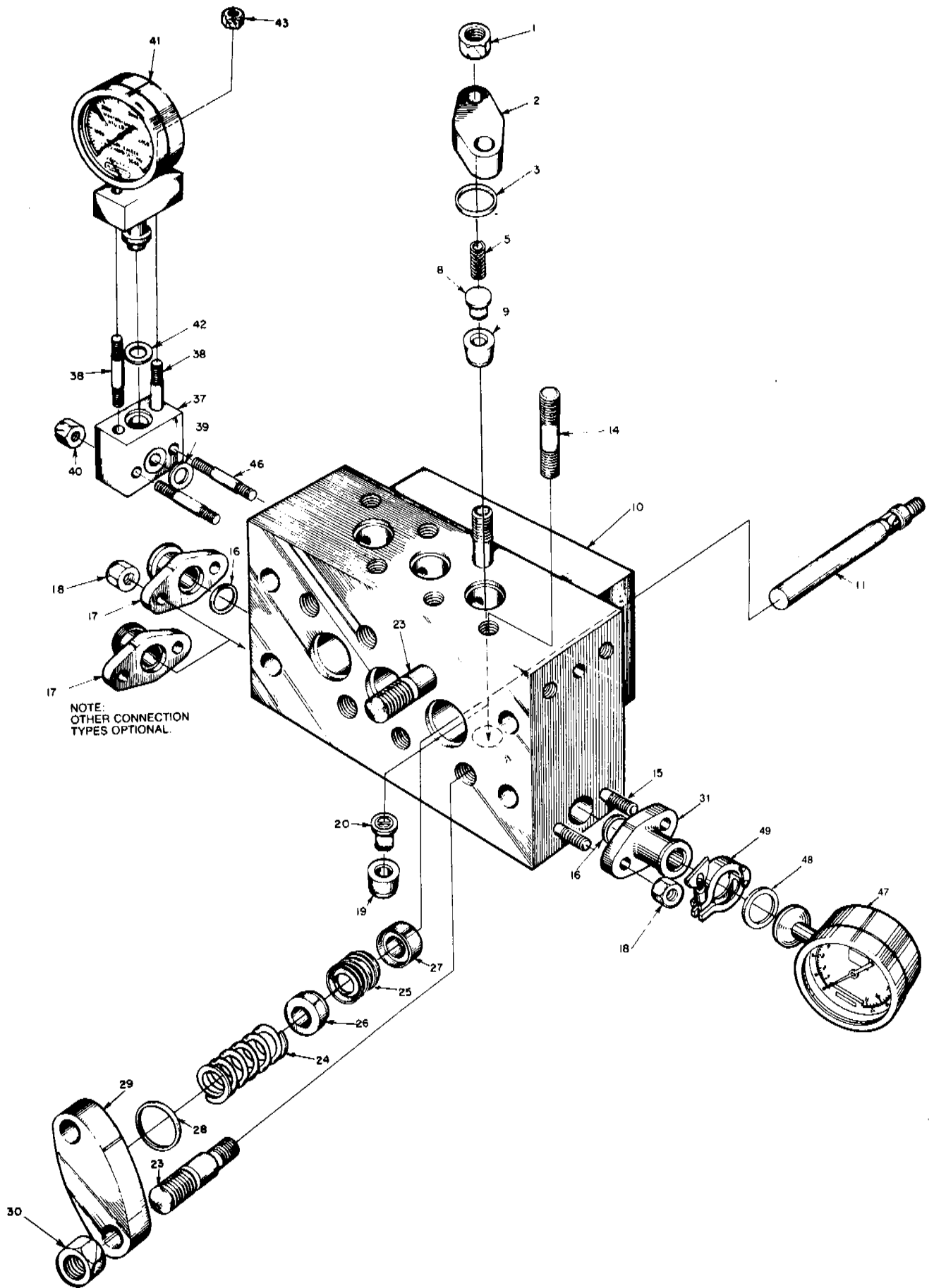


Figure 9

TPS CYLINDER

## "TBS" CYLINDER DESIGN INSTRUCTIONS

(See Figures 3, 10, 11, 12 and 47)

### Cylinder Disassembly

1. Remove the gauge stud nuts (43), gauge (41) and gauge gaskets (42).
2. Remove the gauge block stud nuts (40), gauge block (37) and gauge block gaskets (39).
3. Remove inlet stud nuts (18) from inlet connections (17 and 31).
4. Remove inlet connections (17 and 31) and inlet connection gaskets (16).
5. Remove upper cap stud nuts (1), upper caps (2) and upper cap gaskets (3).
6. Remove front cap stud nuts (30).
7. Remove front caps (29) and front cap gaskets (28).
8. Remove packing adjusting springs (24).
9. Attach wrench (F) to the flats of each crosshead extension (88). Loosen and remove plungers (11) with plunger wrench (J).
10. Remove packings (25) by using packing removal tool (N). First, remove knurled nut from tool. Next, slide tool through packing assembly, consisting of plunger ring (26), packing (25) and packing adjusting ring (27).
11. Remove discharge valve guide retaining springs (4). Remove discharge valve stops (22) with valve stop removal tool (M).
12. Remove suction valve stops (22) with valve stop removal tool (M).
13. Lift and remove suction and discharge valves (20 and 8) with valve removal tool (A).
14. Both suction and discharge valve guides (21 and 7) may be removed with ball valve guide removal tool (C).

### Cleaning

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

### Cylinder Reassembly

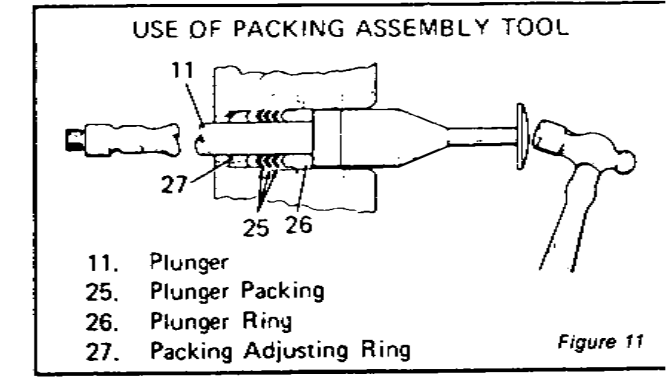
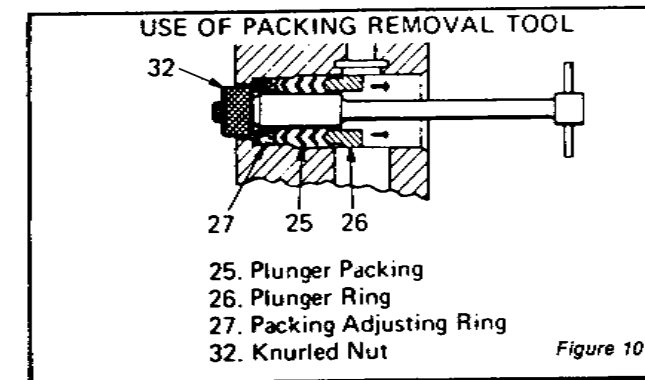
NOTE: Before assembly, all threads and nut faces should be coated with an acceptable lubricant which is compatible with the product being processed.

1. Install suction and discharge valves (20 and 8) with valve removal tool (A).
2. Install suction and discharge valve guides (21 and 7).
3. Install suction and discharge valve stops (22) with valve stop removal tool (M).
4. Install discharge valve guide retaining springs (4).
5. Install upper cap gaskets (3) into gasket recesses and install upper caps (2). Install upper cap stud nuts (1) and tighten securely.
6. Assemble plunger and packing assemblies, as follows. As a unit, assemble packing adjusting ring (27), plunger packing (25) (please refer to packing list or Machine Identification Sheet to determine number of pieces of plunger packing required for your machine) and plunger ring (26) onto plunger (11). Repeat with all plungers.
7. Carefully insert plunger and packing assemblies into the cylinder bores from the front and securely tighten plungers (11) to crosshead extensions (88) with wrenches provided.
8. Using packing assembly tool (O) [Tool (P) for TBSX design], gently tap packing assemblies into cylinder bores, until solid seating is obtained.
9. Install packing adjusting springs (24).
10. Replace front cap gaskets (28) on front caps (29). Place on cap studs (23) and replace front cap stud nuts (30). Tighten firmly and evenly by hand before securing with wrench (E and E1).

Be sure that front caps are not tipped. They must be parallel with the front of the cylinder, or the studs may bend in operation and fail from metal fatigue. Front cap stud nuts (30) must be sufficiently tight to compress the gasket and prevent leakage. This procedure must be followed, double-checking the tightness of the nuts on the cylinder, gauge and homogenizer valve assemblies.

11. Install inlet connection gaskets (16) on inlet connections (17 and 31).
12. Install inlet connection stud nuts (18) on inlet studs (15) and tighten evenly and firmly.
13. Install gauge block gasket (39) into gasket recess and assemble gauge block (37) onto gauge block studs (46). Tighten securely with gauge block stud nuts (40).
14. Install gauge gasket (42) and gauge (41) to gauge block (37). Tighten gauge stud nuts (43) uniformly.

NOTE: Inlet gaskets, connection and caps can be installed on either left or right side of cylinder.



### TBS (TBSX) CYLINDER PARTS LIST

<table border="0" style="width: 100%;"> <tr><td>1</td><td>Upper Cap Stud Nut</td><td style="text-align: right;">6</td></tr> <tr><td>2</td><td>Upper Cap</td><td style="text-align: right;">3</td></tr> <tr><td>3</td><td>Upper Cap Gasket</td><td style="text-align: right;">3</td></tr> <tr><td>4</td><td>Discharge Valve Guide Retaining Spring</td><td style="text-align: right;">3</td></tr> <tr><td>7</td><td>Discharge Valve Guide</td><td style="text-align: right;">3</td></tr> <tr><td>8</td><td>Discharge Ball Valve</td><td style="text-align: right;">3</td></tr> <tr><td>9</td><td>Tapered Discharge Valve Seat</td><td style="text-align: right;">3</td></tr> <tr><td>10</td><td>Cylinder</td><td style="text-align: right;">1</td></tr> <tr><td>11</td><td>Plunger</td><td style="text-align: right;">3</td></tr> <tr><td>14</td><td>Upper Cap Stud</td><td style="text-align: right;">6</td></tr> <tr><td>15</td><td>Connection Stud</td><td style="text-align: right;">4</td></tr> <tr><td>16</td><td>Connection Gasket</td><td style="text-align: right;">2</td></tr> <tr><td>17</td><td>Inlet Connection (Tri-Clamp or Standard)</td><td style="text-align: right;">1</td></tr> <tr><td>18</td><td>Connection Stud Nut</td><td style="text-align: right;">4</td></tr> <tr><td>19</td><td>Tapered Suction Valve Seat</td><td style="text-align: right;">3</td></tr> <tr><td>20</td><td>Suction Ball Valve</td><td style="text-align: right;">3</td></tr> <tr><td>21</td><td>Suction Valve Guide</td><td style="text-align: right;">3</td></tr> <tr><td>22</td><td>Valve Stop</td><td style="text-align: right;">3</td></tr> <tr><td>23</td><td>Front Cap Stud</td><td style="text-align: right;">6</td></tr> <tr><td>24</td><td>Packing Adjusting Spring (Primary &amp; Secondary on TBSX design)</td><td style="text-align: right;">3</td></tr> </table>	1	Upper Cap Stud Nut	6	2	Upper Cap	3	3	Upper Cap Gasket	3	4	Discharge Valve Guide Retaining Spring	3	7	Discharge Valve Guide	3	8	Discharge Ball Valve	3	9	Tapered Discharge Valve Seat	3	10	Cylinder	1	11	Plunger	3	14	Upper Cap Stud	6	15	Connection Stud	4	16	Connection Gasket	2	17	Inlet Connection (Tri-Clamp or Standard)	1	18	Connection Stud Nut	4	19	Tapered Suction Valve Seat	3	20	Suction Ball Valve	3	21	Suction Valve Guide	3	22	Valve Stop	3	23	Front Cap Stud	6	24	Packing Adjusting Spring (Primary & Secondary on TBSX design)	3	<table border="0" style="width: 100%;"> <tr><td>25</td><td>Plunger Packing (See Machine Identification Sheet) (Primary &amp; Secondary on TBSX design)</td><td style="text-align: right;">3</td></tr> <tr><td>26</td><td>Plunger Ring (Primary &amp; Secondary on TBSX design)</td><td style="text-align: right;">3</td></tr> <tr><td>27</td><td>Packing Adjusting Ring (Primary &amp; Secondary on TBSX design)</td><td style="text-align: right;">3</td></tr> <tr><td>28</td><td>Front Cap Gasket</td><td style="text-align: right;">3</td></tr> <tr><td>29</td><td>Front Cap</td><td style="text-align: right;">3</td></tr> <tr><td>30</td><td>Front Cap Stud Nut</td><td style="text-align: right;">6</td></tr> <tr><td>31</td><td>Inlet Gauge Connection</td><td style="text-align: right;">1</td></tr> <tr><td>37</td><td>Gauge Block</td><td style="text-align: right;">1</td></tr> <tr><td>38</td><td>Gauge Stud</td><td style="text-align: right;">2</td></tr> <tr><td>39</td><td>Gauge Block Gasket</td><td style="text-align: right;">1</td></tr> <tr><td>40</td><td>Gauge Block Stud Nut</td><td style="text-align: right;">2</td></tr> <tr><td>41</td><td>Gauge with Flange</td><td style="text-align: right;">1</td></tr> <tr><td>42</td><td>Gauge Gasket</td><td style="text-align: right;">1</td></tr> <tr><td>43</td><td>Gauge Stud Nut</td><td style="text-align: right;">2</td></tr> <tr><td>46</td><td>Gauge Block Stud</td><td style="text-align: right;">2</td></tr> <tr><td>47</td><td>Infeed Pressure Gauge</td><td style="text-align: right;">1</td></tr> <tr><td>48</td><td>Infeed Pressure Gauge Gasket</td><td style="text-align: right;">1</td></tr> <tr><td>49</td><td>Infeed Gauge Clamp</td><td style="text-align: right;">1</td></tr> </table>	25	Plunger Packing (See Machine Identification Sheet) (Primary & Secondary on TBSX design)	3	26	Plunger Ring (Primary & Secondary on TBSX design)	3	27	Packing Adjusting Ring (Primary & Secondary on TBSX design)	3	28	Front Cap Gasket	3	29	Front Cap	3	30	Front Cap Stud Nut	6	31	Inlet Gauge Connection	1	37	Gauge Block	1	38	Gauge Stud	2	39	Gauge Block Gasket	1	40	Gauge Block Stud Nut	2	41	Gauge with Flange	1	42	Gauge Gasket	1	43	Gauge Stud Nut	2	46	Gauge Block Stud	2	47	Infeed Pressure Gauge	1	48	Infeed Pressure Gauge Gasket	1	49	Infeed Gauge Clamp	1
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WHEN ORDERING PARTS, SPECIFY MODEL NO., SERIAL NO.,  
PART NAME AND QUANTITY

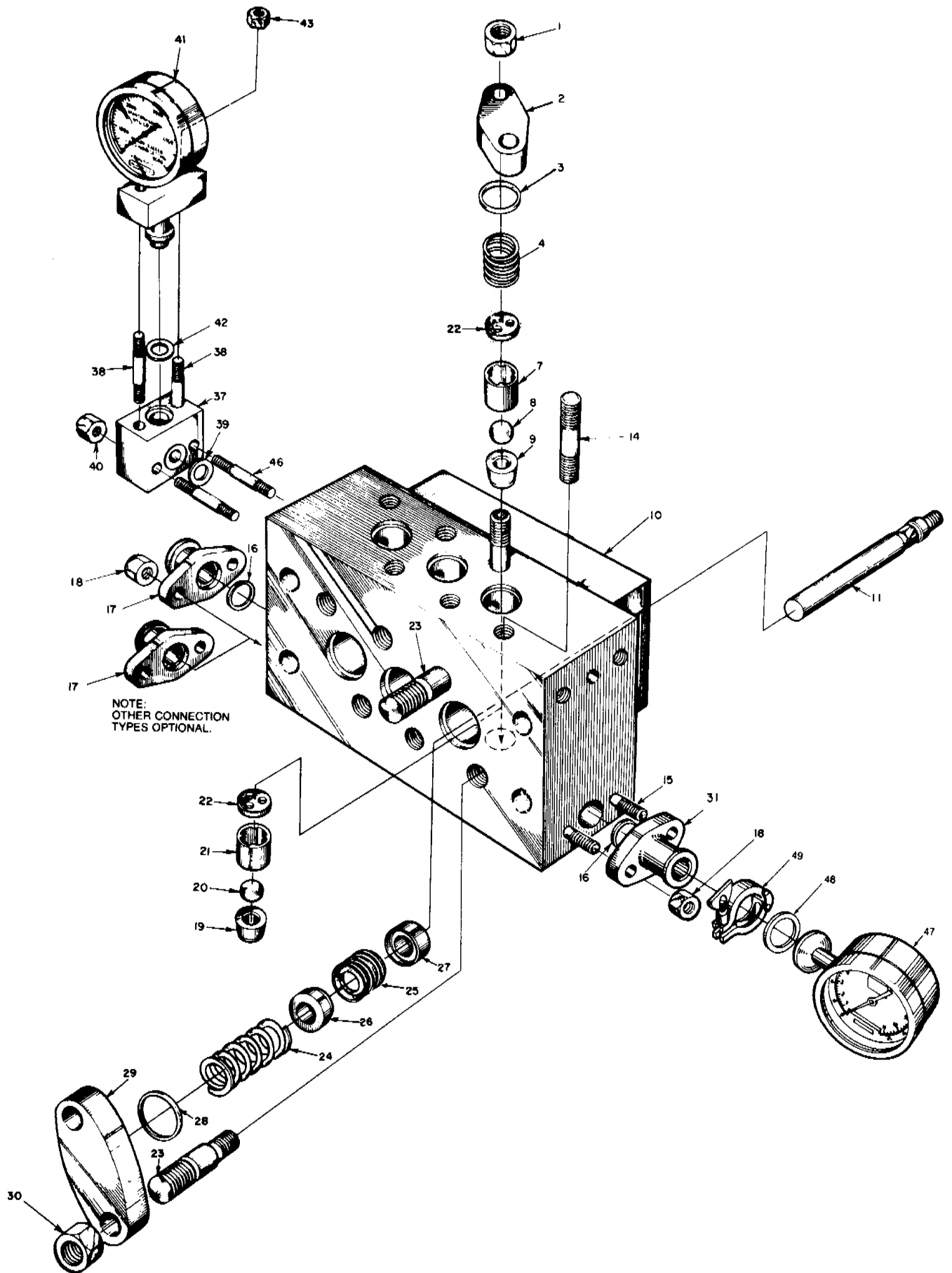


Figure 12

TBS CYLINDER

## "TBA" CYLINDER DESIGN INSTRUCTIONS

(See Figures 3, 13, 14 and 47)

### Cylinder Disassembly

1. Remove the gauge stud nuts (43), gauge (41) and gauge gaskets (42).
2. Remove the gauge block stud nuts (40), gauge block (37) and gauge block gaskets (39).
3. Remove inlet connection stud nuts (18) from inlet connections (17 and 31).
4. Remove inlet connections (17 and 31) and inlet connection gaskets (16).
5. Remove upper cap stud nuts (1), upper caps (2) and upper cap gaskets (3).
6. Remove discharge valve guide retaining springs (4). In addition, remove discharge valve stops (22) and discharge valves (8) with tools supplied.
7. Remove front cap stud nuts (30).
8. Remove front caps (29) and front cap gaskets (28).
9. Remove suction valve stop retainer springs (24).
10. Attach wrench (F) to the flats of each crosshead extension (88). Loosen and remove plungers (11) with plunger wrench (J).
11. Loosen and remove packing adjusting screws (32) with wrench (G).
12. Remove plunger rings (26), plunger packing (25) and packing adjusting rings (27) by inserting packing removal tool (Q) through front of cylinder and tamp against it with hand pressure.
13. Remove suction valve stops (22) with valve stop removal tool (M).
14. Lift and remove suction valves (20) with valve removal tool (C).
15. Both suction and discharge valve guides (21 and 7) may be removed with ball valve guide removal tool (C).

### Cleaning

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

### Cylinder Reassembly

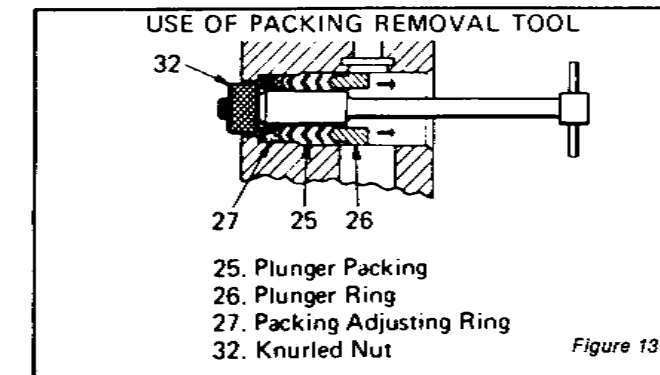
NOTE: Before assembly, all threads and nut faces should be coated with an acceptable lubricant which is compatible with the product being processed.

1. Install suction and discharge valves (20 and 8) with valve removal tool (A).
2. Install suction and discharge valve guides (21 and 7).
3. Install suction and discharge valve stops (22) with valve stop removal tool (M).
4. Install discharge valve guide retaining springs (4).
5. Install upper cap gaskets (3) into gasket recesses and install upper caps (2). Install upper cap stud nuts (1) and tighten securely.
6. When possible, use an acceptable lubricant on packing assembly parts, plunger ring (26), plunger packing (25) and packing adjusting ring (27) and assemble each part individually into the packing bore.
7. Assemble and tighten packing adjusting screw (32) into packing bore and against packing assembly HAND-TIGHT to keep packing assembly in place.
8. Lubricate plunger (11) threads and body and insert through front of cylinder through packing assembly and tighten to crosshead extension (88) with wrenches provided. Repeat with all plungers.
9. Install suction valve stop retainer spring (24) into cylinder bore. Repeat with all retainers.
10. Replace front cap gaskets (28) on front caps (29). Place on cap studs (23) and replace front cap stud nuts (30), tighten firmly and evenly by hand before securing with wrench (E and E1).

Be sure that front caps are not tipped. They must be parallel with the front of the cylinder, or the studs may bend in operation and fail from metal fatigue. Front cap stud nuts (30) must be sufficiently tight to compress the gasket and prevent leakage. This procedure must be followed, double-checking the tightness of the nuts on the cylinder, gauge and homogenizer valve assemblies.

11. Install inlet connection gaskets (16) on inlet connections (17 and 31).
12. Install inlet connection stud nuts (18) on inlet studs (15) and tighten evenly and firmly.
13. Install gauge block gasket (39) and assemble gauge block (37) onto gauge block studs (46). Tighten securely with gauge block stud nuts (40).
14. Install gauge gasket (42) and gauge (41) to gauge block (37). Install and tighten gauge stud nuts (43) uniformly.
15. Retighten packing adjusting screw (32) with wrench (G) just sufficiently to prevent leakage.

NOTE: Inlet gaskets, connections and caps can be installed on either left or right side of cylinder.



### TBA CYLINDER PARTS LIST

1	Upper Cap Stud Nut	6	25	Plunger Packing (See Machine Identification Sheet)	Varies
2	Upper Cap	3	26	Plunger Ring	3
3	Upper Cap Gasket	3	27	Packing Adjusting Ring	3
4	Discharge Valve Guide Retaining Spring	3	28	Front Cap Gasket	3
7	Discharge Valve Guide	3	29	Front Cap	3
8	Discharge Ball Valve	3	30	Front Cap Stud Nut	6
9	Tapered Discharge Valve Seat	3	31	Inlet Gauge Connection	1
10	Cylinder	1	32	Packing Adjusting Screw	3
11	Plunger	3	37	Gauge Block	1
14	Upper Cap Stud	6	38	Gauge Stud	2
15	Connection Stud	4	39	Gauge Block Gasket	1
16	Connection Gasket	2	40	Gauge Block Stud Nut	2
17	Inlet Connection (Tri-Clamp or Standard)	1	41	Gauge with Flange	1
18	Connection Stud Nut	4	42	Gauge Gasket	1
19	Tapered Suction Valve Seat	3	43	Gauge Stud Nut	2
20	Suction Ball Valve	3	46	Gauge Block Stud	2
21	Suction Valve Guide	3	47	Infeed Pressure Gauge	1
22	Valve Stop	3	48	Infeed Pressure Gauge Gasket	1
23	Front Cap Stud	6	49	Infeed Gauge Clamp	
24	Suction Valve Stop Retainer Spring	3			

WHEN ORDERING PARTS, SPECIFY MODEL NO., SERIAL NO.,  
PART NAME AND QUANTITY

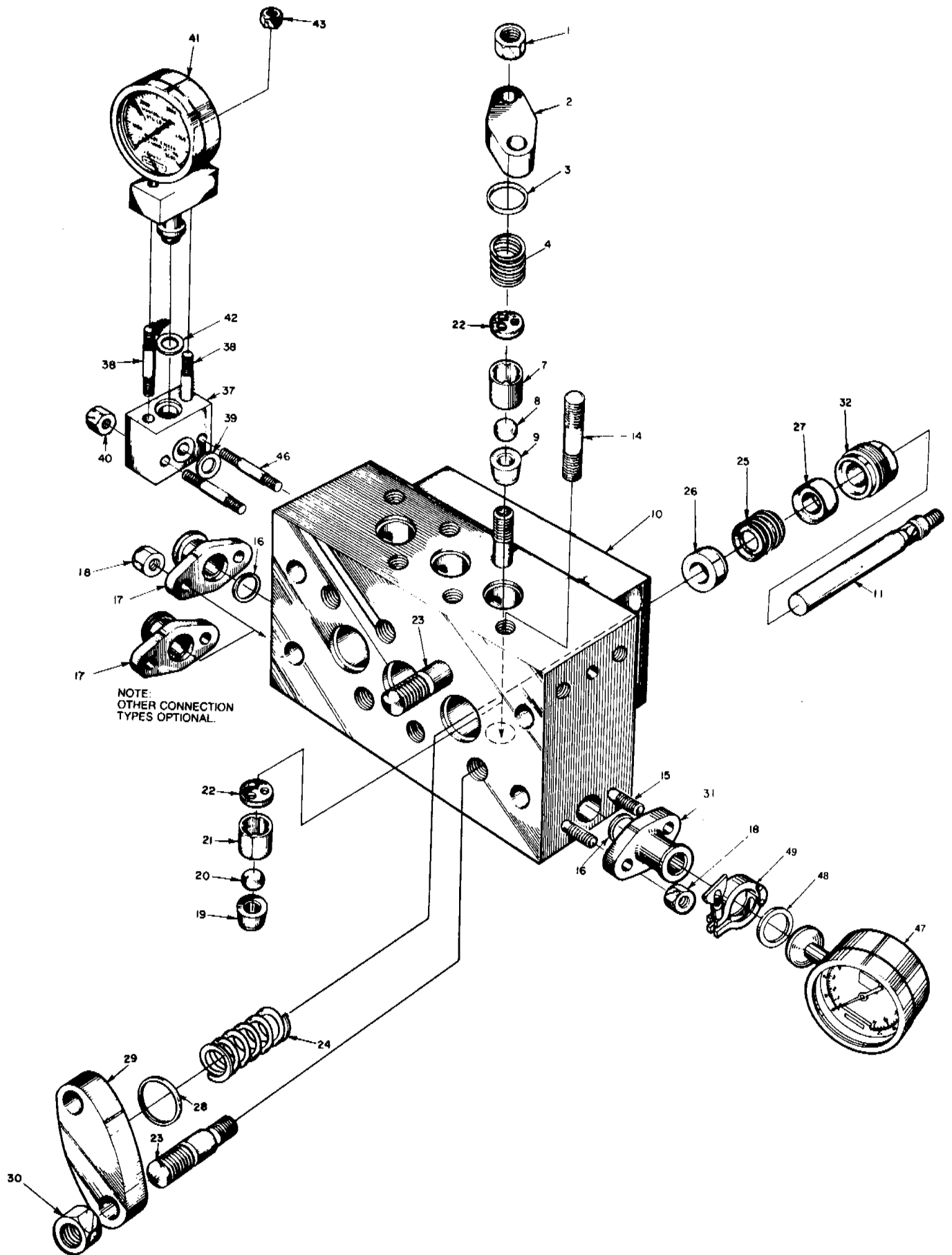


Figure 14

TBA CYLINDER

## DOUBLE-PACKED CYLINDER DESIGN

Double-packed cylinder homogenizer construction provides a means of confining the plungers in an atmosphere where a fluid purge is provided (by steam or other suitable fluid.)

The cylinder is constructed with an inlet fitting, which supplies steam/fluid to each purge zone through a common cavity connecting all plunger bores. The steam/fluid is directed into each plunger bore and confined between sets of primary and secondary plunger packing. The steam/fluid is discharged through a common outlet. The primary packing assembly is spring-loaded and seals the product being pumped in the pumping chamber. The secondary packing assembly is also spring-loaded and provides a purge zone around each plunger.

The construction of the cylinder block and the plunger stroke are designed to prevent any part of the plunger normally in contact with the product from being withdrawn from the purge zone.

The customer would supply the steam/fluid line, including pressure reducing valve, check valve, globe valve, pressure gauge and strainer to the 1/4" NPT fitting supplied in the top of the cylinder, as needed. Condensate piping and trap are included with the machine and are Factory-connected to the drain line.

Steam or hot water at temperatures up to 300°F. is often used for sterilizing the cylinder. Because of the high temperature and the lack of lubricity between the plunger packings, the best high temperature plunger packings available will not give service approaching that of standard plunger packing used in processing food products. Accordingly, these machines are supplied with hard, chrome-plated plungers, which are polished for best packing life.

In operation, steam/fluid supplied to the top of cylinder and the condensate is removed through the built-in steam trap. Never allow steam/fluid pressure to exceed product infeed pressure while processing.

In order to help prolong packing life, steam/fluid flow to plunger seals should be stopped during in-place cleaning cycles.

The following drawing is for a TPSX (poppet-valve) cylinder design. The TBSX design is exactly the same except for ball-type pump valves instead of poppet. For disassembly/reassembly use the instructions and parts list for TPS or TBS cylinder with the TPSX drawing.

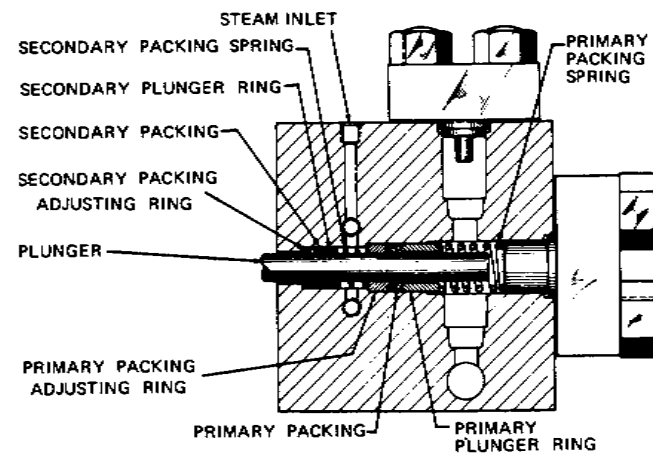


Figure 15

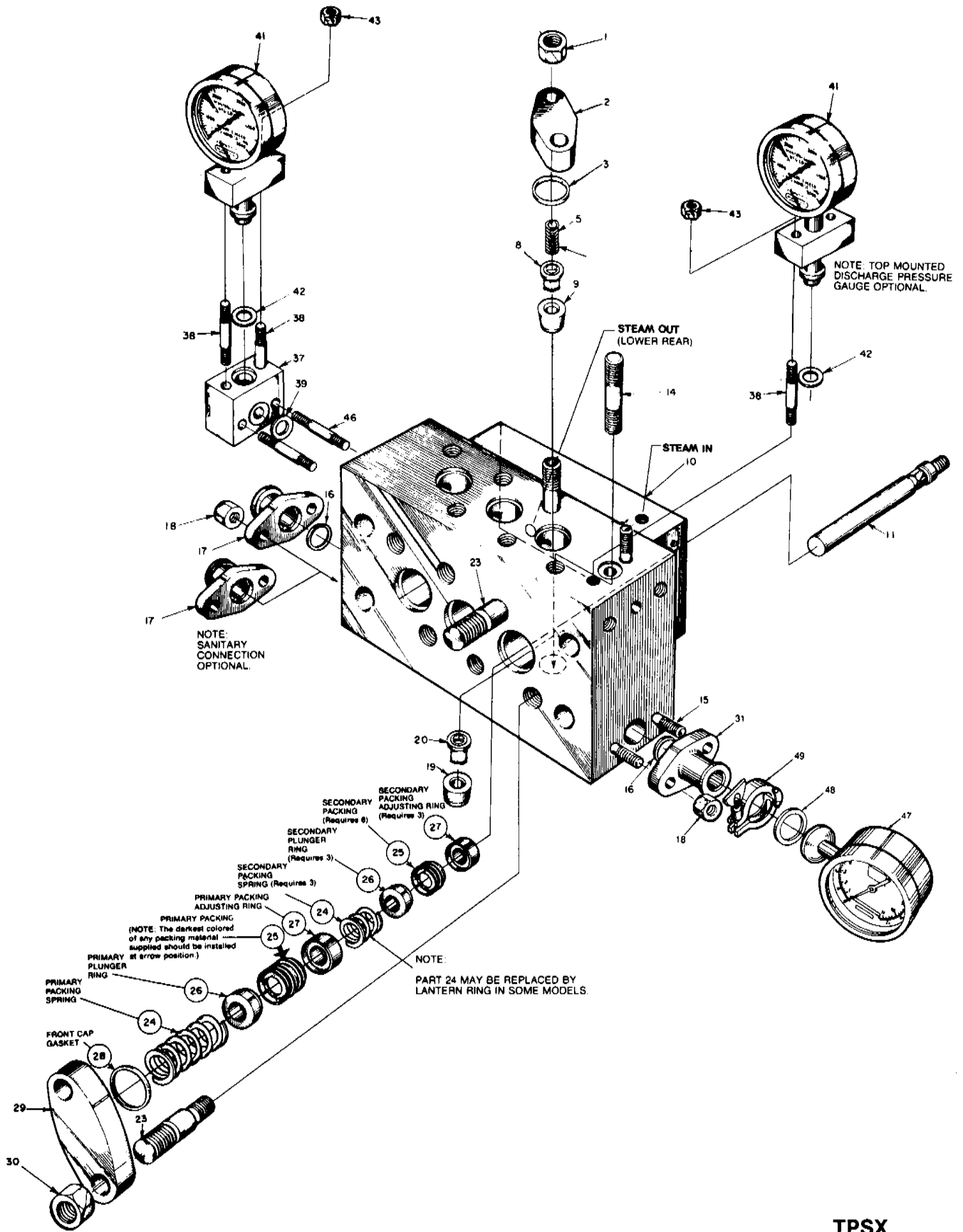


Figure 16

**TPSX**  
**Double-Packed**  
**CYLINDER**  
 (For TBSX see  
 Instructions)



## **SECTION IV**

# **HOMOGENIZER AND HIGH PRESSURE PUMP DISCHARGE BLOCK VALVE ASSEMBLIES**

**SINGLE-STAGE HOMOGENIZING VALVE ASSEMBLY  
(PILOTED TYPE)  
INSTRUCTIONS AND PARTS LIST**

**Valve Disassembly**

1. Remove valve body stud nuts (5), handwheel (9), handwheel support assembly (4) and valve rod packing (3).
2. Remove valve body (2) assembly, being careful not to drop valve components.
3. Remove valve seat gasket (14), valve seat (13), valve (11) and impact ring (12).

**Cleaning**

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal part from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

**Valve Reassembly**

NOTE: If your machine is furnished with HVA, also see Figure 30 for complete reassembly instructions.

1. Install impact ring (12) into valve body (2).
2. Install valve seat (13) and valve (11) as an assembly into valve body (2).  
  
Note: To guard against possible valve stem breakage, be certain that valve (11) remains inserted into valve seat (13) after assembly is placed into position in valve body.
3. Install valve seat gasket (14).
4. Slide assembled valve body (2) over studs (1).
5. Reassemble handwheel (9) and handwheel support assembly (4) and install valve rod packing (3) on valve rod (6)
6. Replace stud nuts (5) and tighten evenly and securely.

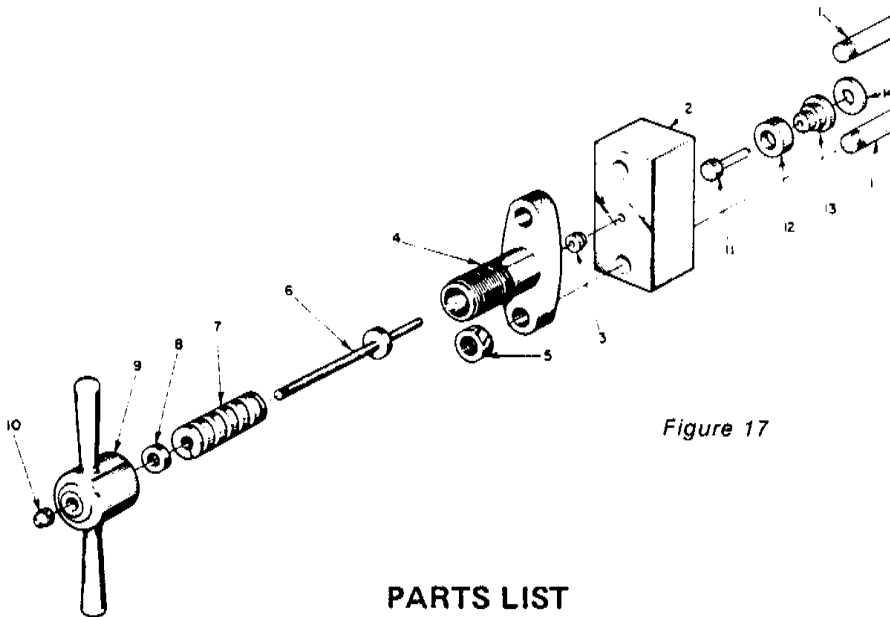


Figure 17

**PARTS LIST**

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
1	Valve Body Stud	2	8	Valve Rod Washer	1
2	Valve Body	1	9	Hand Wheel	1
3	Valve Rod Packing	1	10	Valve Rod Cap Nut	1
4	Hand Wheel Support	1	11	Homo.Valve	1
5	Valve Body Stud Nut	2	12	Impact Ring	1
6	Valve Rod	1	13	Homo.Valve Seat	1
7	Valve Spring	1	14	Homo.Valve Seat Gasket	1

When ordering Parts, specify Model No., Serial No., Part Name and Quantity.

**SINGLE-STAGE HOMOGENIZING VALVE ASSEMBLY  
(FLUTED TYPE)  
INSTRUCTIONS AND PARTS LIST**

**Valve Disassembly**

1. Remove valve body stud nuts (5), handwheel (9), handwheel support assembly (4) and valve rod packing (3).
2. Remove valve body (2) assembly, being careful not to drop valve components.
3. Remove valve seat gasket (14), valve seat (13), valve seat O-ring (17), if used, impact ring (12), valve guide (15) with gasket (16) and valve (11).

**Cleaning**

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

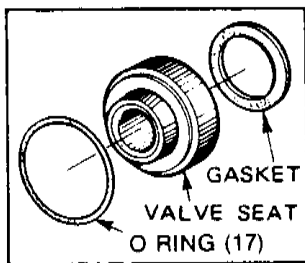
Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

**Valve Reassembly**

NOTE: If your machine is furnished with HVA, also see Figure 30 for complete reassembly instructions.

1. Install valve guide gasket (16) over valve guide (15) and insert into valve body (2).
2. Lubricate valve (11) with an acceptable lubricant and insert into valve guide (15), making sure that the valve moves freely.
3. Reinstall the impact ring (12), valve seat 13, valve seat O-ring (17), if used.
4. Slide assembled valve body over studs (1).
5. Reassemble handwheel (9) and handwheel support assembly (4) and install valve rod packing (3) on valve rod (6)
6. Replace stud nuts (5) and tighten evenly and securely.



Valve Seat Used On Some Assemblies

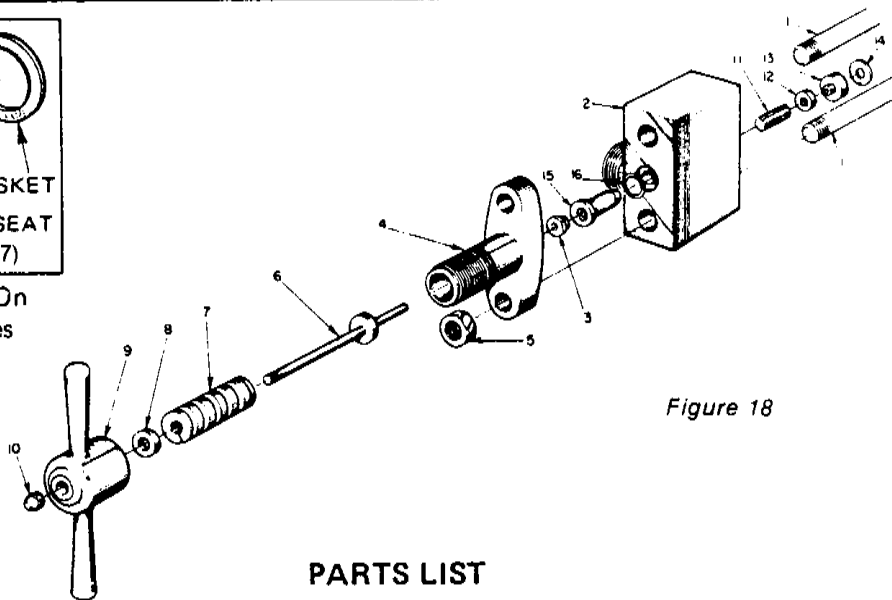


Figure 18

**PARTS LIST**

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
1	Valve Body Stud	2	9	Hand Wheel	1
2	Valve Body	1	10	Valve Rod Cap Nut	1
3	Valve Rod Packing	1	11	Homo. Valve	1
4	Hand Wheel Support	1	12	Impact Ring	1
5	Valve Body Stud Nut	2	13	Homo. Valve Seat	1
6	Valve Rod	1	14	Homo. Valve Seat Gasket	1
7	Valve Spring	1	15	Homo. Valve Guide	1
8	Valve Rod Washer	1	16	Homo. Valve Guide Gasket	1

When ordering Parts, specify Model No., Serial No., Part Name and Quantity.

# SINGLE-STAGE HOMONIZING VALVE ASSEMBLY

(CARBIDE TYPE)

## INSTRUCTIONS AND PARTS LIST

### Valve Disassembly

1. Remove valve body stud nuts (5), handwheel (9), handwheel support assembly (4) and valve rod packing (3).
2. Remove valve body (2) assembly, being careful not to drop valve components.
3. Remove valve seat gasket (14), valve seat assembly (19), valve seat O-ring (17), if used, impact ring (12), valve insert (11), valve guide (15) with gasket (16) and valve holder (18).

### Cleaning

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

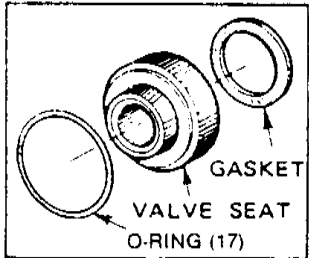
Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

### Valve Reassembly

NOTE: If your machine is furnished with HVA, also see Figure 30 for complete reassembly instructions.

1. Install valve guide gasket (16) over valve guide (15) and insert into valve body (2).
2. Lubricate valve holder (18) with an acceptable lubricant and insert into valve guide (15) making sure that valve holder moves freely.
3. Replace valve insert (11) into valve holder (18).
4. Install impact ring (12), valve seat assembly (19), valve seat O-ring, if used, and valve seat gasket (14).
5. Slide assembled valve body over studs (1).
6. Reassemble handwheel (9) and handwheel support assembly (4) and install valve rod packing (3) on valve rod (6).
7. Replace stud nuts (5) and tighten evenly and securely.



Valve Seat Used On Some Assemblies

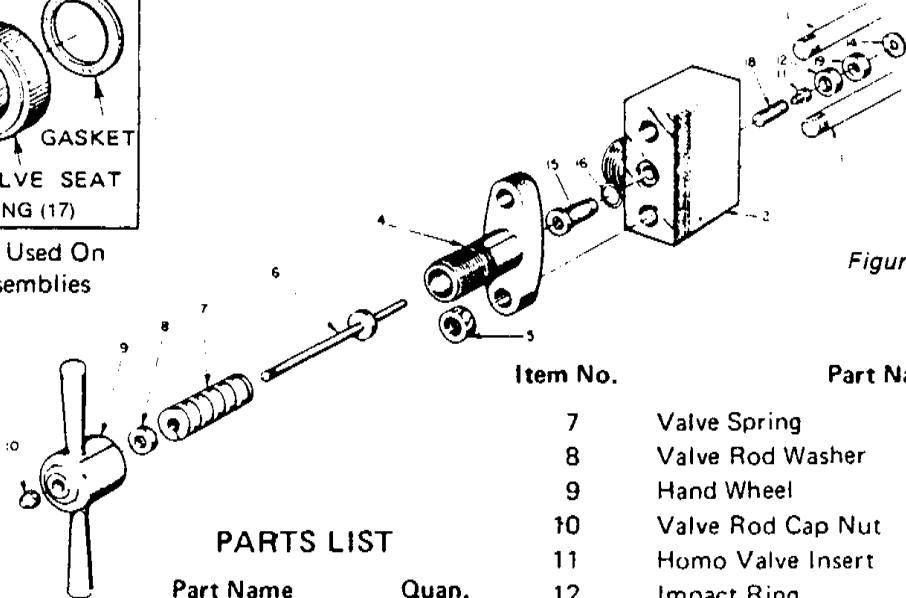


Figure 19

### PARTS LIST

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
1	Valve Body Stud	2	7	Valve Spring	1
2	Valve Body	1	8	Valve Rod Washer	1
3	Valve Rod Packing		9	Hand Wheel	1
4	Hand Wheel Support	1	10	Valve Rod Cap Nut	1
5	Valve Body Stud Nut	2	11	Homo Valve Insert	1
6	Valve Rod	1	12	Impact Ring	1
			14	Homo. Valve Seat Gasket	1
			15	Homo. Valve Guide	1
			16	Homo. Valve Guide Gasket	1
			17	Homo. Valve Seat O-Ring	2
			18	Homo. Valve Holder	1
			19	Homo. Valve Seat Assembly	1

When ordering Parts, specify Model No., Serial No., Part Name and Quantity.

**TWO-STAGE HOMOGENIZING VALVE ASSEMBLY  
(PILOTED-TYPE FIRST- AND SECOND-STAGE VALVES)  
INSTRUCTIONS AND PARTS LIST**

**Valve Disassembly**

1. Remove second-stage valve body stud nuts (27), second-stage handwheel (31), handwheel support assembly (26) and valve rod packing (25).
2. Remove second-stage valve body (24), being careful not to drop the valve components.
3. Remove valve (23), seat (22) and valve seat gasket (21) from second-stage body (24).
4. Remove first-stage valve body stud nuts (5), first-stage handwheel (9) and handwheel support assembly (4).
5. Remove first-stage valve body (2) assembly, being careful not to drop valve components.
6. Remove valve seat gasket (14), valve seat (13), impact ring (12) and valve (11).

**Cleaning**

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

**Valve Reassembly**

*NOTE:* If your machine is furnished with HVA, also see Figure 30 for complete reassembly instructions.

1. Install impact ring (12) into first-stage valve body (2).
2. Insert first-stage valve (11) into valve seat (13) and assemble as a unit into valve body (2).
3. Install valve seat gasket (14).
4. Assemble first-stage valve body (2) on studs (1).
5. Reassemble handwheel (9) and handwheel support assembly (4) and install valve rod packing (3) on valve rod (6).
6. Replace stud nuts (5) and tighten evenly and securely.
7. Insert second-stage valve (23) into valve seat (22) and install as an assembly into second-stage valve body (24).

*Note:* To guard against possible valve stem breakage, be certain that valve (23) remains inserted into valve seat (22), after assembly has been placed into position in valve body.

8. Insert valve seat gasket (21).
9. Assemble second-stage valve body to first-stage valve assembly studs (20).
10. Assemble handwheel (31) and handwheel support assembly (26) and install valve rod packing (25) on valve rod (28).
11. Replace stud nuts (27) and tighten evenly and securely.

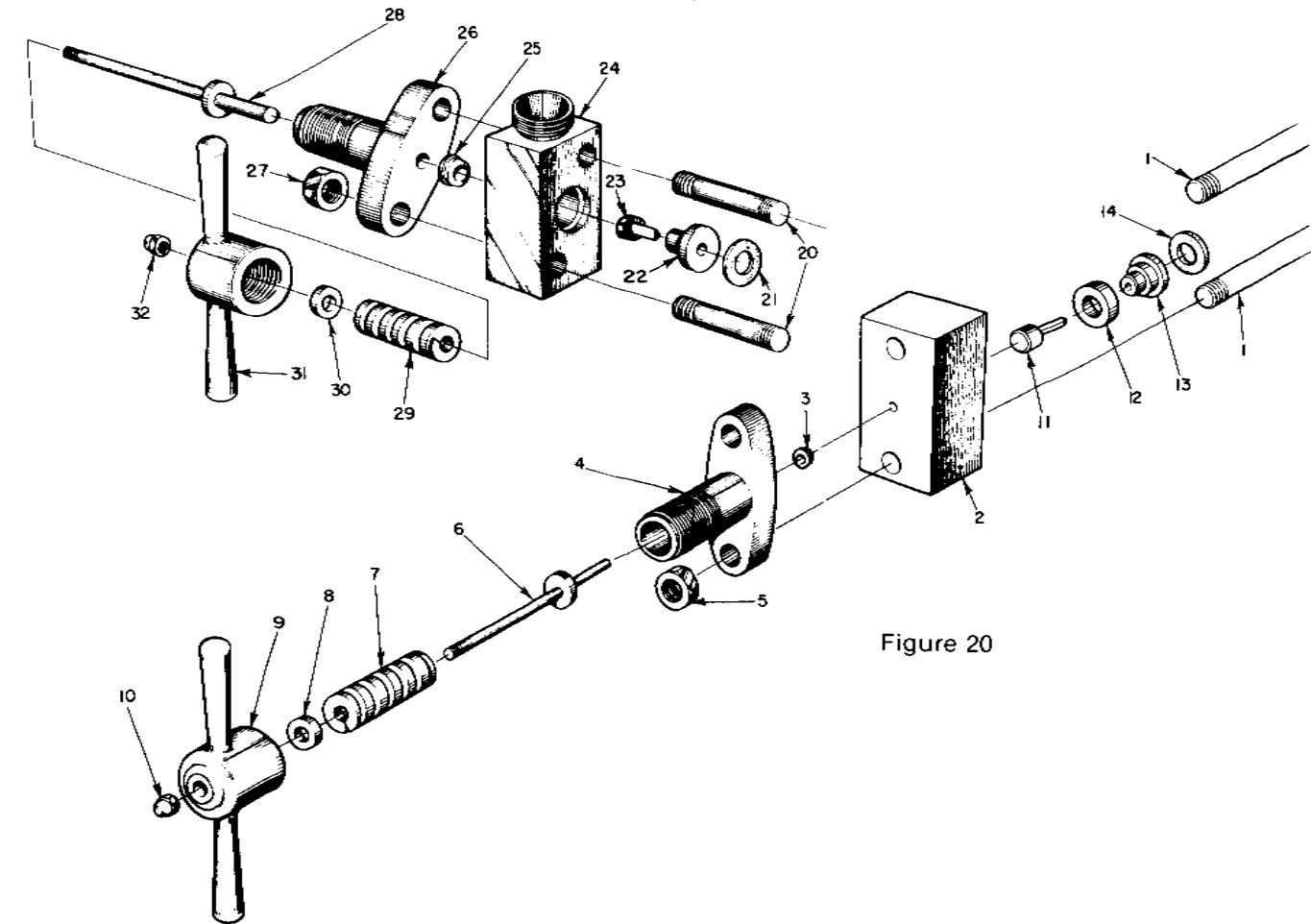


Figure 20

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
<b>FIRST STAGE</b>			<b>SECOND STAGE</b>		
1	Valve Body Stud	2	20	Valve Body Stud	2
2	Valve Body	1	21	Valve Seat Gasket	1
3	Valve Rod Packing	1	22	Valve Seat	1
4	Hand Wheel Support	1	23	Valve	1
5	Valve Body Stud Nut	2	24	Valve Body	1
6	Valve Rod	1	25	Valve Rod Packing	1
7	Valve Spring	1	26	Hand Wheel Support	1
8	Valve Rod Washer	1	27	Valve Body Stud Nut	2
9	Hand Wheel	1	28	Valve Rod	1
10	Valve Rod Cap Nut	1	29	Homo. Valve Spring	1
11	Homo. Valve	1	30	Valve Rod Washer	1
12	Impact Ring	1	31	Hand Wheel	1
13	Homo. Valve Seat	1	32	Valve Rod Cap Nut	1
14	Homo. Valve Seat Gasket	1			

When ordering Parts, specify Model No., Serial No., Part Name and Quantity.

**TWO-STAGE HOMOGENIZING VALVE ASSEMBLY  
(FLUTED-TYPE FIRST-STAGE VALVE, PILOTED-TYPE SECOND-STAGE VALVE)**

**INSTRUCTIONS AND PARTS LIST**

**Valve Disassembly**

1. Remove second-stage valve body stud nuts (27), second-stage handwheel (31), handwheel support assembly (26) and valve rod packing (25).
2. Remove the second-stage valve body (24), being careful not to drop the valve components.
3. Remove valve (23), seat (22) and valve seat gasket (21) from second-stage valve body (24).
4. Remove first-stage valve body stud nuts (5), first-stage handwheel (9), handwheel support (4) and valve rod packing (3).
5. Remove first-stage valve body (2) assembly, being careful not to drop valve components.
6. Remove valve seat gasket (14), valve seat (13), valve seat O-ring (17), if used, impact ring (12), valve guide (15) with gasket (16) and valve (11).

**Cleaning**

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

**Valve Reassembly**

*NOTE:* If your machine is furnished with HVA, also see Figure 30 for complete reassembly instructions.

1. Install valve guide gasket (16) over valve guide (15) and insert into valve body (2).
2. Lubricate valve (11) with an acceptable lubricant and insert into valve guide (15), making sure that the valve moves freely.
3. Reinstall impact ring (12), valve seat (13), valve seat O-ring (17), if used, and valve seat gasket (14).
4. Slide assembled valve body over studs (1).
5. Reassemble handwheel (9) and handwheel support assembly (4) and install valve rod packing (3) on valve rod (6).
6. Replace stud nuts (5) and tighten evenly and securely.
7. Insert second-stage valve (23) into valve seat (22) and install as an assembly into second-stage valve body (24).
8. Install valve seat gasket (21).
9. Assemble second-stage valve body to first-stage valve assembly on studs (20).
10. Assemble handwheel (31) and handwheel support assembly (26) and install valve rod packing (25) over valve rod (28).
11. Replace stud nuts (27) and tighten evenly and securely.

*Note:* To guard against possible valve stem breakage, be certain that valve (23) remains inserted into valve seat (22), after assembly has been placed into position in valve body.

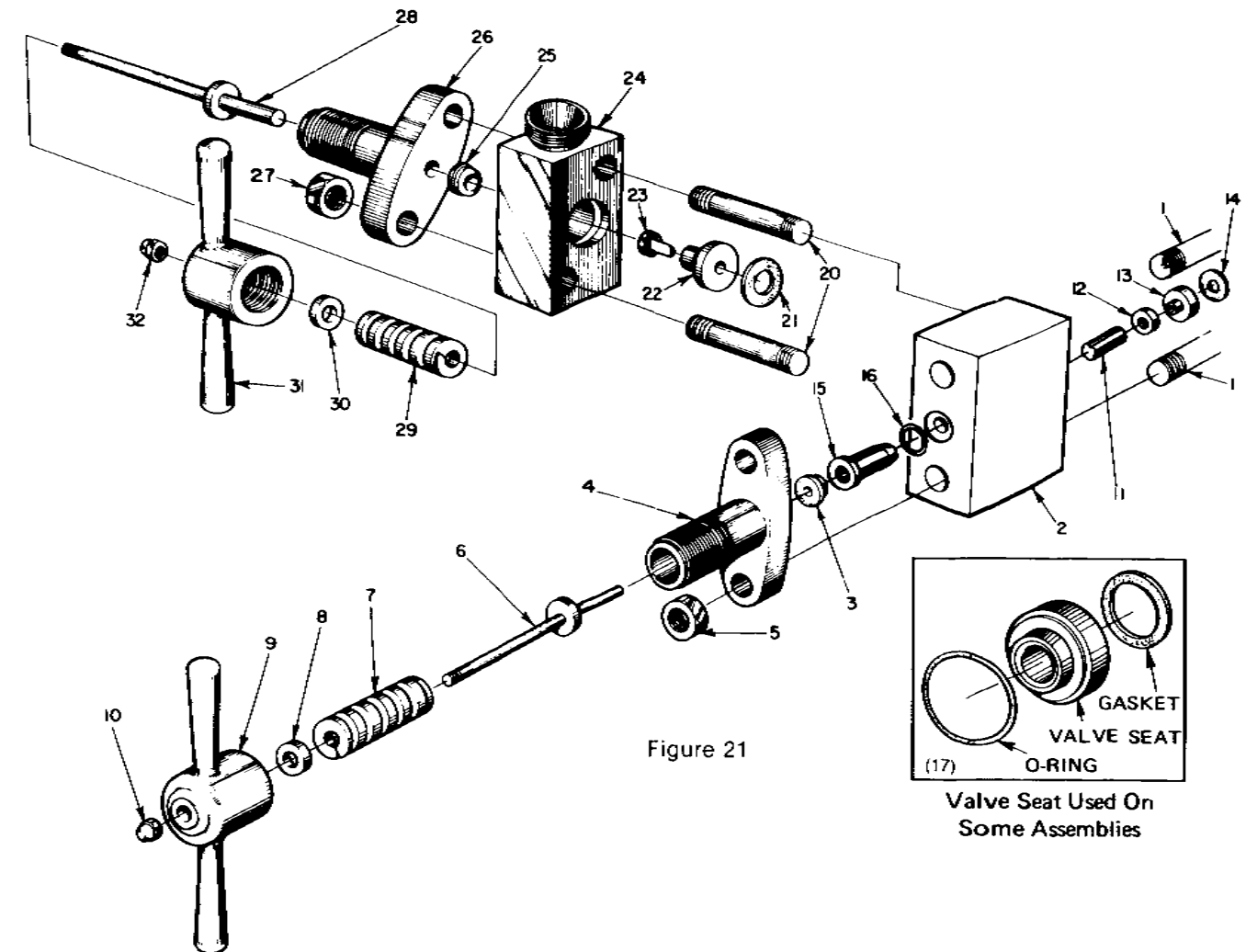


Figure 21

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
<b>FIRST STAGE</b>			<b>SECOND STAGE</b>		
1	Valve Body Stud	2	20	Valve Body Stud	2
2	Valve Body	1	21	Valve Seat Gasket	1
3	Valve Rod Packing	1	22	Valve Seat	1
4	Hand Wheel Support	1	23	Valve	1
5	Valve Body Stud Nut	2	24	Valve Body	1
6	Valve Rod	1	25	Valve Rod Packing	1
7	Valve Spring	1	26	Hand Wheel Support	1
8	Valve Rod Washer	1	27	Valve Body Stud Nut	2
9	Hand Wheel	1	28	Valve Rod	1
10	Valve Rod Cap Nut	1	29	Homo.Valve Spring	1
11	Homo.Valve	1	30	Valve Rod Washer	1
12	Impact Ring	1	31	Hand Wheel	1
13	Homo.Valve Seat	1	32	Valve Rod Cap Nut	1
14	Homo.Valve Seat Gasket	1			
15	Homo.Valve Guide	1			
16	Homo.Valve Guide Gasket	1			

When ordering Parts, specify Model No., Serial No., Part Name and Quantity

**TWO-STAGE VALVE ASSEMBLY  
(CARBIDE-TYPE FIRST-STAGE VALVE, PILOTED-TYPE SECOND-STAGE VALVE)**

**INSTRUCTIONS AND PARTS LIST**

**Valve Disassembly**

1. Remove second-stage valve body stud nuts (27), second-stage handwheel (31), handwheel support assembly (26) and valve rod packing (25).
2. Remove the second-stage valve body (24), being careful not to drop the valve components.
3. Remove valve (23), seat (22) and valve seat gasket (21) from second-stage body (24).
4. Remove first-stage valve body stud nuts (5), first-stage handwheel (9), handwheel support assembly (4) and valve rod packing (3).
5. Remove first-stage valve body (2) assembly, being careful not to drop valve components.
6. Remove valve seat gasket (14), valve seat assembly (13), valve seat O-ring (17), if used, impact ring (12), valve insert (11), valve guide (15) with gasket (16) and valve holder (18).

**Cleaning**

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

**Valve Reassembly**

**NOTE:** If your machine is furnished with HVA, also see Figure 30 for complete reassembly instructions.

1. Install valve guide gasket (16) over valve guide (15) and insert into valve body (2).
2. Lubricate valve holder (18) with an acceptable lubricant and insert into valve guide (15), making sure that valve holder moves freely.
3. Replace valve insert (11) into valve holder (18).

*Note:* To guard against possible damage be certain that valve insert (11) remains inserted into valve holder (18), after assembly has been placed into position.

4. Install impact ring (12), valve seat assembly (13), valve seat O-ring (17), if used, and valve seat gasket (14).
5. Slide assembled valve body over studs (1).
6. Reassemble handwheel (9) and handwheel support (4) assembly and install valve rod packing (3) on valve rod (6).
7. Replace stud nuts (5) and tighten evenly and securely.
8. Insert second-stage valve (23) into valve seat (22) and install as an assembly into second-stage valve body (24).

*Note:* To guard against possible valve stem breakage, be certain that valve (23) remains inserted into valve seat (22), after assembly has been placed into position in valve body.

9. Install valve seat gasket (21).
10. Assemble second-stage valve body to first-stage valve assembly on studs (20).
11. Ressemble handwheel support assembly (26), and handwheel (31) and install valve rod gasket (25) over valve rod (28).
12. Replace stud nuts (27) and tighten evenly and securely.

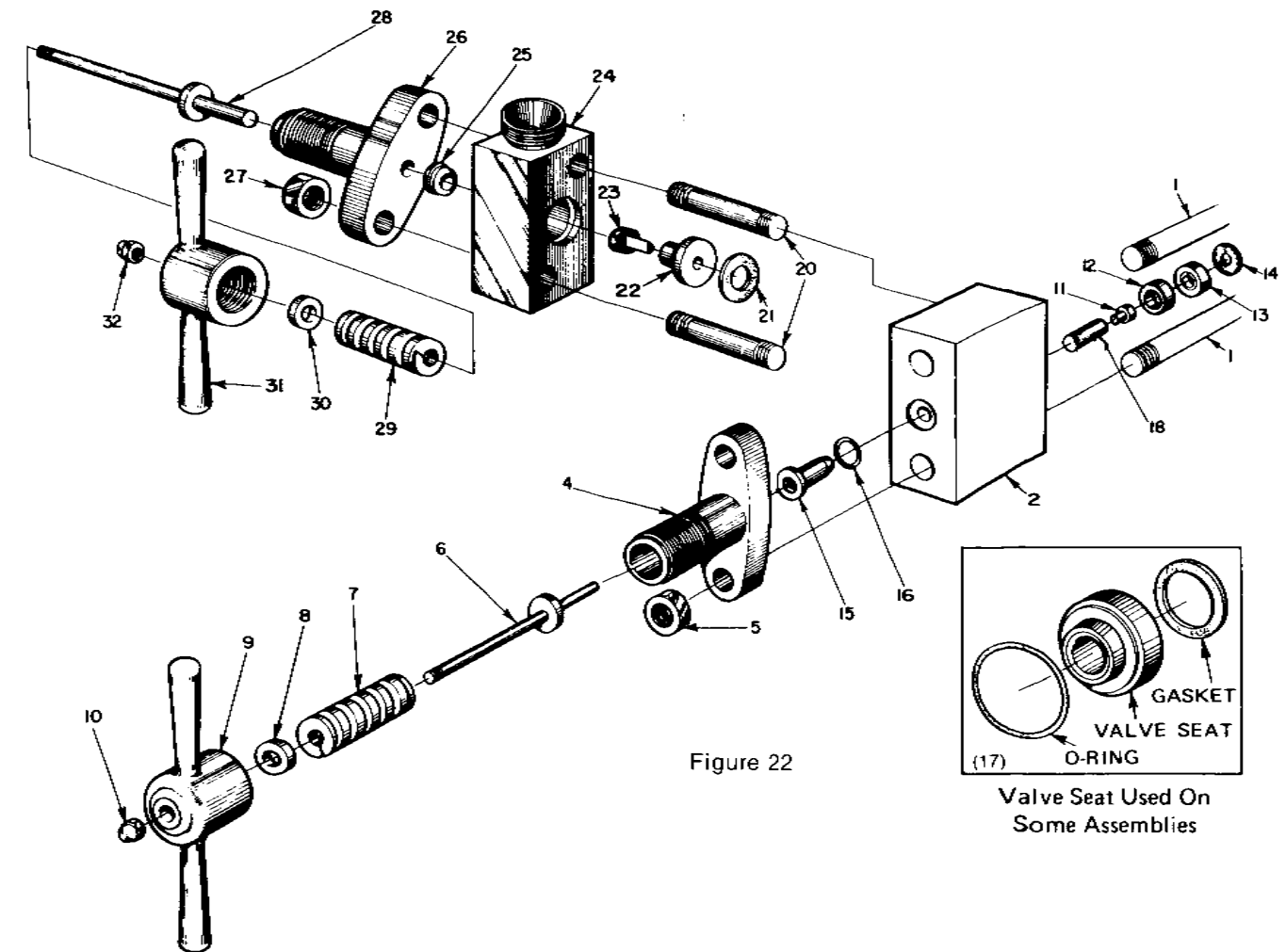
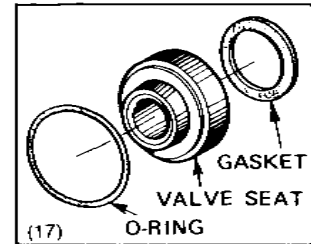


Figure 22



Valve Seat Used On Some Assemblies

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
<b>FIRST STAGE</b>			<b>SECOND STAGE</b>		
1	Valve Body Stud	2	20	Valve Body Stud	2
2	Valve Body	1	21	Valve Seat Gasket	1
3	Valve Rod Packing	1	22	Valve Seat	1
4	Hand Wheel Support	1	23	Valve	1
5	Valve Body Stud Nut	2	24	Valve Body	1
6	Valve Rod	1	25	Valve Rod Packing	1
7	Valve Spring	1	26	Hand Wheel Support	1
8	Valve Rod Washer	1	27	Valve Body Stud Nut	2
9	Hand Wheel	1	28	Valve Rod	1
10	Valve Rod Cap Nut	1	29	Homo. Valve Spring	1
11	Homo. Valve Insert	1	30	Valve Rod Washer	1
12	Impact Ring	1	31	Hand Wheel	1
13	Homo. Valve Seat Assembly	1	32	Valve Rod Cap Nut	1
14	Homo. Valve Seat Gasket	1			
15	Homo. Valve Guide	1			
16	Homo. Valve Guide Gasket	1			
17	Homo. Valve Seat O-Ring	1			
18	Homo. Valve Holder	1			

When ordering Parts, specify Model No., Serial No., Part Name, and Quantity.

## HIGH PRESSURE PUMP DISCHARGE BLOCK ASSEMBLY (RELIEF OR FULL FLOW CONTROL VALVE) INSTRUCTIONS AND PARTS LIST

### Valve Disassembly

1. Remove valve body stud nuts (5), handwheel (9), handwheel support assembly (4) and valve rod gasket (3).
2. Remove valve body (2), being careful not to drop the valve components.
3. Remove valve seat gasket (14), valve (11), seat (13) and impact ring (12) from valve body (2).
4. Remove discharge block (15) and discharge block gasket (16).

### Cleaning

Clean all parts thoroughly. Use brushes. Do not use metal brushes, sponges or other abrasive aids on parts.

Be careful to prevent metal parts from striking each other or other metal objects.

Lubricate all external threads with an acceptable lubricant before reassembling. Repeat this procedure on disassembly for at least one month to allow the threaded parts to become work-hardened.

### Valve Reassembly

Note: If your machine is furnished with HVA, also see Figure 30 for complete reassembly instructions.

1. Install discharge block gasket (16) into discharge block (15) and assemble as a unit onto studs (1).
2. Insert impact ring (12) into valve body (2).
3. Insert valve (11) into valve seat (13) and assemble as a unit into valve body (2).

Note: To guard against possible valve stem breakage be certain that valve (11) remains inserted into valve seat (13), after assembly has been placed into position in valve body.

4. Install valve seat gasket (14).
5. Reassemble handwheel (9) and handwheel support assembly (4) and install valve rod packing (3) onto valve rod (6).
6. Replace valve body stud nuts (5) and tighten evenly and securely.

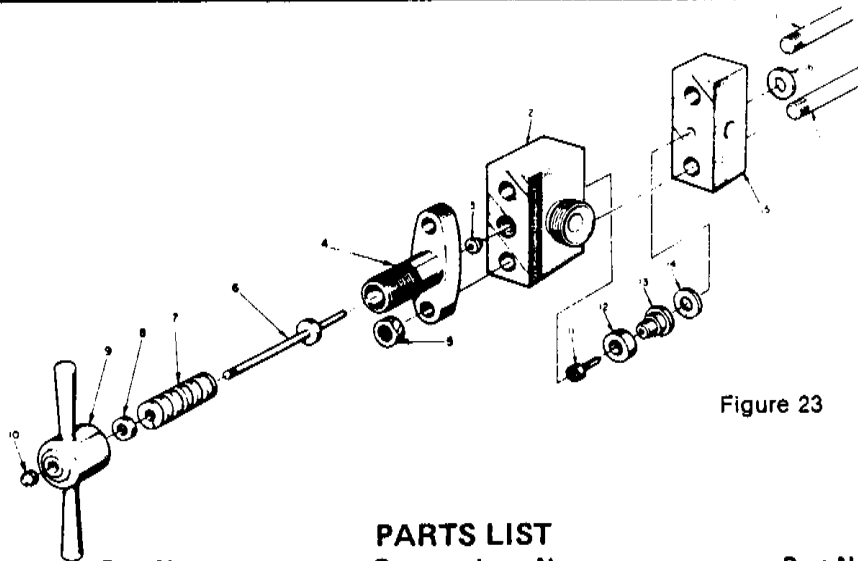


Figure 23

### PARTS LIST

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
1	Valve Body Stud	2	9	Hand Wheel	1
2	Valve Body	1	10	Valve Rod Cap Nut	1
3	Valve Rod Packing	1	11	Homo.Valve	1
4	Hand Wheel Support	1	12	Impact Ring	1
5	Valve Body Stud Nut	2	13	Homo.Valve Seat	1
6	Valve Rod	1	14	Homo.Valve Seat Gasket	2
7	Valve Spring	1	15	Discharge Block	1
8	Valve Rod Washer	1	16	Discharge Block Gasket	1

When ordering Parts, specify Model No., Serial No., Part Name and Quantity.



## THE MICRO-GAP® HOMOGENIZING VALVE

### Introduction

Through extensive experimentation at APV Gaulin, it has been found that homogenization efficiency can be greatly increased, if a certain valve geometry is used and specific fluid flow conditions are met. The basic concept involves the transfer of homogenizing energy to the fluid in the shortest time and with the greatest energy density possible.

The APV Gaulin Micro-Gap homogenizing valve achieves this result with a knife-edge design which maintains an extremely small opening between the valve and seat, thereby generating a thin film of processed fluid. The valve seat geometry has a very narrow travel distance from the high pressure fluid side to the low pressure fluid side, thereby producing a large pressure differential in a very short time over a very short distance. This pressure change in the fluid film produces intense cavitation and turbulence in the liquid. The flow condition through the narrow gap is also affected by the backpressure on the downstream side of the valve. By adjusting the amount of this backpressure the cavitation intensity can be maximized in the fluid film. By combining these elements of narrow land, a very small gap, and an optimum back-pressure, a very high-energy density can be applied to the fluid being homogenized.

Conventional homogenizing valves usually consist of a single valve and seat, which create a small opening through which pressurized fluid flows. As the rate of flow increases, the size of the opening must also increase in order to maintain pressure and accommodate flow. At high flow rates the cross-sectional area must be very large; and this can be accomplished by either increasing the gap between the valve and seat or by increasing the diameter of the valve and seat, so that the gap is small but the circumference is large. However, when the gap is large, homogenizing efficiency is decreased.

The Micro-Gap homogenizing valve overcomes these limitations by stacking the valves in parallel and by allowing the flow to be split into equal parts, such that each part of the flow is simultaneously subjected to the ideal conditions of homogenization. Each valve member acts as both a valve and valve seat. The valve seat has the knife-edge configuration. Because the number of valve members can be varied, a large flow of liquid can be efficiently homogenized by dividing the total flow of product into the correct number of parts, so that each part goes through one valve member at the correct gap and flow conditions. With this stacked configuration the flow can be increased without sacrificing homogenizing efficiency, because each valve member always works on the same rate of flow at the same fluid conditions.

The APV Gaulin Micro-Gap homogenizing valve has been designed for use on dairy products. The increased homogenizing efficiency of the Micro-Gap valve over conventional valves and the ability to retain excellent homogenizing efficiency, even at very high flow rates, results in considerable energy savings. The homogenizing pressure can be lowered significantly using the valve, and the quality of the emulsion will be equivalent to what was previously obtained using a conventional homogenizing valve.

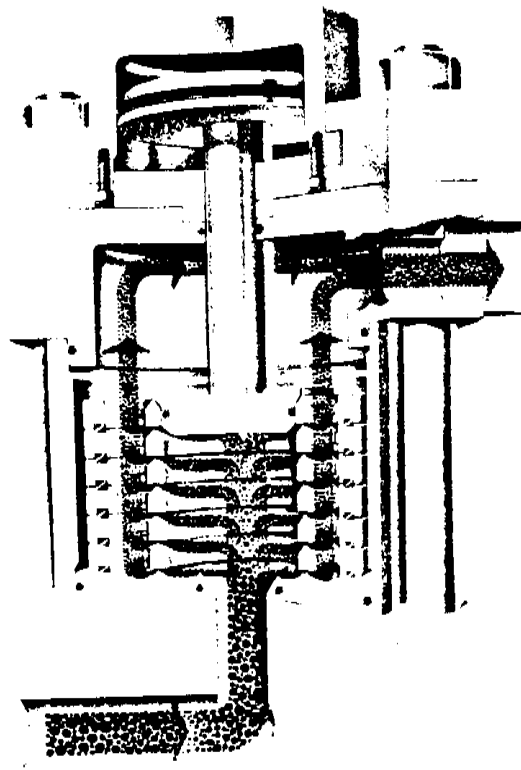


Figure 24

#### THE MICRO—GAP\* HOMOGENIZING VALVE

APV Gaulin has developed the EQA™, which can be used to accurately and quickly determine emulsion quality. It is strongly recommended that the EQA be utilized by all processing plants having homogenizers equipped with Micro-Gap homogenizing valves.

#### Installation of Micro-Gap Valve Assembly

1. Refer to drawings D17408, D17477 and Figure 25.
2. The Micro-Gap homogenizing valve assembly consists of two major sub-assemblies: the HVA mechanism and the Micro-Gap valve assembly with related parts. The entire assembly weighs 50 to 100 lbs., depending on the number of valves.
3. After initial run-in of the machine at the Factory, the Micro-Gap valve assembly is removed from the cylinder, inspected, cleaned and assembled complete with all parts required for operation, as per the customer order. The complete Micro-Gap homogenizing valve assembly has been packed in a separate carton for shipping. This carton will be found in the motor compartment of the machine.
4. For proper installation on the homogenizer carefully slide the entire assembly onto the inlet flange studs (23). Locate the assembly so that it stands upright with the inlet flange (1) located at the bottom. With the gasket (2) in place, slide the assembly fully onto the studs, taking care not to damage stud threads. Install the stud nuts (24) and tighten evenly and firmly to compress the gasket and prevent leakage.
5. Although the Micro-Gap homogenizing valve assembly (including the HVA mechanism) is shipped assembled, it is recommended that you disassemble the Micro-Gap valve components in order to check the number and alignment of the various parts, which could have become misaligned due to possible shipping mishandling, and to better familiarize yourself with its unique but simple design.

6. To complete the installation connect the hydraulic line at the Hansen quick-disconnect coupling. The hydraulic system must then be vented in accordance with the steps shown under "Reassembly of Micro-Gap Valve Components".

### Disassembly of Micro-Gap Valve Components

Using a rubber mat, carefully lay out all of the parts to avoid any chance of bumping, scraping or nicking.

1. Refer to drawings D17408 and D17477.
2. Set the HVA reducing control valve (on control panel) to "0" psig and turn off the HVA pump.
3. Disconnect the product discharge piping.
4. Remove the four Micro-Gap valve assembly stud nuts (26).
5. Remove the actuator body clamp (29).
6. Lift the HVA mechanism (28) straight up and remove from the discharge flange assembly (11).  
NOTE: Slits are machined 1/8" deep in the inlet flange (1) and the discharge flange (11) to provide suitable places to gently pry off the discharge flange and/or the Micro-Gap valve body, if those parts are stuck on the gaskets.
7. Remove the discharge flange assembly and then carefully remove the Micro-Gap valve body (5) straight up, so as not to disturb the Micro-Gap valve stack.
8. Remove the top Micro-Gap valve (8) with plug (9), all of the Micro-Gap valves and springs (8 and 10) and the Micro-Gap base valve (6).
9. Remove the valve plug (9) and O-ring (30) from the top valve.
10. All parts, including the various O-rings, can now be inspected.

### Reassembly of Micro-Gap Valve Components

1. Refer to drawings D17408, D17477 and Figure 25.
2. Use a suitable food-grade lubricant on all O-ring gaskets, prior to installation.

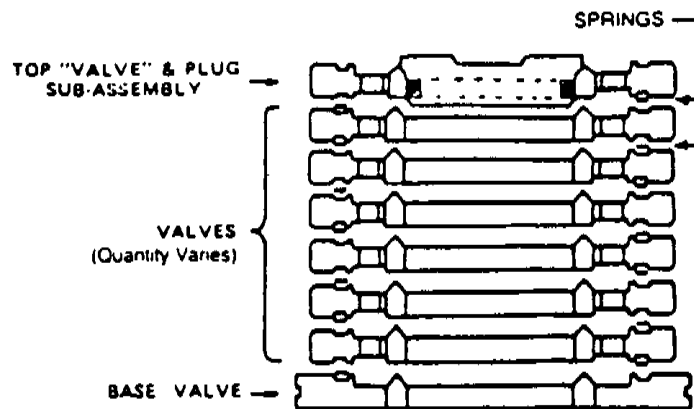


FIGURE 25

3. If the inlet flange (1) was removed from the cylinder during disassembly, mount the inlet flange over the two inlet flange studs (23) using the inlet flange gasket (2) and secure tightly in place with the two inlet flange stud nuts (24). Tighten the nuts evenly and firmly to compress the gaskets and prevent leakage.
4. Install the inlet back-up ring (4) (concave side up), the inlet flange O-ring (3) in the concave side, and the Micro-Gap base valve (6) along with the Micro-Gap base valve O-ring (7).
5. Examine the "This Is Your Machine" sheet enclosed with the manual supplied with the machine to ensure that you have the proper number of Micro-Gap valves (8), top valve plug (9) and valve springs (10) for your assembly.

**CAUTION: If the Micro-Gap valve assembly is assembled with fewer or more Micro-Gap valves or valve springs than specified, extensive damage may result.**

6. Working upwards from the base valve, carefully stack up in position the proper number of Micro-Gap valves and valve springs specified, *excluding* any spares supplied. Be sure that the knife edge of each valve faces up. Use one valve spring in the groove between each valve with the spring split facing down. Be sure that the valve springs fit securely in the mating grooves.
7. Install O-ring (30) on top valve plug (9) and install into the valve plate.
8. Carefully slide the Micro-Gap valve body (5) straight down over the valve stack. Make sure that the valve stack is not disturbed or knocked out of position during this operation.
9. Install the discharge flange assembly (11) with the discharge flange O-ring (14) and actuator rod O-ring (19). For installation convenience the discharge flange assembly may be rotated by 90° increments to line up with the system piping.
10. To install the HVA mechanism loosen but do not remove the vent plug (27) located at the top of the HVA body (28).
11. Install the HVA mechanism straight down and over the four Micro-Gap valve assembly studs (25) and position so that the hydraulic fluid supply fitting is aligned with the hydraulic line and Hansen coupling.
12. Install the acutator body clamp (29).
13. Connect the hydraulic line at the Hansen coupling.
14. Check to insure that the vent plug (27) is still loosened.
15. Tighten the Micro-Gap valve assembly nuts (26).

**NOTE:** Prior to operation, the HVA oil tank must be filled with the oil supplied.

16. Start the HVA pump motor (push/pull switch on the control panel) and set the HVA reducing control valve (also on control panel) to approximately 200 psig in order to fill the HVA body with hydraulic fluid.
17. Vent all air from the HVA lines and actuator. Tighten the vent plug (27), reduce the HVA pressure to "0" and turn off the pump motor. The Micro-Gap valve assembly is now ready for connection to product piping.
18. Referring to Figure 26, install the tee, gauge and restrictor backpressure control, if supplied with your machine.
19. Connect the product piping.
20. Your Micro-Gap homogenizing valve is now ready for operation.

## Disassembly of the HVA Mechanism

If oil begins to leak out between the actuator body clamp and the discharge flange assembly, the HVA O-ring is leaking and should be replaced along with the back-up ring. Refer to drawings D17408 and D17477.

1. Set the HVA reducing control valve (on control panel) to "0". Turn off the HVA pump.
2. Disconnect the HVA hydraulic line at the Hansen coupling.
3. Remove the Micro-Gap valve assembly stud nuts (26).
4. Remove the actuator body clamp (29).
5. Lift the HVA mechanism straight up to remove from the discharge flange assembly (11).
6. Remove the two Allen-head, actuator body screws (22) from the base of the assembly and remove the actuator guide plate (15). The actuator guide plate contains a guide plate bushing (16) which does not normally require disassembly.
7. Loosen but do not remove the vent plug (27) located at the top of the actuator body (28).
8. Grasp the actuator rod (18) by hand and pull the assembly out of the actuator body. The actuator body will contain some oil, which must be disposed of.

**CAUTION: Do not place the HVA rod (18) in a vise to aid in disassembly. Irreparable damage to the rod could result.**

9. Remove the actuator rod O-ring (21) and the back-up ring (20). Inspect and replace as necessary.

## Reassembly of the HVA Mechanism

Refer to drawing: D17477 and D17408.

**CAUTION: Do not place the HVA mechanism rod (18) in a vise to aid in assembly. Irreparable damage to the rod could result.**

1. Install a back-up ring (20) on the actuator rod, so that the concave surface of the ring faces the oil side.
2. Install an actuator rod O-ring (21) ABOVE the back-up ring, so that the bottom of the O-ring seats in the concave surface of the back-up ring.
3. Loosen but do not remove the vent plug (27) located at the top of the actuator body (28).
4. Using a suitable lubricant, such as petroleum jelly or HVA oil, lubricate the O-ring and the inside of the actuator body.
5. Using hand force and a twisting motion, install the actuator rod assembly into the actuator body.  
NOTE: Any damage caused to the O-ring through the use of excessive force or sharp tools during this operation will result in leakage.
6. Install the actuator guide plate (15), so that the large pilot goes into the actuator body, as show in the drawing.
7. Install and tighten the two Allen-head actuator body screws (22).
8. Prior to installing the HVA mechanism into the Micro-Gap valve assembly, check to see that the vent plug is still loose and then push the actuator rod (18) until fully retracted into the actuator body (28).
9. To install the HVA mechanism on the Micro-Gap valve assembly, carefully slide the HVA mechanism straight down and over the four Micro-Gap valve assembly studs (25).

10. Install the actuator body clamp (29).
11. Connect the hydraulic line at the Hansen coupling. Rotate the Hansen coupling and the actuator body, as needed.
12. Check to ensure that the vent plug is still loosened.
13. Install and tighten evenly the four Micro-Gap valve assembly stud nuts (26).

NOTE: Prior to operation, the HVA oil tank must be filled with the oil specified. (See Section V — HVA System).

14. Start the HVA pump motor (push/pull switch on the control panel) and set the HVA reducing control valve (also on the control panel) to approximately 200 psig in order to fill the HVA body with hydraulic fluid.
15. Vent all air from the HVA lines and actuator. Tighten the vent plug, reduce the HVA pressure to "O" and turn off the pump motor. The Micro-Gap valve assembly is now ready for connection to product piping.
16. The system relief valve is located at the rear of the machine on the equipment service panel, bottom right side, and the system pressure gauge is located on the right side in the HVA pump discharge piping. It is a 0-2,000 psig (141 kg/cm<sup>2</sup>) gauge. The relief valve is preset at the Factory. However, if it becomes necessary to reset the relief valve, see the Maintenance Section

### **Micro-Gap Valve Discharge Piping and Backpressure Control**

Figures 26, 27 and 28 illustrate several methods for achieving the desired amount of backpressure required to effectively operate the Micro-Gap homogenizing valve assembly.

NOTE: When using the flow restrictor shown in Figure 26, it is necessary to extend the outlet pipe 12 to 18 inches beyond the flow restrictor, before installing an elbow or tee in the discharge line. This will help to reduce any noise or vibration in the line caused by the high velocity flow through the flow restrictor.

### **Starting the Machine**

1. Start the homogenizer on water and allow the machine to run until full flow has been achieved.
2. Start the HVA pump motor
3. Turn the reducing valve control knob counter-clockwise, until the hydraulic pressure gauge (located on the panel above the knob) comes to rest at approximately zero.
4. Adjust the HVA pressure by turning the reducing valve control knob clockwise, until total desired homogenizing pressure is indicated on the homogenizer pressure gauge. Do not exceed the safe design pressure of the homogenizer, as specified in the front of your operation manual and on the homogenizer nameplate (located in the well area of the machine's power end).
5. If the flow-restrictor device is used, the backpressure (indicated on the backpressure gauge) must be 10 to 15% of the total homogenizing pressure. For example, if the homogenizing pressure desired is 1200 psig (84 kg/cm<sup>2</sup>), the backpressure must be 120 to 180 psig (8.4 to 12.7 kg/cm<sup>2</sup>).
6. If an air-actuated valve is used, as with a variable-speed motor, set the air pressure to obtain 10 to 15% on the backpressure gauge.
7. The Micro-Gap valve assembly has been fitted with 3-1/8"-diameter Micro-Gap valves and a 4-1/2" HVA. The HVA pressure needed is approximately 50% of the homogenizing pressure desired. For example, it should require about 600 psig (42 kg/cm<sup>2</sup>) to obtain 1200 psig (84 kg/cm<sup>2</sup>) homogenizing pressure.

8. Reset the HVA system relief valve to 200 psig (14 kg/cm<sup>2</sup>) above the required HVA pressure. (See Maintenance Section for procedure.)  
NOTE: Monitor both the main homogenizing pressure and the backpressure gauges, per normal plant practice.
9. Turn the reducing valve knob counter-clockwise until the HVA pressure gauge at the control panel comes back to minimum position. The HVA system pressure indicated at the rear of the machine should remain constant for all product pressures.
10. Reduce HVA pressure to the minimum point.
11. Shut off the HVA motor and the homogenizer main motor.

### **Cleaning**

It is very important to thoroughly flush the Micro-Gap valve assembly with water during the flush cycle. It is very important that the HVA pressure is turned off. In this way no particles will be allowed to remain in or around the valves.

### **Micro-Gap Valve Wear/Reconditioning**

1. Because of the critical tolerances between the Micro-Gap valves, it is important to prevent foreign material from entering and lodging in the Micro-Gap valve assembly.
2. The valve assembly should be inspected periodically to check for the presence of milkstone, foreign material or for wear and/or damage.
3. Record the HVA pressure required to obtain desired homogenizer pressure with a new set of Micro-Gap valves. As the valves wear, additional HVA pressure will be required to obtain this same homogenizer pressure. Do not exceed 200 psig additional HVA pressure. This indicates maximum wear on Micro-Gap valves. Use of more than 200 psig additional pressure may crack the top valve.
4. If unable to obtain the desired homogenizing pressure or if the emulsion quality (as determined by an APV Gaulin EQA™) is not adequate, replace all of the valves, including the base valve.
5. The valves can be resurfaced several times; but, due to the critical tolerances, they must be returned to APV Gaulin for this repair.

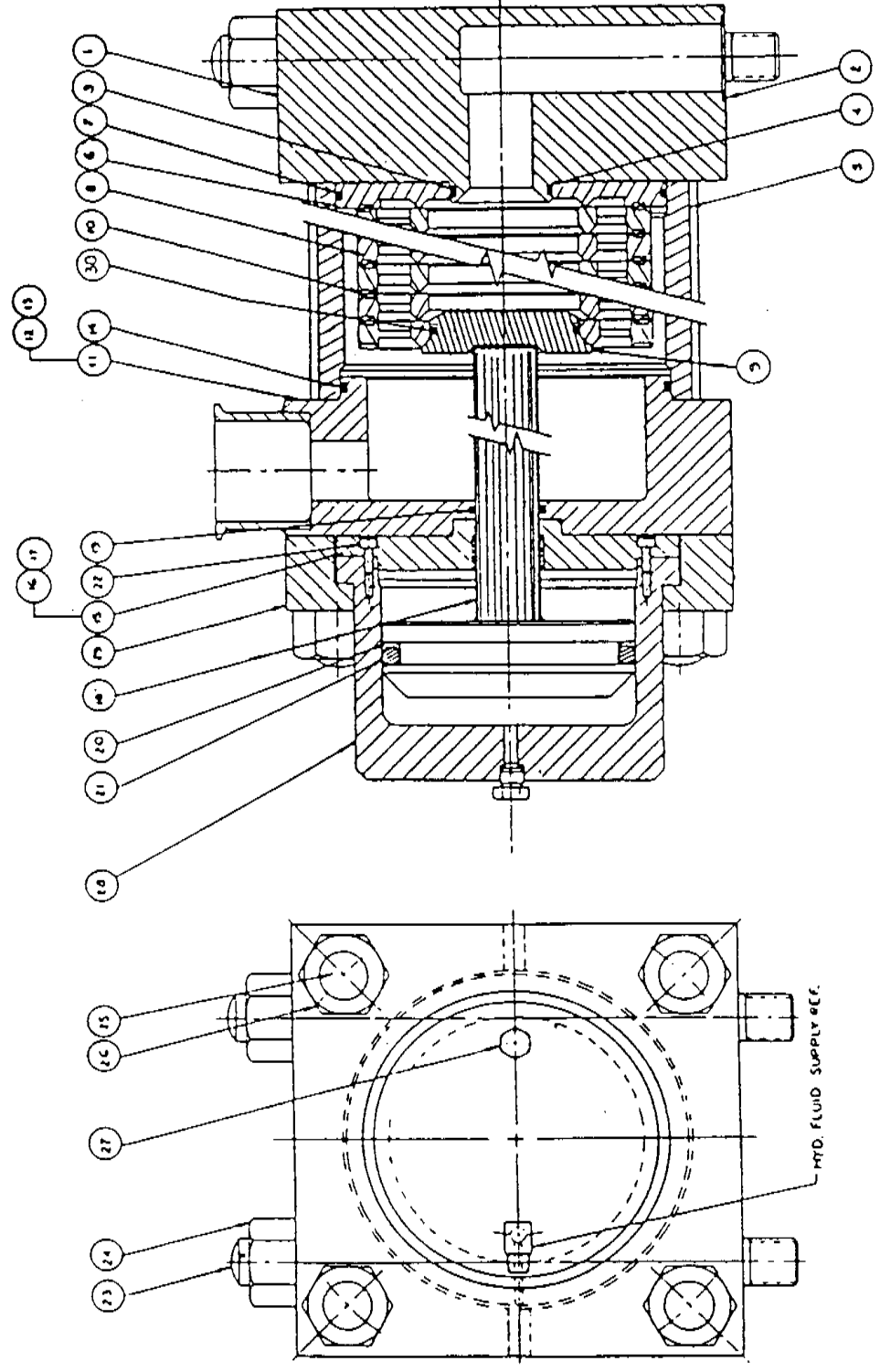
### **Micro-Gap Valve Assembly Leakage**

(See Drawing D17408)

If oil begins to leak out between the actuator body clamp (29) and the discharge flange assembly (11), the actuator O-ring (21) is leaking and should be replaced, along with the back-up ring (20). If leakage of the product being processed occurs from the same area, the HVA rod O-ring (19) is leaking and should be replaced.

NO.	QTY	DESCRIPTION
1	1	INLET FLANGE
2	1	INLET FLANGE FLAT GASKET
3	1	INLET FLANGE O-RING GASKET
4	1	O-RING GASKET BACKUP RING
5	1	MICRO-GAP VALVE BODY
6	1	MICRO-GAP BASE VALVE
7	1	MICRO-GAP BASE VALVE GASKET
8	1	MICRO-GAP VALVE
9	1	TOP VALVE PLUG
10	1	MICRO-GAP VALVE SPRING
11	1	DISCHARGE FLANGE ASSEMBLY
12	1	DISCHARGE FLANGE
13	1	FERRULE
14	1	DISCHARGE FLANGE GASKET
15	1	ACTUATOR GUIDE PLATE ASS'Y
16	1	ACTUATOR GUIDE PLATE
17	1	BUSHING
18	1	ACTUATOR GUIDE PLATE
19	1	ACTUATOR ROD
20	1	ACTUATOR ROD SEAL
21	1	BACK-UP RING
22	1	ACTUATOR ROD O-RING
23	2	ACTUATOR BODY SCREW
24	2	INLET FLANGE STUD
25	2	INLET FLANGE STUD NUT
26	4	MICRO-GAP ASSEMBLY STUD
27	4	MICRO-GAP ASSEMBLY NUT
28	1	VENT PLUG
29	1	ACTUATOR BODY
30	1	ACTUATOR BODY CLAMP
31	1	TOP VALVE PLUG O-RING

\* QUANTITY WILL VARY ACCORDING TO CAPACITY



APV GAULIN, INC.  
MICRO-GAP® VALVE ASSEMBLY  
DRAWING D17408



# RESTRICTOR BACKPRESSURE CONTROL

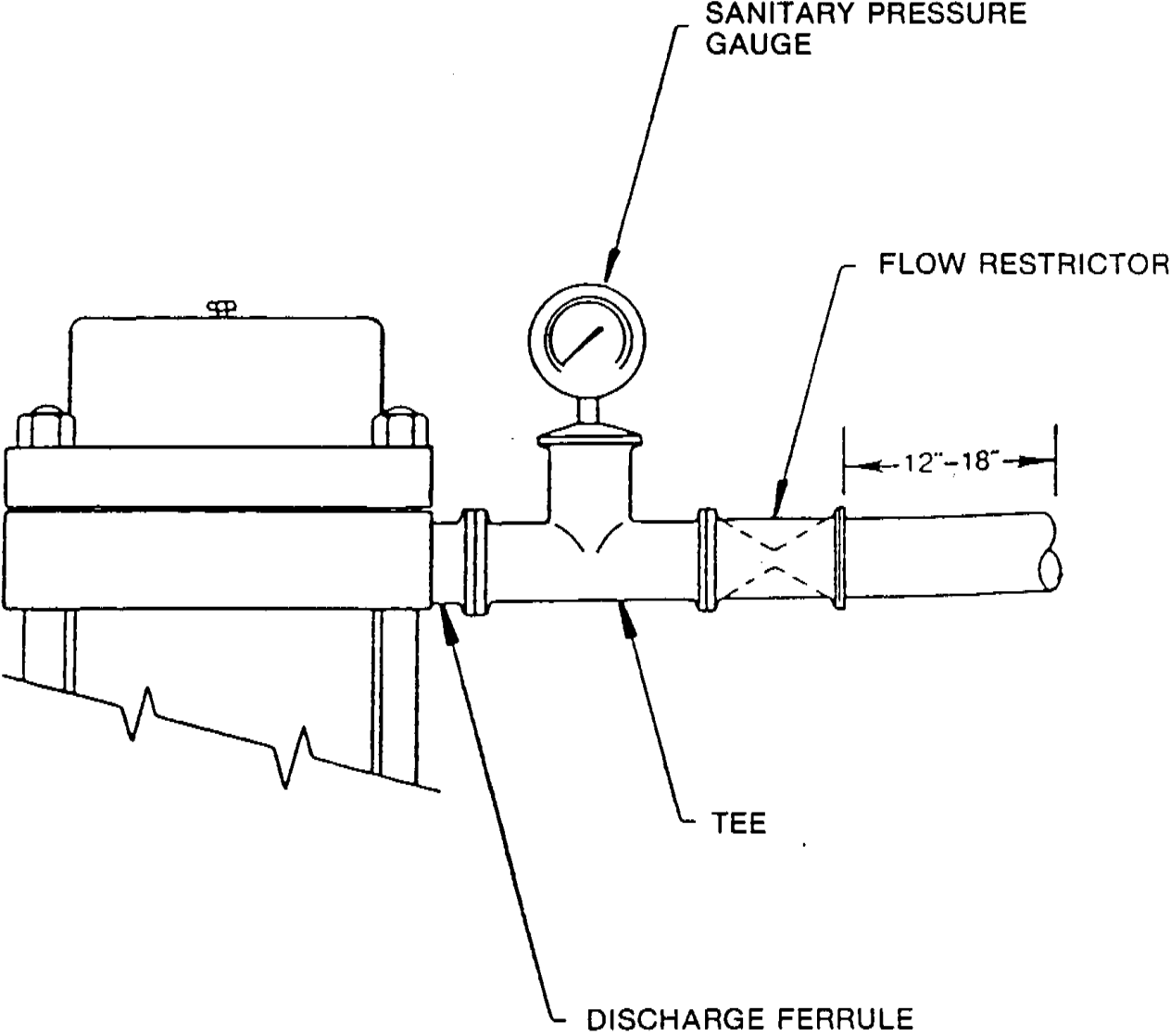
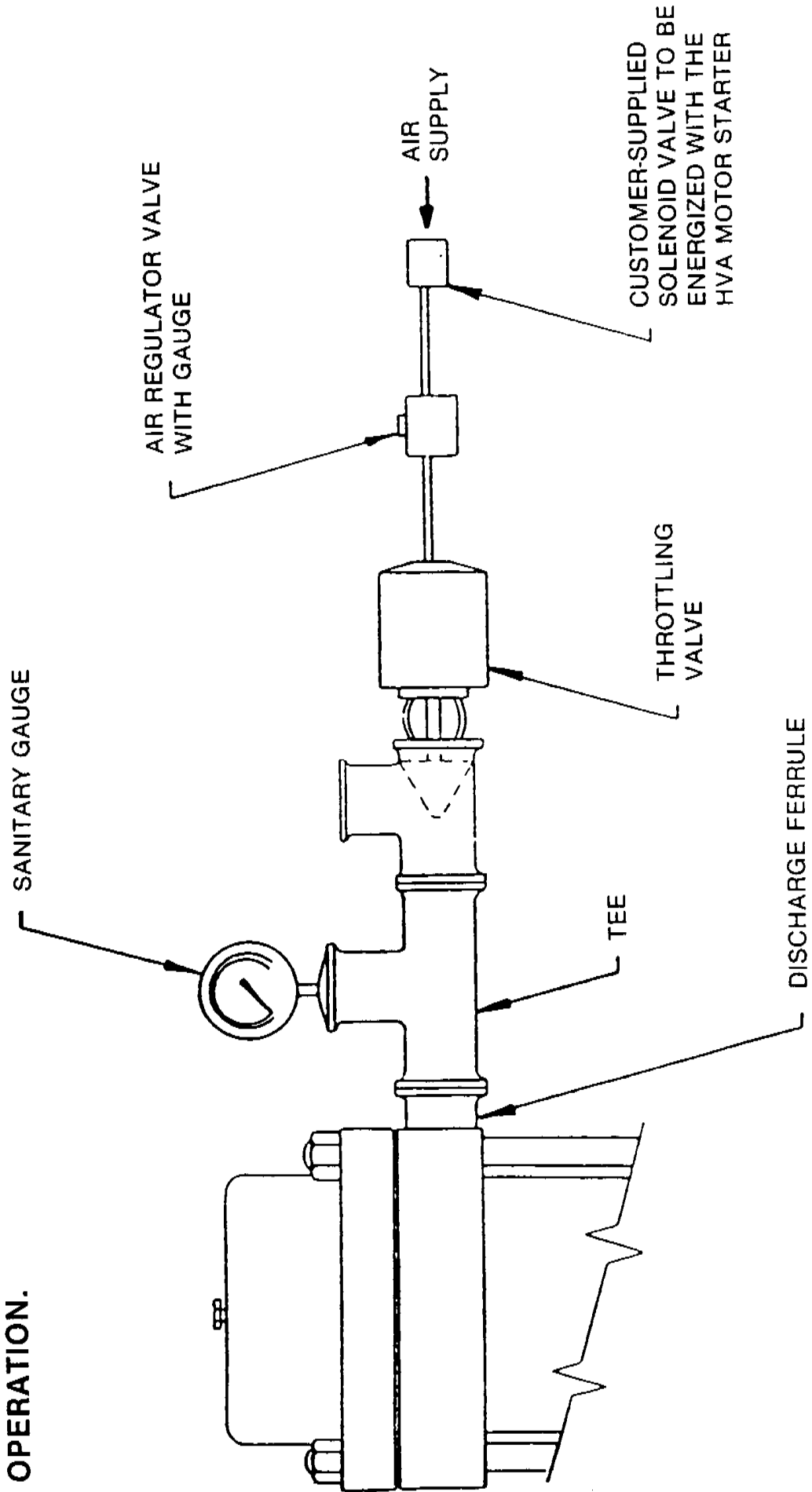


FIGURE 26

**MANUAL AIR-OPERATED  
BACK PRESSURE CONTROL  
FOR VARIABLE-CAPACITY  
OPERATION.**



**AUTOMATIC AIR-OPERATED  
BACK PRESSURE CONTROL  
FOR VARIABLE-CAPACITY  
OPERATION.**

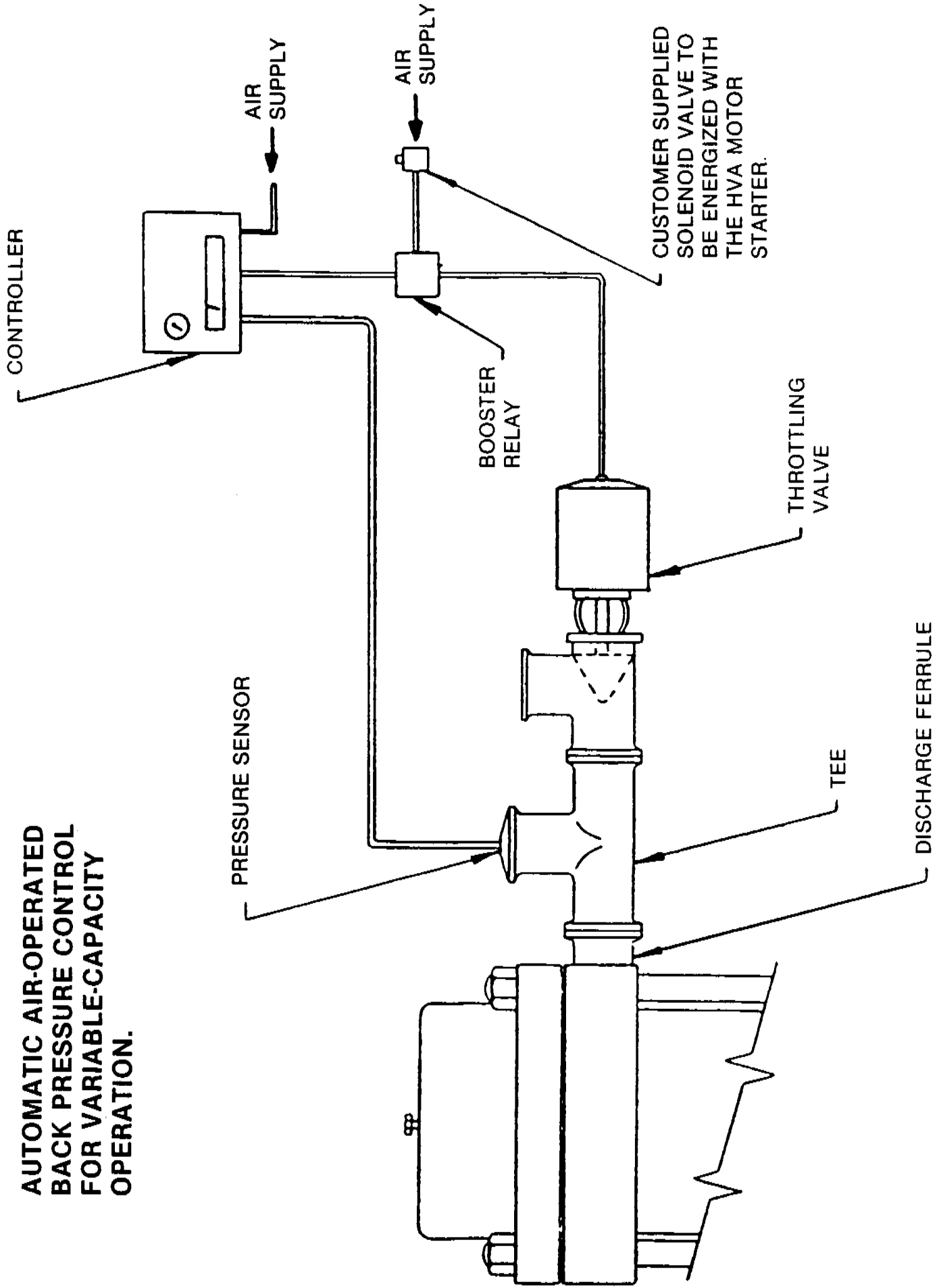


FIGURE 28

## **SECTION V**

### **HVA SYSTEM**

#### **HVA Operation**

The hydraulic valve actuated (HVA) system includes a hydraulic (system) relief valve, which has been carefully set to control the maximum desired homogenizing pressure or the maximum safe operating pressure of the homogenizer or pump.

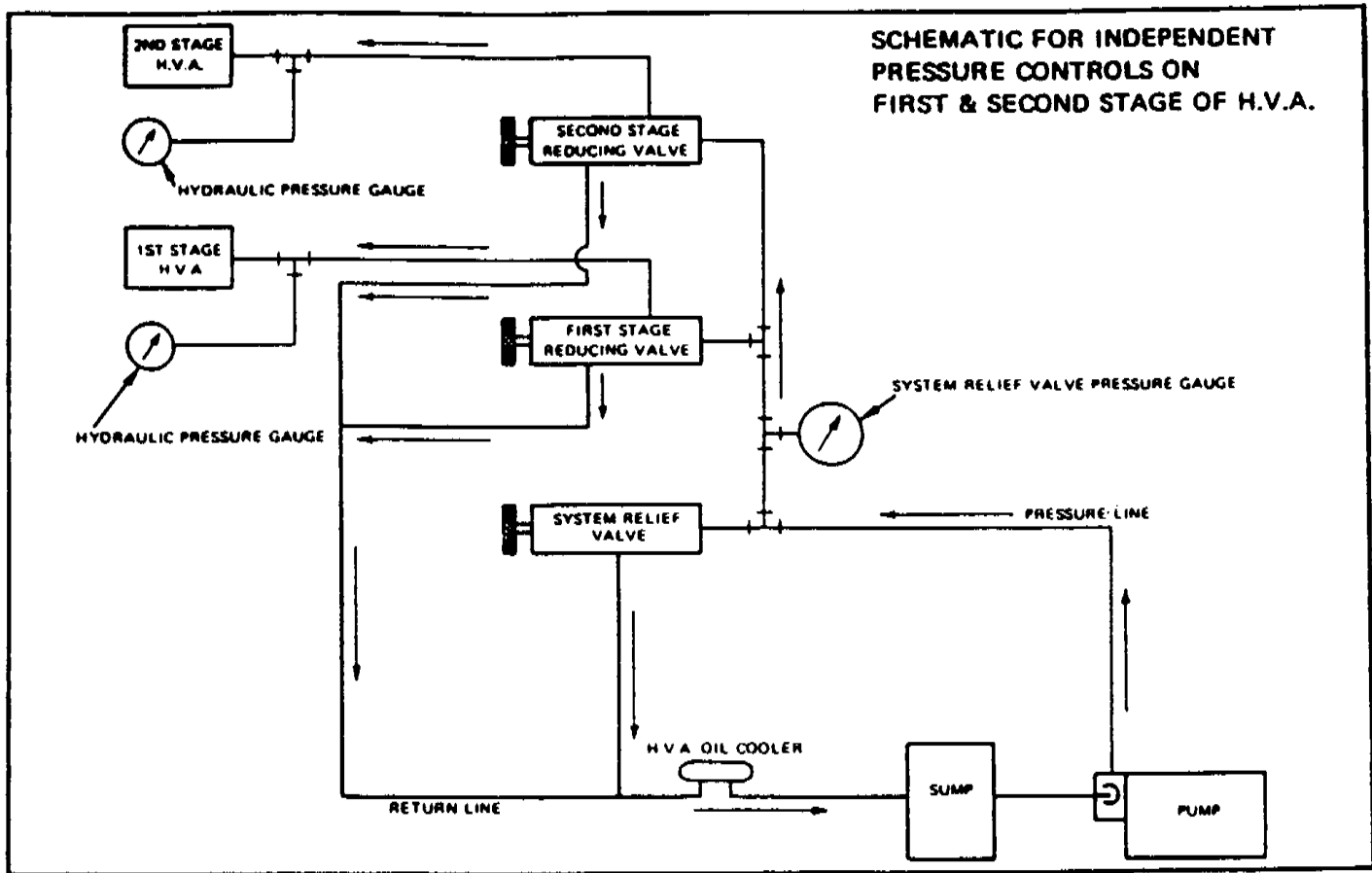
Each stage of a single- or two-stage homogenizing, relief or full flow control valve is controlled by a separate pressure reducing valve, permitting independent control of each stage.

The HVA relief valve and HVA reducing valves in a single- or two-stage machine are piped in series. Therefore, pressure must be created by the HVA relief valve before the HVA reducing valves can be operated.

On initial start-up the system will be empty of hydraulic oil. The oil filter supplied as part of the unit is of good quality, in order to insure clean oil to HVA pump and mechanism. However, the HVA is intended for use with oil not a mixture of oil and water, making it essential that excess condensation or water leakage into the HVA sump be avoided.

#### **Start-Up Instructions for HVA System**

1. Clean and wipe out inside of actuator oil reservoir sump, before filling with oil.
2. Fill HVA oil reservoir three-quarters full (approximately one gallon) with hydraulic oil. (Refer to specifications in Section II.)
3. On Factory-installed HVA units, all water and hydraulic connections have been completed. A common water supply line has been furnished for both HVA oil cooler and machine oil cooler.
4. Wire motor. Motor may be wired independent of homogenizer or pump or tied in with homogenizer or pump starter. If it is tied in with the starting circuit of the homogenizer or pump, a time-delay switch should be provided to permit the homogenizer or pump to commence pumping, prior to the application of HVA pressure to the homogenizer, relief or full flow control valves.
5. Check rotation of the HVA pump. The direction of rotation is marked on the motor or the pump housing. Incorrect rotation can damage the pump shaft seal, if pressure is applied.



**FIGURE 29**

**Initial Start-Up of HVA Valve Assemblies**

For single-stage homogenizing, relief or full flow control valves, disregard second-stage instructions.

1. Loosen but do not remove vent plugs on top of first- and second-stage actuator bodies.
2. Turn first- and second-stage HVA reducing valve control knobs counter-clockwise several turns to relieve possible pressure build-up in system.
3. Start the HVA pump motor and allow to run for a few moments to fill the system with hydraulic oil.
4. The HVA relief valve, located inside the rear compartment of MS(P) machines has been pre-set for operation. If it becomes necessary to readjust the HVA relief valve, turn the control screw clockwise until 800 to 1000 psig registers on the HVA relief valve pressure gauge, located on the pressure line leading to the HVA reducing valves.
5. Turn first- and second-stage HVA reducing valve control knobs clockwise several turns to create a slight pressure on the system to speed up the air bleeding process through the vent plugs.
6. Allow HVA pump and motor to operate for this limited time period, until all air is expelled from the actuator bodies, as indicated by air-free oil escaping through the loosened vent plugs.
7. Tighten the vent plugs.

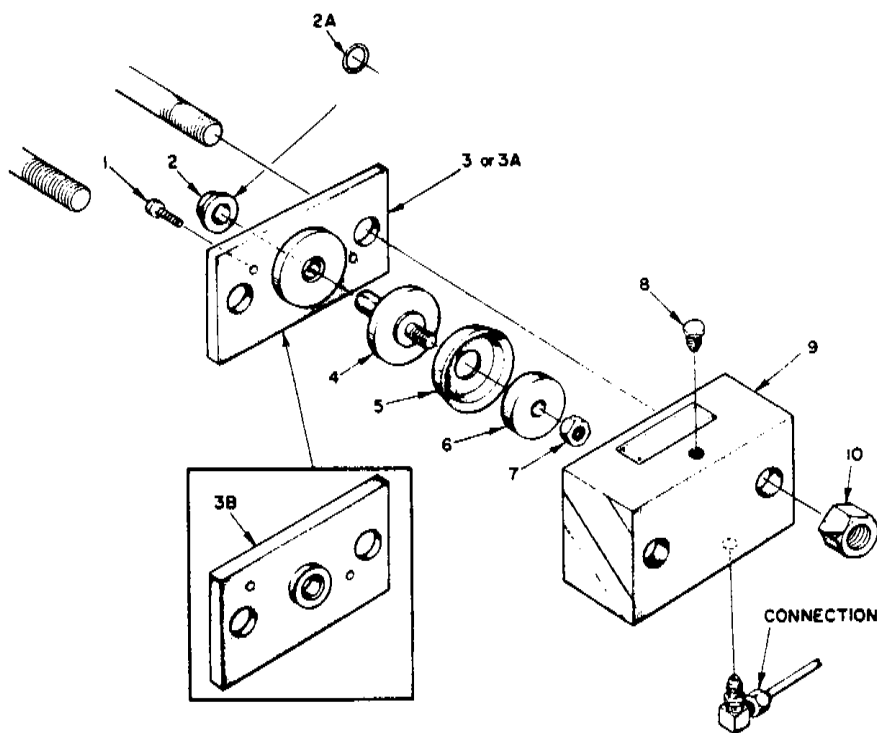
8. Turn first- and second-stage HVA reducing valve control knobs counterclockwise until hydraulic pressure gauges come to rest at the minimum point. This reading should not exceed 20 to 30 psig on either gauge.
9. Stop HVA pump and motor.
10. Start homogenizer or pump on water and allow the machine to run until full flow has been reached.

**CAUTION: Do not start the HVA pump until full flow has been obtained and all air has been removed from the product system. Failure to observe this precaution can cause serious damage to the homogenizer or pump by shock loading.**

11. Start the HVA pump.
12. On the two-stage homogenizing valve assembly the second-stage processing pressure should be adjusted first. Turn the second-stage HVA reducing valve control knob clockwise, until the desired second-stage pressure is indicated on the product pressure gauge. Turn first-stage HVA reducing valve control knob clockwise, until desired total product pressure is reached.
13. If the desired product processing pressure cannot be obtained, there may not be sufficient hydraulic pressure available. Increase the HVA relief valve pressure as necessary.
14. Set the HVA relief valve approximately 200 psig higher than indicated on the first-stage HVA oil pressure gauge at maximum product operating pressure. When properly set, the relief valve will prevent the homogenizer from operating at pressures higher than desired or in excess of the safe operating pressure of the machine. Turn HVA reducing valve control knobs on first- and second-stage HVA reducing valves counter-clockwise, until hydraulic pressure gauges come back to their minimum position.
15. Repeat steps 12. and 13. Record the hydraulic pressure indicated on the gauges for the desired product operating pressure. The hydraulic pressure should remain constant for the product operating pressure required.
16. Tighten the control knob locknuts on the first- and second-stage HVA reducing valves to maintain a constant valve setting. Subsequent and similar operating pressures can be achieved by starting the HVA pump motor. Daily settings are not required.
17. When homogenizers are operated on more than one product requiring different pressure combination, steps 12. and 13. should be repeated for each product. Manual adjustment of the HVA reducing valve control knobs will be required when product changes are made.

## HYDRAULIC VALVE ACTUATOR ASSEMBLY (HVA)

Single-Stage or First and Second-Stage Bodies of Two-Stage Assemblies



### HVA PARTS LIST

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
1	Actuator Body Screw	2	4	Actuator Valve Rod	1
2	Valve Rod Seal (Single Stage Only)	1	5	Actuator Packing	1
2A	Valve Rod Seal (1st & 2nd Stage Only)	1	6	Actuator Packing Follower	1
3	Actuator Guide Plate (Single Stage Only)	1	7	Valve Rod Nut	1
3A	Actuator Guide Plate (2nd Stage Only)	1	8	Vent Plug	1
3B	Actuator Guide Plate (1st Stage Only)	1	9	Actuator Body	1
			10	Valve Body Stud Nut	2

Figure 30

#### HVA Disassembly (See Figure 30.)

1. HVA pressure must be off and motor stopped, before disassembly.
2. Remove valve body stud nuts (10).
3. Disconnect the "quick-disconnect" couplings that connect the hydraulic lines to the actuator body (9).
4. Remove the assembled actuator body assembly.

NOTE: For removal of the homogenizer, relief or full flow control valve assemblies, refer to the detailed instructions described in Valve Disassembly Instructions (Section IV).

#### HVA Reassembly (See Figure 30.)

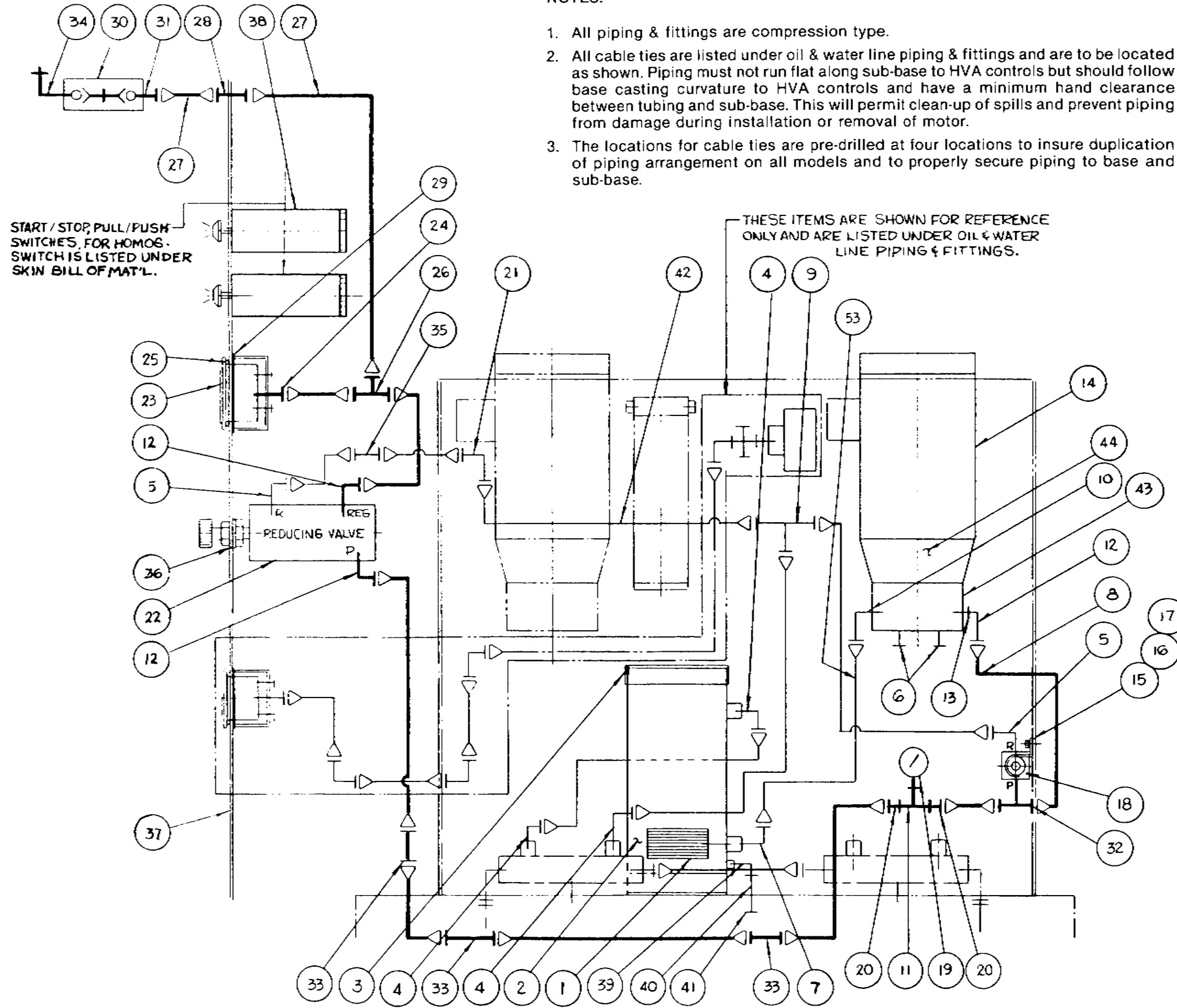
Reverse disassembly procedure by completing these steps:

1. Replace the assembled actuator body.
2. Reconnect the "quick-disconnect" couplings.
3. Install valve body stud nuts (10) and tighten evenly and securely.

NOTE: On reassembly it is very important that the "quick-disconnect" couplings are reconnected prior to tightening the valve body stud nuts (10). This allows the actuator to bleed off any surplus oil that could cause a hydraulic lock.

NOTES:

1. All piping & fittings are compression type.
2. All cable ties are listed under oil & water line piping & fittings and are to be located as shown. Piping must not run flat along sub-base to HVA controls but should follow base casting curvature to HVA controls and have a minimum hand clearance between tubing and sub-base. This will permit clean-up of spills and prevent piping from damage during installation or removal of motor.
3. The locations for cable ties are pre-drilled at four locations to insure duplication of piping arrangement on all models and to properly secure piping to base and sub-base.

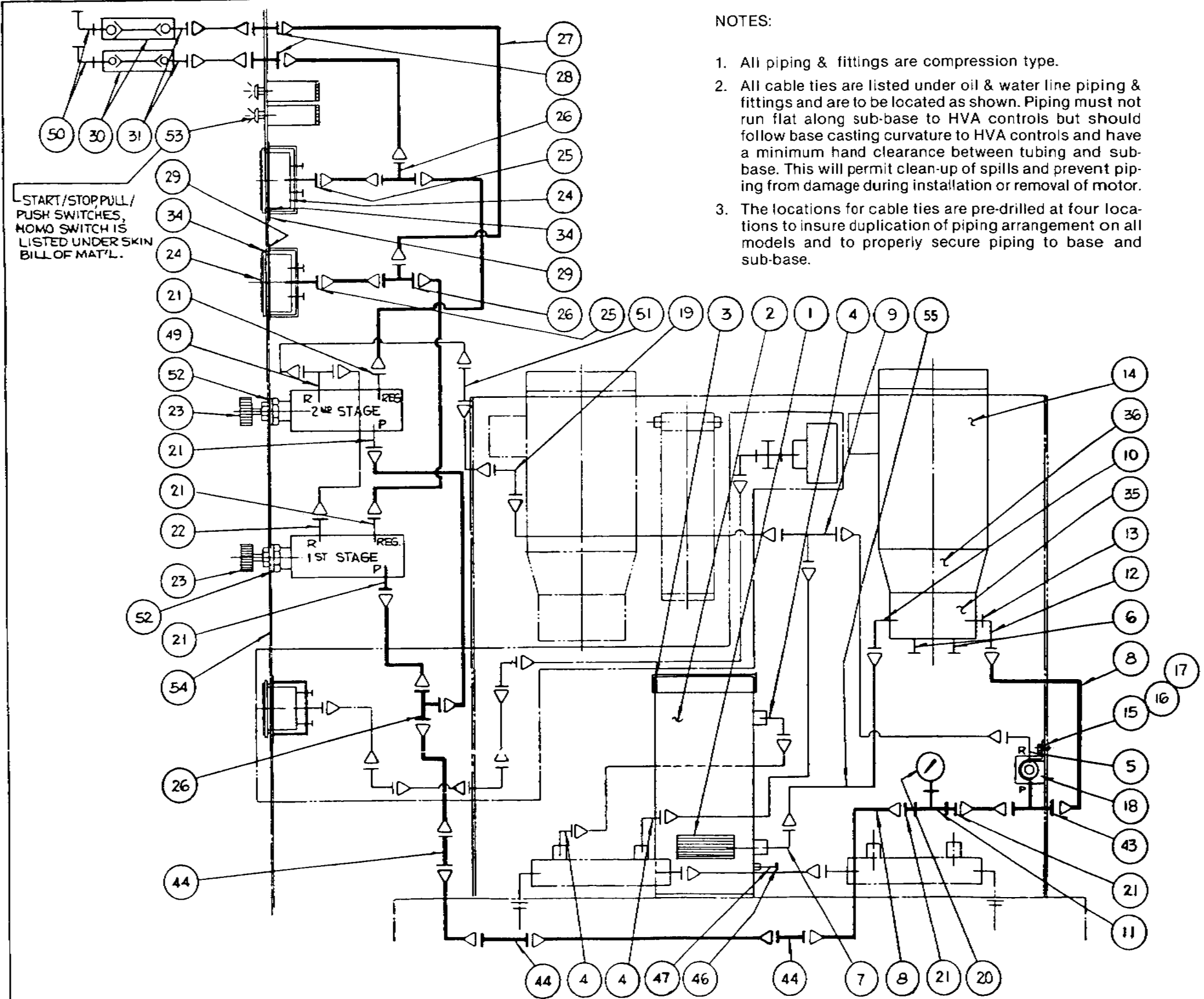


ITEM NO.	QTY	DESCRIPTION	MAT'L.	SIZE
53	20 IN.	TUBING	COPPER	1/2T
52	3	LOCKWASHER (RESERVOIR MTG.)	STEEL	5/16
51	3	BOLTS (RESERVOIR MTG.)	STEEL	5/16-18x3/4 LG.
50	4	NUTS (MOTOR MT'G.)	STEEL	5/16-18
49	4	LOCKWASHER (MOTOR MT'G.)	STEEL	5/16
48	4	BOLTS (MOTOR MTG. BOLTS)	STEEL	5/16-18x1" LG.
47	4	BOLTS (BRKT. TO PUMP)	STEEL	5/16-18x3/4 LG.
46	1	COUPLING (MOTOR TO PUMP)	STEEL	-1-
45	4	BOLTS (BRKT. TO MOTOR)	STEEL	3/8-16x1" LG.
44	1	BRACKET	ALUM.	-1-
43	1	PUMP	ALUM.	1/2P
42	40 FT.	TUBING	COPPER	3/8T
41	1	PIPE CAP	BRASS	3/8P
40	1	PIPE NIPPLE	BRASS	3/8P x 5" LG.
39	1	STREET ELBOW	BRASS	3/8P
38	1	START/STOP, PULL/PUSH SWITCH	ALUM.	-1-
37	1	CONTROL PANEL	LEXAN	-1-
36	1	GASKET (SHIELD)	BUNA-N	1/4 x 3/4 ID
35	1	UNION	BRASS	3/8T
34	1	SWIVEL ELBOW (SPECIAL)	S. S.	7/16-20 x 1/8P
33	3	UNION	STEEL	1/4T x 1/4T
32	1	MALE BRANCH TEE	STEEL	1/4T x 1/4T x 1/4P
31	1	MALE CONNECTOR	S. S.	1/4T x 1/8P
30	1	2-WAY SHUT OFF COUPLING	S. S.	1/8P
29	1	GASKET (SHIELD)	BAKELITE	3 3/16 x 2 1/16
28	1	BULKHEAD UNION	S. S.	1/4T
27	3 FT.	TUBING	S. S.	1/4T
26	1	TUBING TEE	STEEL	1/4T
25	1	O-RING	BUNA-N	2 5/8 ID x 1/8 TK
24	1	FEMALE CONNECTOR	STEEL	1/4T x 1/8P
23	1	PRESSURE GAUGE	STEEL	1/8P
22	1	REDUCING VALVE	ALUM.	1/4P
21	1	UNION ELBOW	BRASS	3/8T x 3/8T
20	2	MALE CONNECTOR	STEEL	1/4T x 1/4P
19	1	PRESSURE GAUGE	STEEL	1/4P
18	1	RELIEF VALVE	ALUM.	1/4P
17	1	BOLT	STEEL	1/4-20 x 1/2 LG.
16	1	LOCKWASHER	STEEL	1/4
15	1	CLAMP	MALB. IRON	1/2P
14	1	MOTOR - VARIES, SPECIFIED BY APPL.	STEEL	-1-
13	1	REDUCING BUSHING	STEEL	1/2P x 1/4P
12	3	MALE ELBOW	STEEL	1/4T x 1/4P
11	1	PIPE TEE	STEEL	1/4P
10	1	MALE ELBOW	BRASS	1/2T x 1/2P
9	1	UNION TEE	BRASS	3/8T
8	10 FT.	TUBING	STEEL	1/4T
7	1	MALE ELBOW	BRASS	1/2T x 3/8P
6	3	PIPE PLUG	IRON	3/8P
5	2	MALE ELBOW	BRASS	3/8T x 1/4P
4	3	MALE ELBOW	BRASS	3/8T x 3/8P
3	2	NUT (TINNERMAN CLIP)	STEEL	1/4-20
2	1	RESERVOIR & COVER	STEEL	-1-
1	1	FILTER	STEEL	3/4P

PARTS LIST

APV GAULIN, INC.  
SINGLE-STAGE HVA  
DRAWING D17477





NOTES:

1. All piping & fittings are compression type.
2. All cable ties are listed under oil & water line piping & fittings and are to be located as shown. Piping must not run flat along sub-base to HVA controls but should follow base casting curvature to HVA controls and have a minimum hand clearance between tubing and sub-base. This will permit clean-up of spills and prevent piping from damage during installation or removal of motor.
3. The locations for cable ties are pre-drilled at four locations to insure duplication of piping arrangement on all models and to properly secure piping to base and sub-base.

START/STOP/PULL/  
PUSH SWITCHES,  
HOMO SWITCH IS  
LISTED UNDER SKIN  
BILL OF MAT'L.

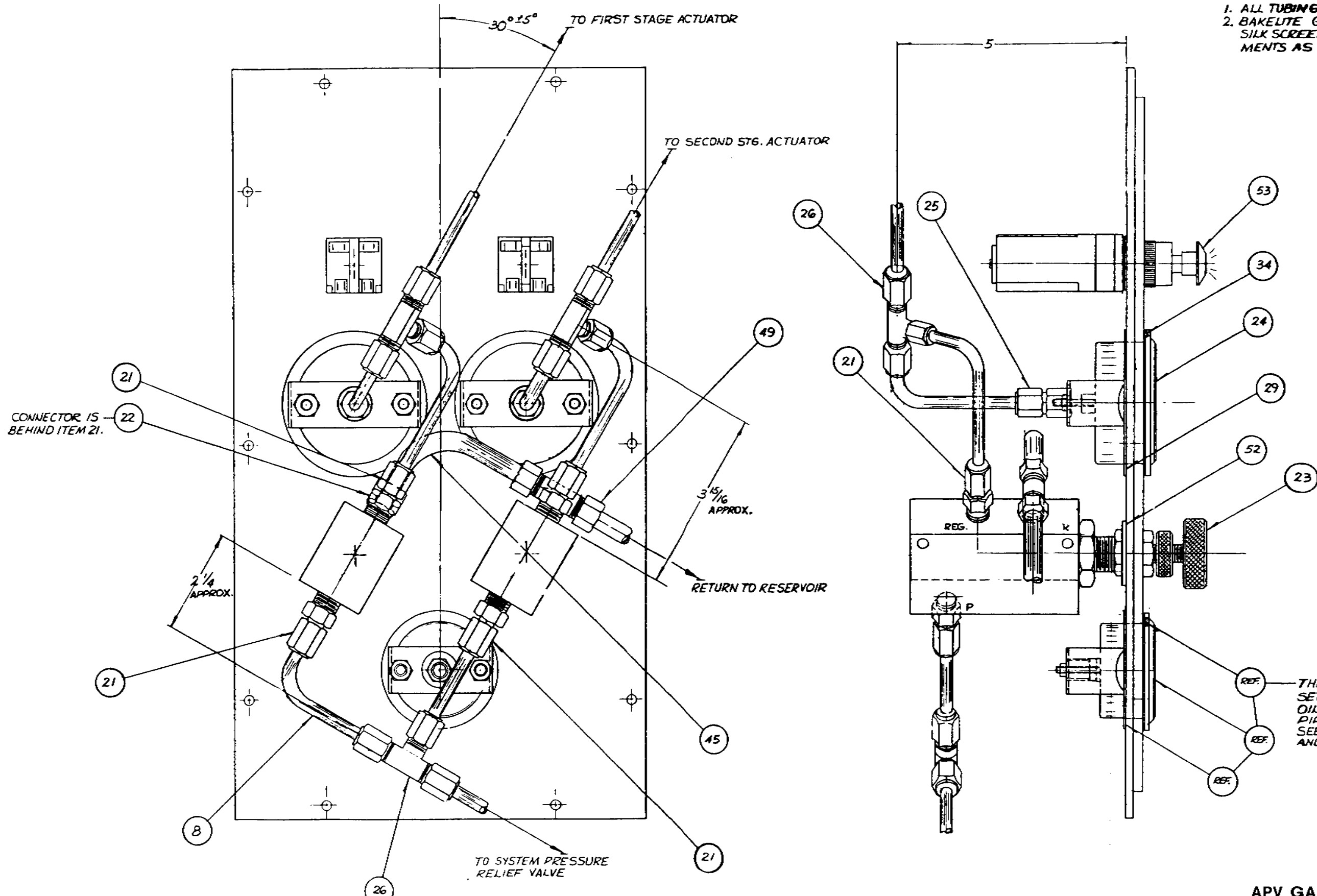
ITEM NO.	QTY.	DESCRIPTION	MAT'L.	SIZE
55	20 IN.	TUBING	COPPER	1/2T
54	1	CONTROL PANEL	LEXAN	
53	1	START/STOP/PULL/PUSH SWITCH	ALUM.	
52	2	GASKET (SHIELD)	BUNA-N	1 1/4 x 3/4 ID
51	1	UNION	BRASS	3/8T
50	2	SWIVEL ELBOW (SPECIAL)	S.S.	7/16-20 x 1/8P
49	1	MALE BRANCH TEE	BRASS	3/8T x 3/8T x 1/4P
48				
47	1	NIPPLE (PIPE)	BRASS	3/8P x 2" LG.
46	1	PIPE CAP	BRASS	3/8P
45	40 FT.	TUBING	COPPER	3/8T
44	3	UNION	STEEL	1/4T x 1/4T
43	1	MALE BRANCH TEE	STEEL	1/4T x 1/4T x 1/4P
42	4	NUTS (MT'G. MOTOR)	STEEL	5/16-18
41	4	LOCK WASHER (MT'G. MOTOR)	STEEL	5/16
40	4	BOLTS (MT'G. MOTOR)	STEEL	5/16-18 x 1" LG.
39	4	BOLTS (BRKT. TO PUMP)	STEEL	5/16-18 x 3/4 LG.
38	1	COUPLING (MOTOR TO PUMP)	STEEL	
37	4	BOLTS (BRKT. TO MOTOR)	STEEL	3/8-16 x 1" LG.
36	1	BRACKET (PUMP)	ALUM.	
35	1	PUMP	ALUM.	1/2P
34	2	O-RING	BUNA-N	2 5/8 x 2 3/4
33	3	LOCK WASHER (RESERVOIR MT'G.)	STEEL	5/16
32	3	BOLTS (RESERVOIR MT'G.)	STEEL	5/16-18 x 3/4 LG.
31	2	MALE CONNECTOR	S.S.	1/4T x 1/8P
30	2	2 WAY SHUT OFF COUPLING	S.S.	1/8P
29	2	GASKET (SHIELD)	BAKELITE	3 3/16 x 2 11/16
28	2	BULKHEAD UNION	S.S.	1/4T
27	6 FT.	TUBING	S.S.	1/4T
26	3	TUBING TEE	STEEL	1/4T
25	2	FEMALE CONNECTOR	STEEL	1/4T x 1/8P
24	2	PRESSURE GAUGE	STEEL	1/8P
23	2	REDUCING VALVE	ALUM.	1/4P
22	1	MALE CONNECTOR	BRASS	3/8T x 1/4P
21	6	MALE CONNECTOR	STEEL	1/4T x 1/4P
20	1	PRESSURE GAUGE	STEEL	1/4P
19	1	TUBING ELBOW	BRASS	3/8T x 3/8T
18	1	RELIEF VALVE	ALUM.	1/4P
17	1	BOLT	STEEL	1/4-20 x 1/2 LG.
16	1	LOCK WASHER	STEEL	1/4
15	1	CLAMP	MALB. IRON	1/2P
14	1	MOTOR - VARIES, SPECIFIED BY APPL.		
13	1	REDUCING BUSHING	STEEL	1/2P x 1/4P
12	1	MALE ELBOW	STEEL	1/4T x 1/4P
11	1	PIPE TEE	STEEL	1/4P
10	1	MALE ELBOW	BRASS	1/2T x 1/2P
9	1	UNION TEE	BRASS	3/8T
8	16 FT.	TUBING	STEEL	1/4T
7	1	MALE ELBOW	BRASS	1/2T x 3/8P
6	2	PIPE PLUG	IRON	3/8P
5	1	MALE ELBOW	BRASS	3/8T x 1/4P
4	3	MALE ELBOW	BRASS	3/8T x 3/8P
3	2	NUT (TINNERMAN CLIP)	STEEL	1/4-20
2	1	RESERVOIR + COVER	STEEL	
1	1	FILTER	STEEL	3/4P

PARTS LIST

LEGEND	
	HIGH PRESSURE
	LOW PRESSURE

APV GAULIN, INC.  
TWO-STAGE HVA  
DRAWING D17478A

NOTES:  
 1. ALL TUBING BENDS 90° AS SHOWN.  
 2. BAKELITE GASKET INSTALLED BETWEEN SILK SCREENED SURFACE AND INSTRUMENTS AS SHOWN.



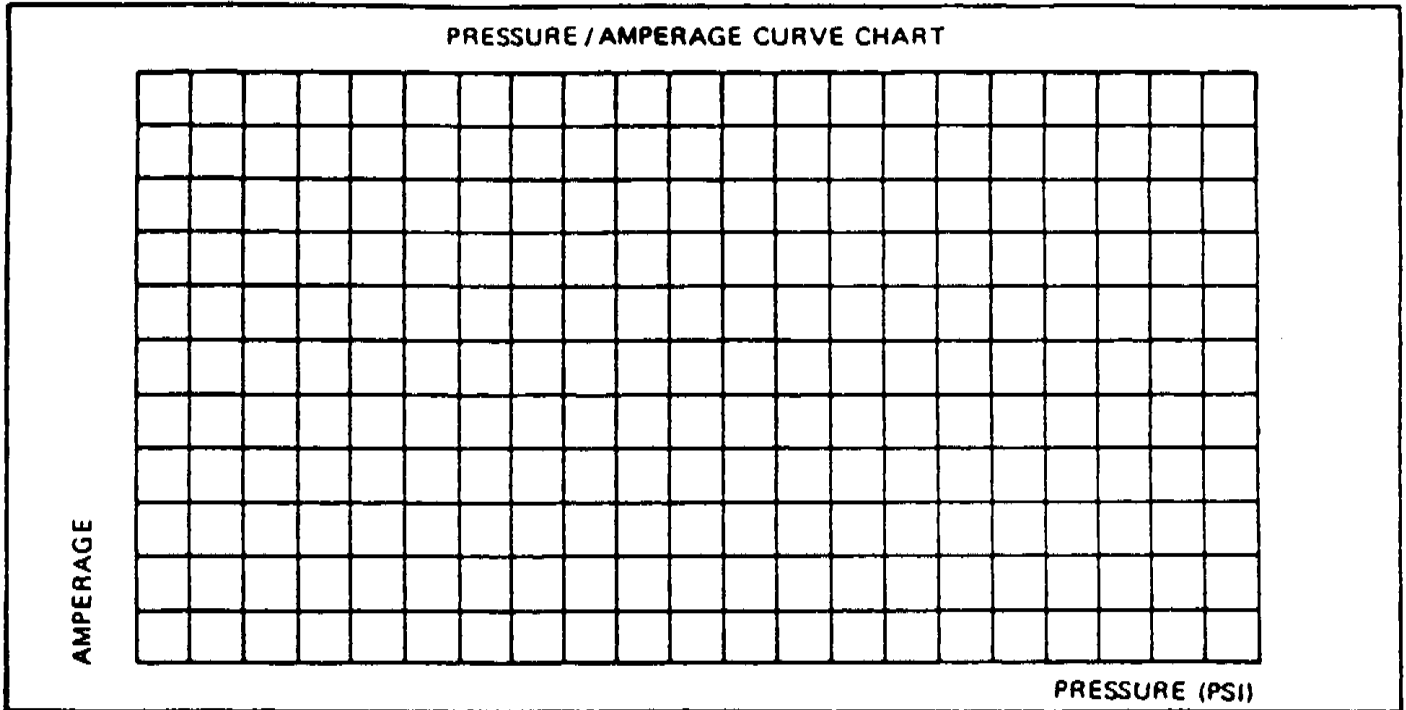
THESE ARE LISTED SEPARATELY UNDER OIL & WATER LINES PIPING & FITTINGS. SEE APPLICABLE DWG. AND BILL OF MATERIAL.

APV GAULIN, INC.  
 TWO-STAGE HVA CONTROL PANEL  
 PIPING & FITTINGS  
 DRAWING D17478B

**SECTION VI**  
**HOMOGENIZER OPERATION**

**Test Operation**

This is the opportune time to construct a pressure/amperage curve to facilitate future, occasional check-out of the gauge accuracy in the event that the gauge fails. It is a simple procedure. Merely record on the accompanying graph (Figure 31) three or four pressure gauge readings up to the maximum operating pressure for the machine, as well as the corresponding amperage reading determined by your electrician, as each of the pressures are reached and recorded. Future amperage readings should correspond with the pressures indicated by the gauge.



**FIGURE 31**

Any foreign matter in the product piping or water supply must be flushed out, before the system is put into operation.

Turn on the water for the water-spray assembly, which cools the plunger packing assemblies, and adjust the flow using the control valve. Turn on the separate line for cooling the power-end and HVA coolers (if supplied).

Prior to initiating test operation, the operation of the low oil pressure cut-out switch, as well as the flow and aim of the water-spray nozzles should be checked.

Clean water should be used for initial testing of the homogenizer or high pressure pump. During the water test run, a capacity check should be made at normal pressure to determine if the machine is operating at its rated flow. See Section VIII for procedure to conduct a capacity check.

Various products being homogenized or pumped may require more infeed pressure than that required for water. It is recommended that the required infeed pressure be determined for each different product processed and notes taken to enable the operator to set up the required pressure whenever changing the product.

## **Constant Requirements**

No matter where the homogenizer or pump is located, efficient and safe operation demands the following.

1. Homogenizing temperature must be 140°F. on dairy products (except evaporated milk).
2. Minimum infeed pressure about 10 psig or greater must be maintained, as dictated by product temperature, viscosity and flow rates. High pressure pumps require approximately one pound pressure per one percent of total solids feed pressure for dairy and food products.
3. Air entrainment in product must be kept to absolute minimum possible (two percent or less) to avoid serious damage from shock loading.
4. Do not start or shut down the machine under load.
5. Do not apply pressure until machine is pumping smoothly with air expelled from cylinder and infeed lines.
6. Uninterrupted product supply is required. Machine should not be operated with pressure applied while product runs out.

## **Product Operation**

When homogenizers and pumps are operated on more than one product, thus requiring different pressure combinations, manual adjustment of the reducing valve control knob will be required.

Start the feed pump, if one is in use. Adjust the flow of cooling water lines. Check the machine oil level. Separate water piping is supplied to the water-supply assembly used to cool the plungers. Before starting the machine, make certain that the water is running. Direct the flow of the nozzles to the top of each plunger. (See Figure 39.)

Make certain that the reducing valve on the HVA panel is in the full open position by turning the knob counter-clockwise. This will permit the full flow of the product through the valve assembly without pressure. Open the product supply valve and start the machine motor.

If the systems are operating properly and the product is pumping smoothly through the machine, start the HVA motor and gradually turn the reducing valve on the HVA panel clockwise, until the desired pressure is indicated on the product discharge pressure gauge. At this point the machine should be functioning properly.

With the exception of listening for abnormal noises and checking gauge for excessive fluctuation, no further attention is needed. If operation is not smooth, immediately turn the HVA reducing valve counter-clockwise to the full open position to reduce pressure and refer to "Constant Requirements".

## **Shut-Down**

1. If an air-operated backpressure valve is used, shut off the air supply.
2. Reduce the HVA pressure to the minimum point.
3. Turn off the HVA pump motor.
4. Turn off the machine.

## SECTION VII

### RECOMMENDED REGULAR MAINTENANCE SCHEDULE

#### Daily Inspection

1. Drain any condensate from the power frame oil through the petcock, before starting the machine.
2. Check the oil level (visible through the oil-level sight glass) and add oil, if required.
3. Check the oil pressure (20-40 psig, 1.4 to 2.8 kg/cm<sup>2</sup>) and adjust, if necessary.
4. Check the water lubrication and cooling systems. Check-water spray nozzles to make sure they are flowing freely and are aimed correctly.
5. Check for any leaks from cylinder or power frame.
6. With the machine running, listen for any abnormal sound.

#### Monthly Inspection

1. Check tightness of all bolts, nuts and fittings.
2. Check for oil leaks.
3. Check belt tightness and adjust, if necessary.
4. Disassemble and inspect all homogenizer, relief or full flow control valves and cylinder parts for wear and damage.
5. Inspect baffle packing and crosshead extensions for leaks. Readjust or replace, if necessary.
6. Inspect gaskets and packing for leakage and replace, if necessary.

#### Six-Month Inspection

1. Drain oil, clean crankcase, gear case and oil-level sight glass. Replace oil filter cartridge. Fill with oil to proper level.
2. Repeat all monthly checks.
3. Lubricate motor bearings according to manufacturer's instructions.
4. Inspect connecting rod bearing inserts for possible wear or damage. Replace, if necessary.
5. Inspect and adjust crosshead ball joints.
6. Tighten cylinder stud nuts.
7. Carefully check operation of low oil-pressure switch.
8. Replace HVA oil filter located in HVA oil reservoir.



## SECTION VIII

### MAINTENANCE PROCEDURES

#### Introduction

The purpose of this section is to provide maintenance procedures, to recommend lubricants and to list the recommended torque values on fasteners.

#### Cylinder Stud Installation

APV Gaulin MS(P) homogenizers and high pressure pumps are provided with straight studs except for front cap studs, which are Factory-installed using anaerobic adhesives. Should loosening occur, studs should be properly reinstalled.

##### 1. Background

- a. MS homogenizers and pumps utilize straight studs, which are locked into the cylinder block with Loctite 272 anaerobic adhesive. Do not use Loctite on front cap shoulder-type studs.
- b. Anaerobic adhesives, which remain liquid while exposed to air cure, without heat or catalysts when confined between closely fitted steel parts. Steel accelerates the curing process. However, stainless steels require priming prior to using Loctite 272. Use Primer T (747), which contains fine steel particles that develop full strength bonds.
- c. These adhesives will harden in the bottle, if contaminated with metal particles. Do not dip metal parts or brushes into the bottle or return contaminated compound to the bottle after using. Do not mix primers with the compound, as this will also cause hardening.
- d. The shelf life of Loctite compound is guaranteed for one year minimum at 68°F ± 20°.
- e. Loctite compounds are non-toxic.

##### 2. Application Technique

- a. Cleaning — Parts that are to be joined should be solvent-cleaned, using Loctite Safety Solvent No. 75559 or any commercially available solvent such as trichloroethylene, trichloroethane, perchloroethylene, MEK, acetone, alcohols or freon solvents. Do not use kerosene, gasoline, naphtha, fuel oil, Varsol or Stoddard solvents. These products leave a surface film and can reduce strength greatly if not flushed off properly. Therefore, apply solvent and flush away oil, dirt and grease. Wipe studs with a clean rag. Blow out metallic or other residue from stud holes with compressed air, then wipe with a clean rag.
- b. Coating — Coat stud threads, which are to be covered with Loctite with Primer T (747) and allow to dry 3 to 5 minutes. Apply a rim of Loctite 272 (code-colored red) around the top edge of the female thread. Thoroughly coat the first three or four threads of the stud.
- c. Installation — All straight studs used on the top and the gauge and valve body studs should be turned into the tapped hole in the cylinder until they bottom. Do not use Loctite or shoulder-type studs.
- d. Cure — Loctite 272 will cure in one to two hours.
- e. Clean-Up — Uncured material may be air-blown or wiped with a clean cloth. Solvent indicated in 2.a. may be used for clean-up.

## **Ways to Prevent Cylinder Breakage**

Two major contributing causes of cylinder breakage on machines supplied with shoulder-type, front cylinder studs are failure to maintain proper torque on front cap shoulder studs and improper tightening of front cap stud nuts.

### **1. Stud Torquing**

The shoulder-type stud design requires that the studs be torqued carefully to specifications and that the torque loads be maintained at all times. The studs are torqued properly before each machine leaves the Factory; but, if proper torque loads are not then maintained so as to keep the studs in a pre-stressed condition, the inherent advantage of the shoulder is lost, and eventual stud failure is certain.

In order to properly torque the shoulder-type studs, a stud-driver installation tool is required (see Figure 32).

### **2. Stud Nut Tightening**

It is absolutely necessary that the front cap stud nuts be tightened evenly with care taken to build up the proper torque load on each nut as equally as possible. If the nuts are not tightened evenly unusual loads will be brought to bear on each stud, and a flexing/bending action will take place ensuring eventual stud failure.

Torque applied to the nuts should never be greater than the recommended torque load on the studs. If this condition is allowed to occur, the stud shoulder will be pulled away from the cylinder, flexing will result, and rapid stud failure will occur. (See Figures 33, 34 and 35.)

## **Instructions for Making a Stud Driver Installation Tool**

1. Use a piece of hexagon stock approximately twice the length of the thread on the stud and of a size to enable a hole to be drilled and tapped through the center of the diameter of the stud thread.
2. The hole may be drilled by hand on a lathe, drill press or on a radial drill depending upon the type of machinery available and the size of the hole to be drilled.
3. When the recommended size hole has been drilled for the size tap to be used through the length of the desired piece of hexagon stock, the hole must be tapped.
4. The hole should be tapped from one end to the other, either by hand using a tap wrench or by machine.
5. When the thread has been cut and completely cleaned, it is suggested that a stud be tried from both ends to determine the fit. If a tightness is felt the body (hexagon stock) should be retapped.
6. Before the stud driver is used, the threads should be well lubricated.
7. It is suggested that a piece of brass, lead or a piece of ordinary solder be inserted in the tapped hole to be located between the stud to be assembled and the compression bolt or used stud. This will prevent scoring or galling of the two threaded pieces and will enable the removal of the driver from the stud being assembled.
8. Into one end of the threaded body a bolt or used stud is assembled to a depth which will only permit approximately half of the length of threaded area on the new stud to enter the threaded body from the opposite end.



9. With an open-end wrench to fit the hexagon stud driver body, tighten and torque the new stud into position.
10. When stud is assembled, hold the driver with a wrench to prevent loosening the stud. With another wrench, loosen the compression bolt or used stud and remove the driver from the stud.
11. Keep threads and brass or lead piece well lubricated each time the tool is used.

#### **TORQUE VALUES FOR MS18-10TBS CYLINDER ASSEMBLY NUTS**

The high pressure side of the MS18-10TBS machine is sealed with O-ring seals. Proper torquing of the studs and nuts on the high pressure side is necessary, both to seal the fluid end and to avoid stud failure.

The following list of stud nut torque values is to be complied with, when assembling the machine.

DESCRIPTION	PART #	TORQUE VALUE (ft. - lbs.)	REMARKS
Front cap shoulder studs	410464	1750 ± 5%	High pressure fluid end
Front cap stud nut	570126	1500 ± 5%	High pressure fluid end
Top cap nut	570122	1000 ± 5%	High pressure fluid end

#### **TORQUE VALUES FOR MS45-10TBS CYLINDER ASSEMBLY NUTS**

The MS45-10TBS machine is provided with all straight studs. The high pressure side is sealed with O-ring seals.

The Proper torquing of the nuts on the high pressure side is necessary, both to seal the fluid end and to avoid stud failure.

The following list of stud nut torque values is to be complied with, when assembling the machine.

NUT LOCATION	PART #	THREAD SIZE	TORQUE VALUE (ft. - lbs.)	REMARKS
Front and top cap studs	570122	1-3/8 - 6	504 ± 5%	High pressure fluid end
Cell Disruption valve assembly studs	570118	1-1/8 - 7	376 ± 5%	High pressure fluid end
Cell Disruption valve body adapter or first-stage homogenizing valve body studs	570014	7/8 - 9	147 ± 5%	High pressure fluid end
Inlet Studs	570008	1/2 - 13	1 to 2	Low pressure fluid end. Fitting sealed with 90° Duro Rubber gasket
Gauge Adapter Studs	570012	3/4 - 10	96 ± 5%	For mounting a special adapter to which is attached a pressure gauge with a male NPT connection between the first and second stages. High pressure fluid end.
Gauge	570010	5/8-11	55 ± %	For mounting a pressure gauge with a diaphragm connection. High pressure fluid end.

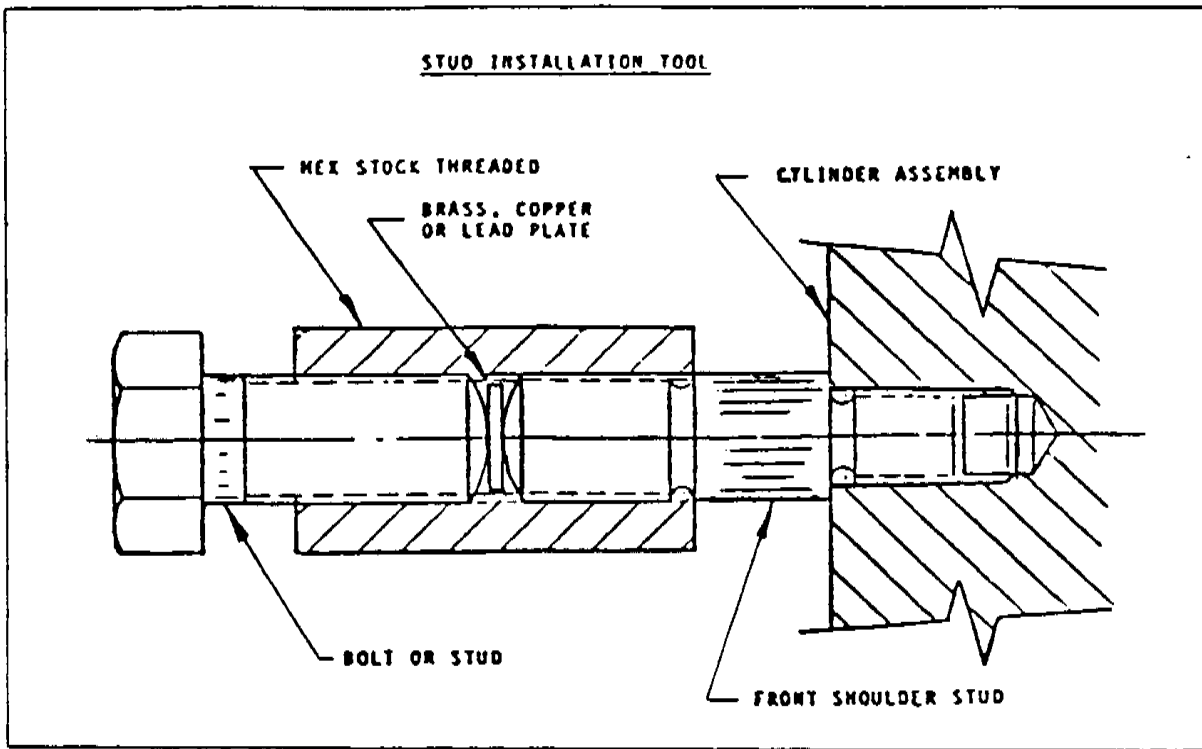


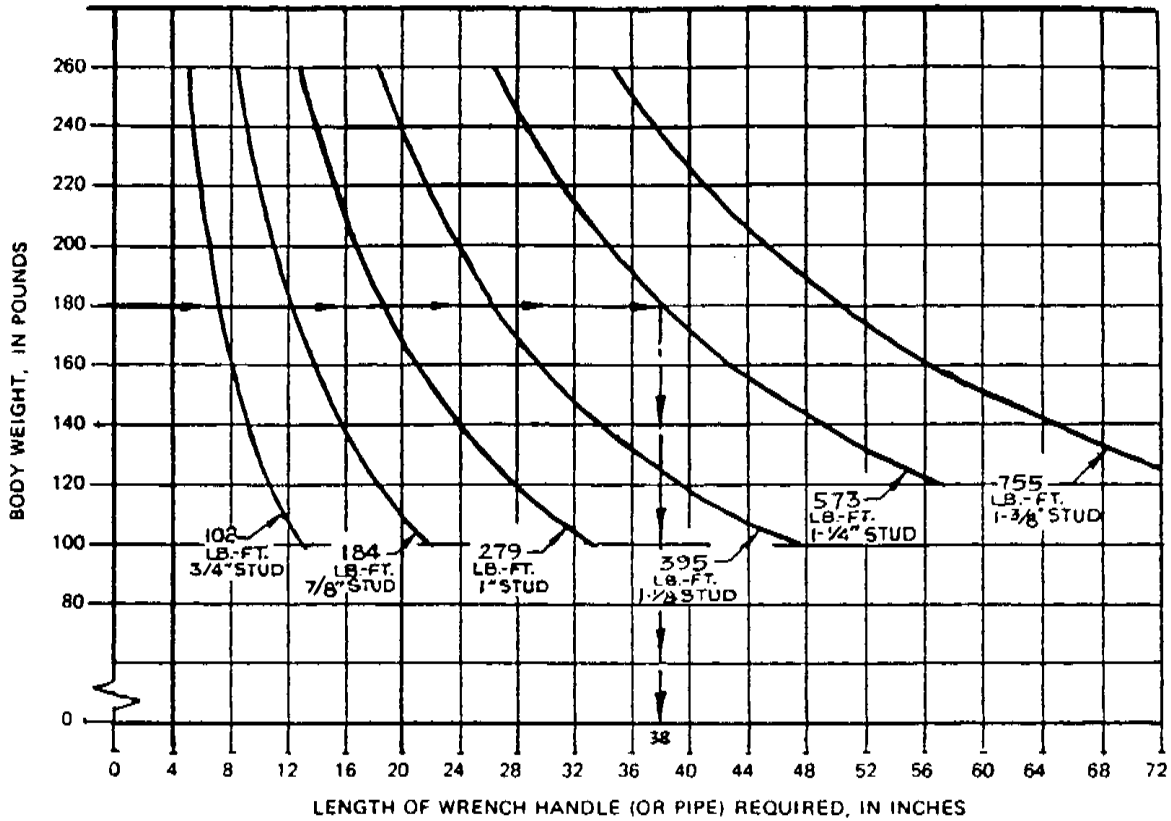
FIGURE 32

### TORQUING THE SHOULDER-TYPE STUD

To properly install studs a torque wrench is normally required. However, if none is available, it is necessary to install studs with the use of a socket wrench, adjustable wrench or open-end wrench and piece of pipe of a length as specified in the table attached. (It is very important to use exactly the length of the pipe indicated.) When using the specified length of pipe, slide the pipe over the wrench handle all the way up

to the wrench end. Do not permit the pipe to slip off the end of the wrench. Now, using your body weight, grip the pipe at the very end, so that both your hands are next to each other. Lean on the pipe, forcing the hex stock to turn. When you cannot turn any further, this will have produced a torque equal to or greater than the maximum torque required.

FIGURE 34



**HOW TO USE TORQUE CURVES**

1. The torque value curves shown above represent calculated value based on dead body weight. The use of additional body force or push on the wrench or pipe handle end (such as jumping on the handle) will produce an over-torque on the stud.
2. Example: Refer to the arrow-line shown. If a 180-pound person wants to torque a 1 1/4" stud, he should use a 38" long wrench or pipe extension, as measured from the center of the stud.

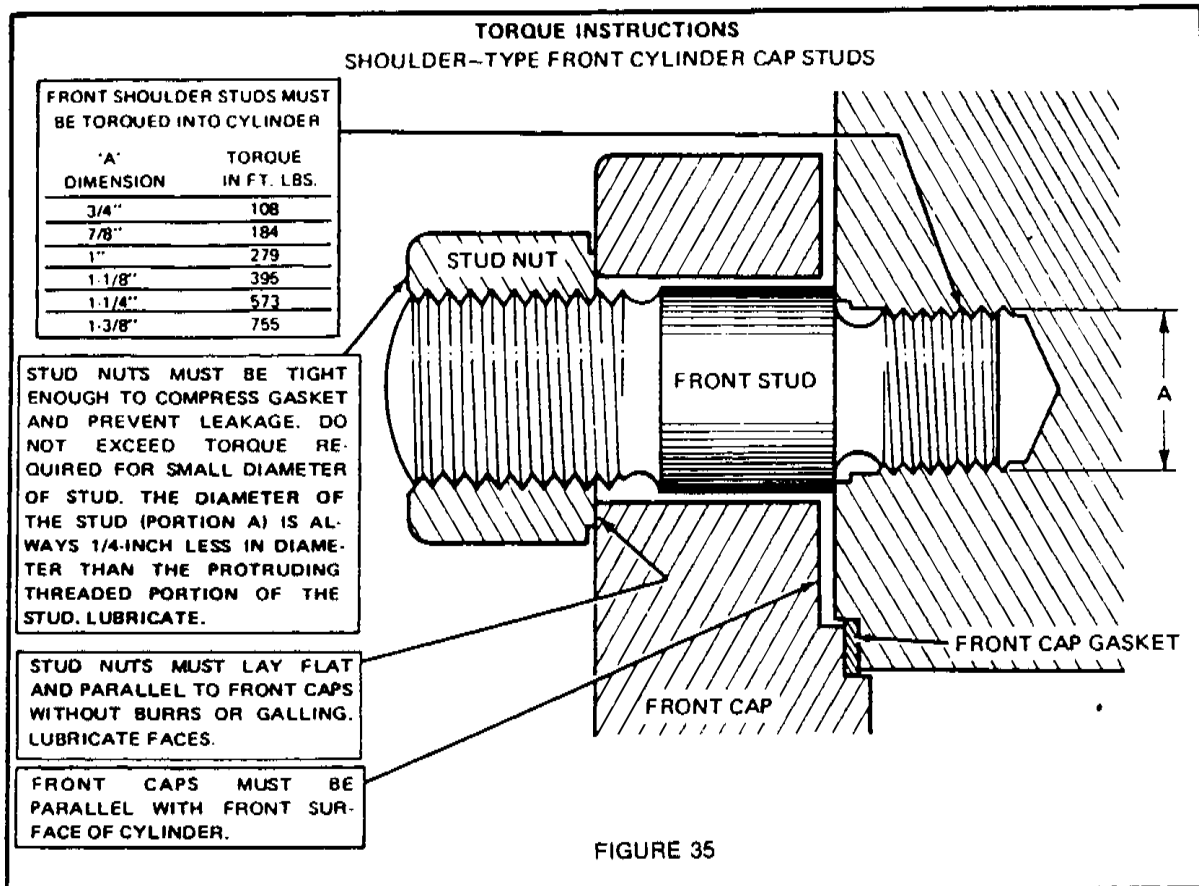


FIGURE 35

### TYPICAL TWO-STAGE HOMOGENIZING VALVE ASSEMBLY

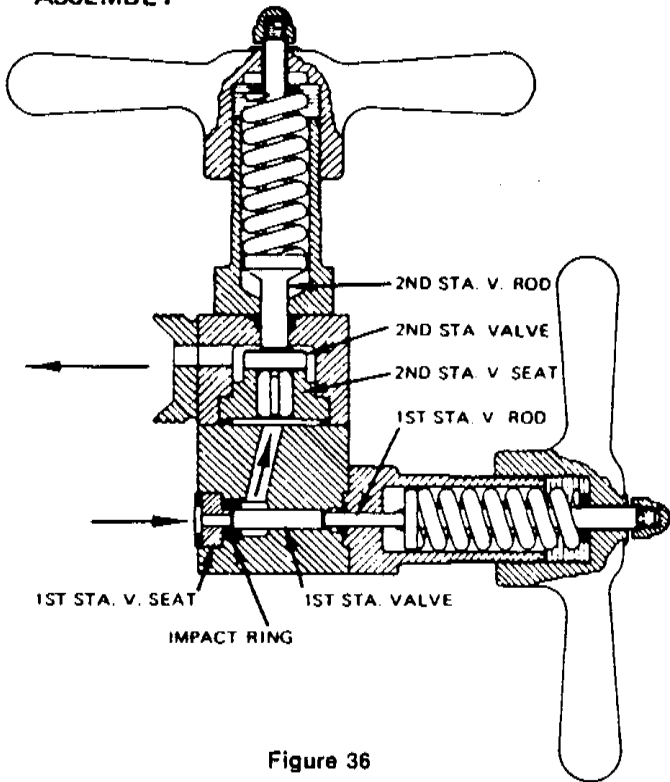
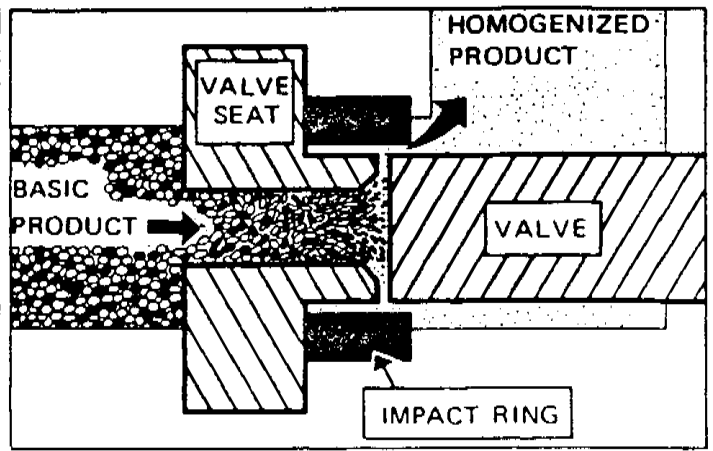


Figure 36

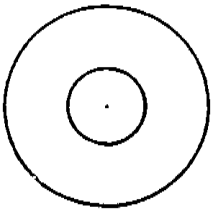
### THE GAULIN HOMOGENIZING VALVE EXPLAINED



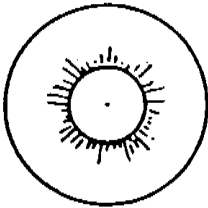
**How it works:** Product premix is pumped to the valve at high pressure and low velocity. As it enters the space between the valve and the seat, velocity increases rapidly up to a maximum of 57,000 ft./min. (17,370 m./min.) with a corresponding decrease in pressure to the vapor pressure of the product, and vapor bubbles form in the liquid. As the product leaves the valve-valve seat area, velocity decreases sharply and pressure increases, causing the bubbles to implode (cavitate). The intense energy release and turbulence resulting from cavitation generates powerful shearing forces and particle disruption — in effect, homogenization.

Figure 37

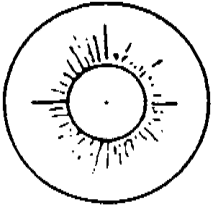
### Valve Wear Pattern Guide



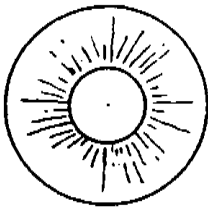
1. NEW VALVE — Complete bearing across whole face



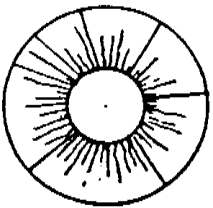
2. USED VALVE — 1/2 of face still bearing — no channels — in excellent condition



3. USED VALVE — 3/4 of face gone — no erosion — still good but watch for channels



4. VALVE READY FOR REGRINDING — Approx. 7/8 of face gone — failure of valve can occur at any moment



5. EROSION GROOVES — Radial grooves due to erosion at any stage of wear — valve must be reground for proper operation regardless of other face conditions

Figure 38

## Plunger Packing

Leakage through the plunger packing is the result of worn packing, usually caused by the following: worn packing adjusting rings, worn or misaligned plungers, packing material unsatisfactory for high temperature or highly abrasive conditions, insufficient compression of the packing. Even new packing blows out from shock loading.

1. Packing adjusting rings are made of nylon, nickel alloy or bronze, depending on the duty required. Any type of ring should wear faster than the plunger. Plunger rings are always of stainless steel with a minimum clearance of .040" over the plunger. No metal contact between sliding members, when both are made of stainless steel, can be permitted without immediate damage.
2. Plungers are available in 18-8 s.s., hardened 17-4PH s.s., hard chrome-plated s.s., Colmonoy-coated and of special materials as well, depending on the duty requirements. For liquid, non-abrasive product 18-8 s.s., which is relatively soft, is completely satisfactory. Abrasive products require harder materials. High pressure packings demand highly polished, hard-surfaced plungers.

Clearance between the plunger and metal packing adjusting ring is .002", when new. When this total clearance reaches .010", one or both parts should be replaced. A split in the center of the "V" or the inner lip of a nylon ring worn over 1/32" below the outer lip will require immediate replacement.

When plungers show lengthwise scoring, which is cutting out the packing, mount them in a lathe or drill press chuck and polish for several minutes with 180-grit emery cloth.

3. Standard, "V" rubber or cotton duck and styrene rubber packings are recommended for use only up to 185°F. Operation at 200°F. will greatly reduce their useful life. Other packing materials are needed to withstand chemical action or abrasive materials. Consult Factory for availability of materials for unusual duties.
4. The packing spring is self-adjusting, but in time it can take a permanent set. If the packing is allowed to move back and forth with the plunger it will fail quickly, and the packing spring must be replaced.

NOTE: The tapered seat, ball-valve cylinder (TBA) features a packing adjusting screw. For proper adjustment, refer to TBA Cylinder Design Instructions in Section III.

5. Although plungers are interchangeable, it is best practice to maintain the same assemblies in each location. Lubricate threads, prior to assembling and avoid denting shoulders of plungers as this creates misalignment.

## Pump Valve Seats

There are three types of suction and discharge valve seats:

1. "PS" cylinder construction indicates that the seats are integral with the stainless-steel cylinder. They will develop small pits on seating areas during the work-hardening process. This will continue for the first 1,000 hours or so. They can also show indentations from undissolved particles in the product. When lapping of valves to their seats is necessary, use automotive, medium-grit, water-soluble, valve grinding compound.

2. "TPS" and "TPSX" cylinder construction uses Rexalloy (Stellite), field-removable valve seats with 17-4PH, hardened poppet valves. If erosion grooves form across the seating surface, use tool (K) to remove seats. Remove round nut on bottom, insert rod down through seat, hold round nut with tool (M), screw rod into nut, slide rubber cushion ring over rod, follow with metal spacer block and top nut. Tighten upper nut until seat is pulled out of taper. If loose for any reason, they will create a pounding sound. APV Gaulin recommends that seats be returned to the Factory for regrinding.

When replacing seats, make certain that tapers on seats and in the cylinder bores are clean and dry. Pack seat in dry ice or immerse in an alcohol/dry-ice mixture for 20-30 minutes. Install in cylinder by tapping into place with a piece of wood or brass. Since any leakage between the seats and the cylinder bores will create serious damage, extreme care should be used in assembling the seats.

3. "TBS" and "TBSX" cylinder construction uses field-removable valve seats with Rexalloy (Stellite) ball valves. Except for sizes and shape, they are the same and should be treated as described above.

For valve seat refacing in the field, Rexalloy seats may be refaced on a lathe, using a carbide tool bit. Carbide, tapered seats are available for very abrasive products. Carbide seats must be returned to the Factory for refacing.

## **Pump Valves**

There are several pump valve materials and designs:

1. 18-8 stainless-steel valves are standard in "PS" cylinders only. Pitting that develops across seating surfaces as described above, will usually not affect pumping operation, unless they become lined to form a bypass across the seat area. If this occurs, valve and seat must be refaced. Grinding kits are available for purchase, and valve seat refacing tools are available on a rental basis. If used, the valves will then have to be turned on a lathe to a true 45° angle and then lapped to the seats.

If poppet valves hang up or stick, the cause is either product build-up or a burr at the bottom of the 45° angle of the pump valve seat.

2. 17-4PH, hardened stainless-steel valves are standard in "TPS(X)" cylinders. They will withstand much more abrasion than 18-8 valves. If problems develop, treat them the same as 18-8 s.s. valves.
3. Rexalloy (Stellite) ball valves, used in "TBS(X)" construction only should be inspected regularly. Pits, dents or surface cracking will quickly lead to erosion of the pump valve seats and the ball valves; therefore, they should be replaced promptly. Sticking or hanging up usually indicates product build-up or insufficient clearance between ball valves and ball valve guides for the viscosity of the product being handled. Abnormal noise, pressure gauge fluctuation and uneven pumping are associated with valves sticking.

## **Capacity Check**

Capacity measurements should be made with cold water only. They should be made with the machine disconnected from the normal processing system. Any bypass lines should be removed. The suction line should be dropped in a tank from which an adequate supply of water can be made available. All water should be discharged through the valve system and piped in such a way that a vessel of known capacity will collect all of it. The suction line should be gasketed at each joint.

1. Start the machine and run until all air is expelled from the infeed pipe and cylinder.
2. With all pressure off, direct the discharge into the measuring vessel and time the fill with a stop watch. The vessel should have a capacity of about one minute of pumping; i.e., for 6000 gph use a 100-gallon container.

$$\text{CAPACITY IN U.S. GPH} = \frac{\text{VOLUME (GAL.)}}{\text{TIME (SEC.)}} \times 3600$$

For example, 100 gallons in 60 seconds:

$$\text{CAPACITY} = \frac{100}{60} \times 3600 = 6000 \text{ gph}$$

3. Repeat at maximum pressure. If more than 3% difference occurs, the problem may lie in the condition of the pump valves and seats or in belt slippage. In addition, product compressibility may be a factor, or there may be air in the product.

### Product Pressure Gauge

Gauge problems are due, primarily, to improper care in handling the gauge or severe shock-loading caused by operating either with air in the product or with inadequate infeed pressure.

1. A pressure/amperage curve (see Section VI, Figure 31) is useful for rechecking gauge accuracy. Many users permanently install an ammeter in the motor line as a double-check on the gauge.
2. Repeated gauge failures indicate possible abnormal operating conditions, which should be checked out. If no abnormal conditions can be found, improved gauge life (up to five times) has been obtained by installing a remotely mounted APV Gaulin EPM™. (See Section IX.)

### Homogenizer, Relief and Full Flow Control Valve Parts

For Micro-Gap valves, see Section IV.

1. Valve Rod — Whether the valve rod is used with either manually or HVA controlled valves, it must be kept straight and free from burrs, so it can move freely within the valve body. If it binds, pressure cannot be properly controlled. If burrs develop, polish rod with 180 grit emery cloth and also polish the holes through which it travels. Always lubricate rod prior to assembly.
2. Valve Rod Packing — This packing serves two purposes. The first is to seal against product leakage. The second is to dampen down the motion of the valve rod. When the packing becomes worn, it allows rapid oscillation of the valve rod, accelerating wear and affecting pressure control.
3. Valve Spring — Valve springs can take a set, break and, although they are plated, corrode and weaken. They should always be heavily lubricated with grease upon assembly, and the valve rod washer must be installed between the spring and the handwheel.
4. Handwheel and Handwheel Support — Other than an occasional check on the condition of the threads and lubrication prior to assembly, no maintenance is usually required.

5. Valve and Valve Seat — The valves will be of Rexalloy (Stellite), tungsten carbide or similar very hard materials. The wear patterns shown in Figure 38 will apply to all materials and all configurations. Valves and valve seats must always have a continuous contact area around the full circumference on valve and seat. If this contact is broken at any point, as illustrated on Figure 38, Item 5, the valve and seat require relapping or regrinding.

a. Rexalloy (Stellite) valves can be lapped in your plant using a standard oil-mixed grinding compound, medium grit. Piloted valves (ones in which there is a three- or four-sided pilot which enters the hole in the valve seat to keep the valve face parallel with the seat) are ground to each other. Apply a small dab of compound at three places on the seating surface. Either hold the parts in your hands and rotate them together or secure them in a lathe chuck, turning at slow speed.

**CAUTION: Keep the compound away from the wings of the valve pilot to avoid increasing the diameter of the valve seat hole. Repeat process, adding compound as required, until seating surfaces are restored to approximately the No. 2 pattern shown in the Wear Pattern Guide (see Figure 38).**

b. For valves and seats of the unpiloted type apply the same type of automotive valve-grinding compound. Lap each piece separately by rotating them in a circular motion against a smooth, flat, hard surface such as a piece of heavy plate glass.

c. When seating surfaces are permitted to develop erosion channels, as shown on 5. of the wear pattern guide, they cannot be corrected by lapping, and Factory regrinding will be required.

6. Impact Rings — These are available in Rexalloy (Stellite) and other materials and are designed to help prevent the high velocity stream, upon leaving the faces of the valve and seat, from cutting deep grooves in the stainless-steel valve bodies. When the groove or grooves on the inside of the ring are worn to a depth of approximately 1/32 to 1/16", the part should be replaced to maintain efficient homogenization. Impact rings cannot be repaired.

7. Valve Seat Gasket — These, as well as all other gaskets in the fluid end of the machine, are available in several materials to handle the specific duty required. Replacement is only required when leakage develops.



## Water Spray Assembly Adjustment

**WARNING: If the spray nozzles become clogged or misaligned, rapid deterioration of the plunger packing will result.**

1. Turn on and adjust the flow of water to the water spray assembly to obtain three steady streams.
2. Make sure that the spray nozzles are flowing evenly. A clogged nozzle can usually be freed by working a thin piece of wire into the end of the nozzle.
3. The nozzles are individually adjustable. Loosen the tubing nut around the nozzles. Aim the flow and tighten the nut.
4. The stream of water from each nozzle should be aimed so that the stream enters near the inner top surface of the plunger clearance hole (see Figure 39).

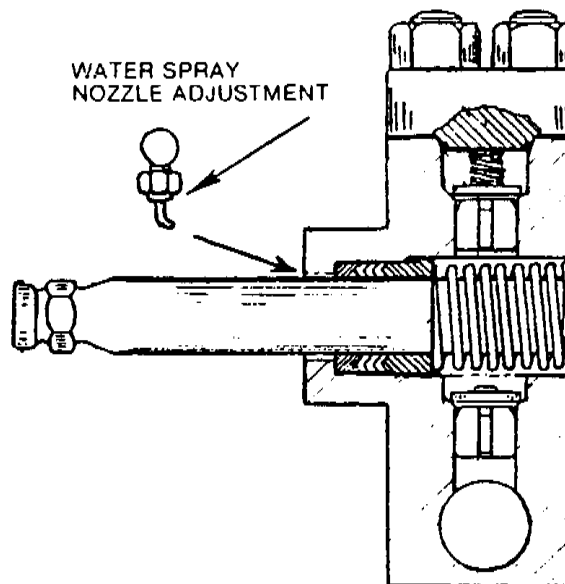


FIGURE 39

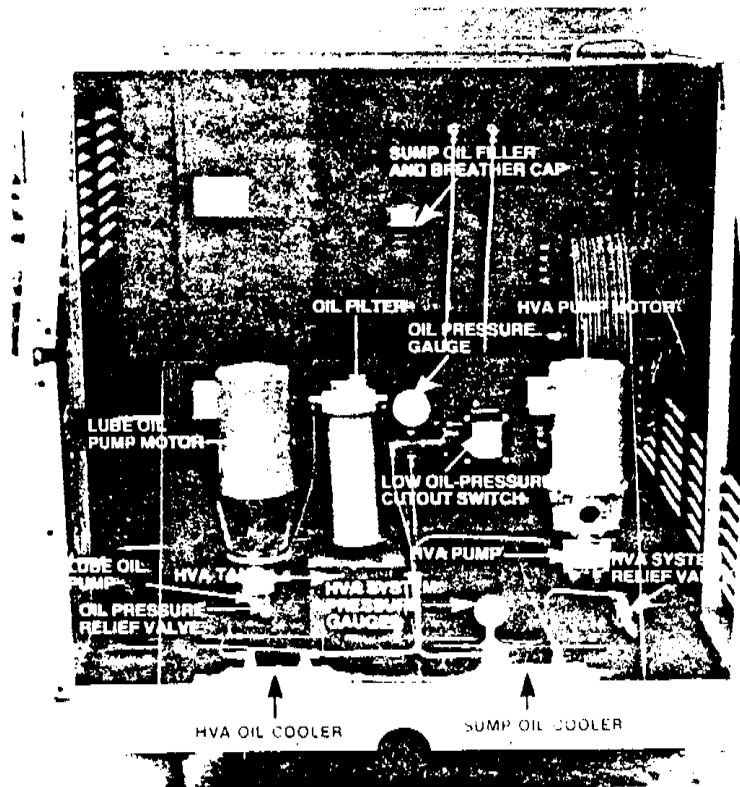


FIGURE 40

### Power End Lubrication

The power frame, housing the eccentric shaft, the driveshaft and crossheads, is gasketed and tightly covered. Although the crankcase (power-end) is vented to allow the escape of heat and moisture, a certain amount of condensation is unavoidable. To avoid oxidation of machined surfaces and emulsification of lube oil, the following procedure is recommended. After the machine has been shut down overnight to permit the water to separate from the oil, open the petcock (located at the right side of the machine) and drain the flow into a container, until the flow of water stops and the flow of oil begins. Close the petcock and discard the contents of the container. Check the oil level and add fresh oil, if required.

NOTE: Excessive water in the oil sump may be caused by a leaking cooler, worn baffle packing, defective top cover gasket or excessive humidity. The following checks can be made with machine off.

1. Check the oil cooler by disconnecting one oil line fitting and turning on the cooling water. If the cooler leaks, water will come out the oil connection.
2. To check the baffle seal packing remove the top covers, stand at the side of the machine and direct a stream of water from a hose at the baffle packing area toward the back of the machine. Observe if water comes through into the oil compartment. Adjust or replace, as necessary.
3. Visually check the top gasket and replace, if necessary.
4. Excessive condensation can develop, if the cooling water is very cold. It will be seen as puddles of water standing on flat surfaces when the top cover is removed and as drops hanging from the underside of the top cover. Raising the water temperature and/or insulating under the top cover are methods of correction.

## **Oil Changing**

1. Frequency of oil changing depends on the type of service required.
  - a. On intermittent service change the oil every 500 operating hours or six months, whichever comes first. Always change the oil, if it becomes emulsified with water.
  - b. On continuous service, if the oil is free of contamination or emulsification with condensate, it can be used for 2000 hours.
2. Whenever the oil is changed, clean the crankcase compartment with steam or kerosene and wipe clean and dry.
3. Check strainer at bottom of crankcase for cleanliness and replace the oil filter cartridge, located at the rear of the machine.

## **Oil Pump and Relief Valve Adjustment**

(See Figure 40.)

The lubrication oil pump with motor is mounted at the top left of the panel at the rear of the machine. The oil relief valve is mounted on the head of the pump. The relief valve assembly consists of a valve held against a seat by a spring and an adjustment screw. The adjustment screw is sealed by a copper washer and a hex-sided cap.

1. Oil pressure is raised by removing the cap and turning in (clockwise) the screw to increase spring force against the poppet valve.
2. If pressure cannot be increased, remove the adjusting screw, the spring and the valve. Check the seating surfaces of the valve and seat for damage. Repair or replace, if necessary.
3. If the problem still persists, check all oil line fittings for tightness and/or cracks. Check all lubricated points for excess oil loss due to wear and check packing gland on oil pump shaft for tightness. Replace oil pump only as a last resort.

## **Low Oil-Pressure Safety Cut-Out Switch Adjustment**

(See Drawing C-17660.)

This switch is connected to the lubrication system and is electrically connected to the main motor starter. Its function is to shut the machine down, if the oil pressure drops below the set point. Note, when starting the machine, it is necessary to hold the pull/start switch until the pressure rises above the set point.

To check the set point (with the machine running) lower the oil pressure adjustment, as above. If the switch is wired correctly and set properly, the machine will shut down to approximately 10 psig oil pressure.

To adjust for proper operation:

1. Adjustment is made by first loosening the external Allen set screw. Then, rotate the slotted adjusting screw to increase or decrease setting, as required. Note: After final adjustment is reached, tighten Allen set screw. Some switches may have an internal knurled nut in lieu of adjusting screw, and adjustment is made by turning the knurled nut up or down.

2. The set point at which the low oil-pressure switch will stop the machine should be checked **at least once every six months**. Using a continuity tester connected to the normally open and common terminals of the switch, jog the machine so that the oil pressure goes above 10 psig. Watch the oil pressure gauge and continuity tester as the pressure drops. The switch contact should open when the oil pressure drops to 10 psig (+ 2 -0 psig). If this does not occur, adjust switch, per the previous instructions.

### **Cooling Water and Oil Temperature**

Adjust the water flow to the oil cooler, so that the drain water flowing from the cooler is warm but not hot to the touch.

The lube oil temperature can safely run as high as 155°F (68°C.). If any question arises, measure the actual sump oil temperature. Unless the room temperature is very high, normal oil temperature will be under 140°F. (60°C.).

1. If the oil temperature is abnormally high, the heat could be coming from the motor or from friction in the power-end. If the motor compartment temperature is below oil temperature, the problem can be assumed to be in the components of the power-end.
2. High oil temperature can be caused by high oil pressure, too tight or too rough bearing surfaces or incorrect oil.
3. See Section II for oil information and the following pages for parts information.

### **Motor Lubrication**

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

### **Motor Warranty**

If provided with the machine, the motor has been selected to meet load requirements and is covered by a warranty issued by the motor manufacturer. Should difficulty arise, contact the local representative of the motor manufacturer, our representative or the Factory. **If any modification or repair not authorized by the motor manufacturer is undertaken, the warranty is automatically waived.**

NEMA motor specifications do not include a temperature rise factor. The motor manufacturer's limitation on temperature rise is dependent on air temperature surrounding the motor during operation. This should not exceed 105°F. (40°C.), unless special motors are supplied.

### **Connecting Rod and Crosshead Assemblies**

(Figures 41 and 47.)

On all models the connecting rod sub-assembly consists of the two halves of the connecting rod (72 and 76), a set of two steel-backed, babbitted bearing halves (74), two bolts with lock nuts (73 and 77), a crosshead bearing retainer nut (81), bearing retainer (82) and ball (83). The crosshead sub-assembly includes only the crosshead (86) and set screws (85 and 87). The crosshead bearing (4) must be ordered as a separate part.

1. The connecting rod bearing halves must be used as a set, but they can be interchanged in the same connecting rod. They are automatically located by the dowels (75).

**CAUTION: Make sure dowels are bottomed in holes in connecting rod. Oil film clearance should be approximately .001" per one inch of diameter when bolts are pulled up tight. There are no shim spacers so, if wear develops to the point where a bearing slap occurs, bearing liners must be replaced.**

2. After connecting rod bolt locknuts are removed and replaced a number of times, the locknuts may begin to slip and loosen up. When annual or semi-inspection reveals this, replace them promptly with new ones.
3. On model MS(P)-18 machines the torque requirement for tightening the crosshead bearing ball into the connecting rod is 60 ft. lbs. (Loosen both set screws before tightening.)  
On model MS(P)-45 machines the torque requirement is 90 ft. lbs. (Loosen both set screws before tightening.)
4. The crosshead ball and socket adjustment should be properly maintained, since wear increases rapidly as clearance increases. Adjust as follows:
  - a. Remove the oil lines and crosshead cover (64).
  - b. Turn the crosshead by means of the crosshead extension (88), until the crosshead set screw (85) is exposed.
  - c. Loosen and remove the set screw.
  - d. Hold the bearing retainer nut (81) with a crosshead bearing tool (H), while slowly turning the crosshead extension (88) with its wrench (F), until a slight drag is noticed on the crosshead extension.
  - e. Lock the set screw at that point.
  - f. Repeat on the others and replace the crosshead cover and oil lines.

### **Crosshead Extension and Baffle Seal Packing**

(See Figure 47.)

Because the very critical plunger alignment starts at the crosshead, it is important that the shoulders of the crosshead extension remain square and undamaged by mishandling.

1. Tighten the two crosshead extension set screws (87) to pull the crosshead extension (88) back against the square end of the crosshead (86).
2. The shoulder of the plunger, tightened against the shoulder on the threaded end of the crosshead extension, maintains and extends the alignment to the plunger.
3. Damage to the threads in the stainless-steel crosshead extension generally should only be repaired by grinding or cutting away the damaged thread.
4. Baffle packing consists of one Teflon washer (90A), two pieces of square-braided packing (90) and one more Teflon washer, in that order. With the crosshead extension in place, install the parts in the baffle gland, being careful that they go completely into place. Using wrench (G) and light hand pressure, tighten the adjusting nut (89) securely **while the machine is running**. When removing old packing, be careful not to damage the packing box or crosshead extension with the packing removal tool (Q).

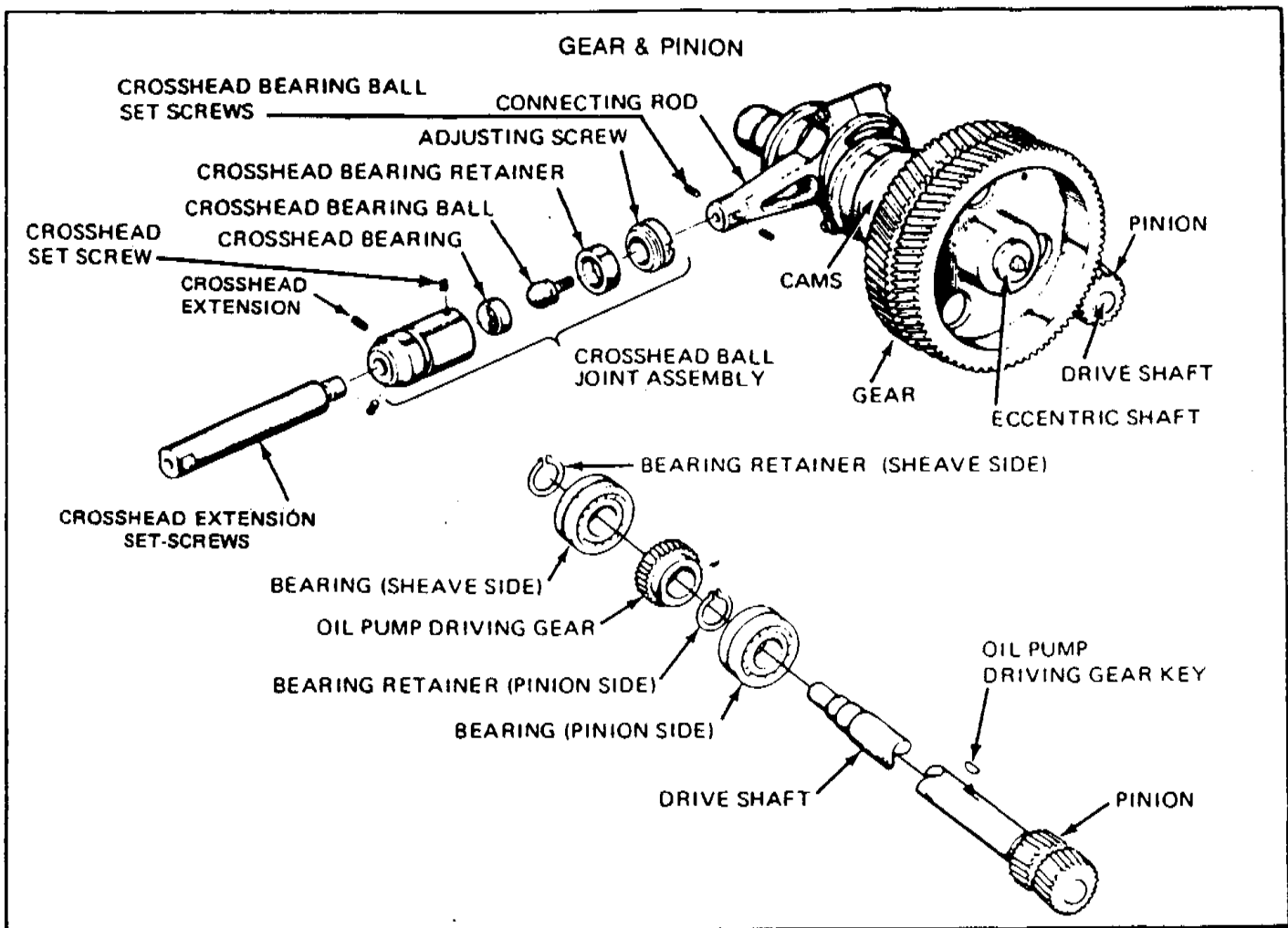


FIGURE 41

## Gear and Pinion

(See Figures 41 through 47.)

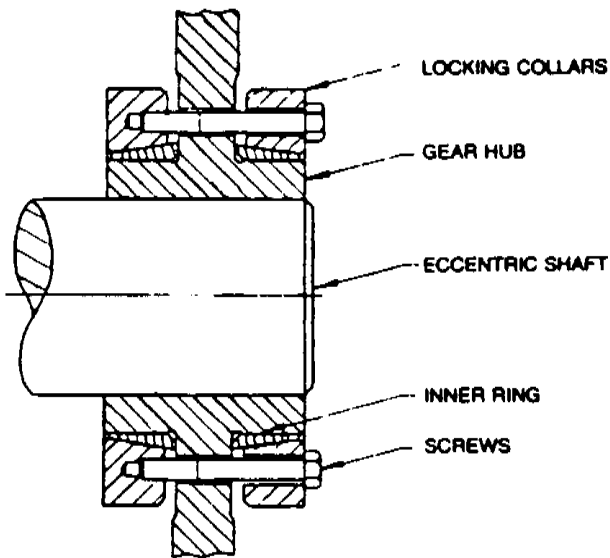
1. Normal rotation of the large gear is counter-clockwise when observed from the gear side (right side) of the machine.
2. If it becomes necessary, because of wear or excessive gear noise, rotation can be reversed so that the new, unworn side of the gear teeth will carry the load. To reverse rotation exchange any two of the main motor leads (in a three-phase circuit), thus, changing motor direction. Do not change the rotation of the oil pump motor, if inter-connected to main motor.
3. Gear wear will occur over a long period of usage. It is usually indicated by the development of small pit marks on the working side of the gear teeth. Obviously, this wear will be greatly accelerated by using the wrong oil, failure to drain condensate and water from the oil or by over-loading the machine.
4. Over-loading will occur, if maximum operating pressure is exceeded, if product contains entrained air or if the machine is partially starved through lack of sufficient infeed pressure. A "knock" in the machine usually indicates the presence of air or insufficient infeed pressure. Severe problems can still be caused by these factors when the knocking sound is only faintly audible.

5. Gear noises will develop with gear wear. It will appear as a "growl" or "rumbling" sound and will be synchronous with each revolution of the large gear (one full stroke of one plunger). It usually becomes louder when pressure is applied to the machine. Check clearance between gear and pinion by measuring driveshaft end-play. The minimum should be 1/32".
6. The pinion gear is heat-shrunk on the driveshaft and is not removable. Because it is never good practice to replace only one half of a pair of gears which have run together for any length of time, the gear, pinion and driveshaft should be replaced, if any single part requires replacement.

### Gear Shrink-Disc Connection

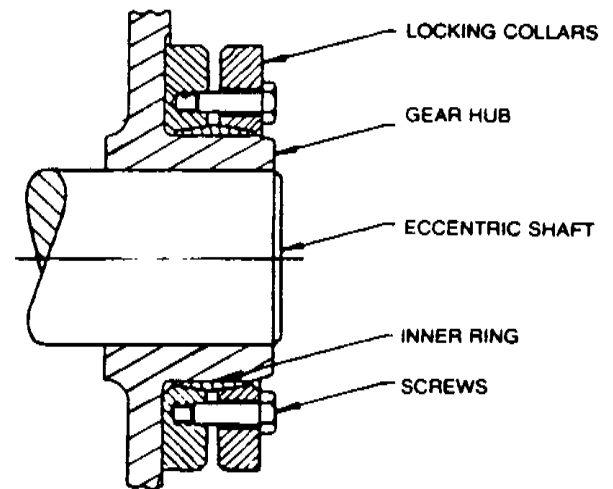
The gear is equipped with a shrink-disc connection which exerts an external clamping force on the gear hub, when installed, to establish a mechanical shrink-fit between the eccentric shaft and gear.

For the model MS(P)-18 the shrink disc consists of two locking collars, two tapered inner rings and locking screws (see Figure 42). For the model MS(P)-45 the shrink disc consists of two locking collars, as well as a solid, double-tapered inner ring and locking screw (see Figure 43). A key is not required between the eccentric shaft and the gear when using a shrink-disc connection.



SHRINK DISC  
MODEL MS(P)-18

Figure 42



SHRINK DISC  
MODEL MS(P)-45

Figure 43

## **Driveshaft**

(See Figures 41 through 47.)

The driveshaft assembly consists of the shaft with a pinion gear heat-shrunk in place, two self-aligning roller bearings (these are not the same size), two bearing lock rings and driveshaft oil seal.

### **Gear and Driveshaft Assembly Removal**

1. Lock out the electrical power supplied to the machine.
2. Drain all oil from power-end of machine.
3. Remove the top cover, left center panel, right center panel, right rear panel, left rear panel, rear panel, splash cover guard, top bolting hardware and top cover panel supports.
4. Remove the gear case cap screws and the gear case.
5. Remove the driven sheave and driveshaft seal retainer from the driveshaft.
6. Gradually loosen the shrink-disc locking screws all the way around. Initially, each screw should be released about a quarter of a turn only; thus, tilting and jamming of collars will be avoided.
7. Pull the gear from the eccentric shaft. Any rust formed on the eccentric shaft in front of the gear hub must first be removed.
8. The driveshaft assembly will slide out with the gear as the gear is pulled off the eccentric shaft.

### **Gear and Driveshaft Assembly Installation**

1. The assembly can only be removed and replaced from the gear side.
2. The pinion end-bearing is slightly larger on the O.D. than the bearing for the opposite end. The outer races have only a slight interference fit in the bearing housings, so the shaft can float to be self-aligning. The mesh of the herringbone gear and pinion will move it into alignment.
3. New bearings are installed on the driveshaft by heating them in oil to 250°F.
4. Slide the pinion end-bearing into place on shaft against the shoulder and install lock ring.
5. Slide the opposite end-bearing into place and install the lock ring.
6. Slide the complete driveshaft assembly into the base from the gear side of the machine until the sheave side bearing enters the sheave side bearing housing. At this point the gear side bearing has not entered the gear side bearing housing.
7. Degrease (solvent-clean) the eccentric shaft gear bore and the outside diameter of the eccentric shaft where it will seat.
8. Slide the gear over the eccentric shaft, while lifting the driveshaft to mesh the pinion with the gear.
9. Continue sliding the gear and driveshaft until the driveshaft bearing enters the bearing housing and until the gear seats against the eccentric shaft shoulder. Since the driveshaft bearings are self-aligned, they may cock in the bearing housing. Carefully tap the outer race to align them with the bearing housing and prevent jamming.
10. Tighten all locking screws on the shrink disc gradually and all the way around (not in diametrically opposed sequence). (See Figure 44.)

Be sure that the locking collars stay parallel when tightening. Several passes are required until all screws are torqued to 42 ft. lbs. Check tightening torque with a torque wrench.



11. Assemble the driveshaft seal retainer and driven sheave.
12. Assemble the gear case and gear case cap screws
13. Reassemble the top cover panel supports, top cover bolting, splash-guard cover, all panels and top cover.
14. Fill the power-end with proper oil.
15. Resume electrical power to the machine and commence operation.

### **Shrink Disc Disassembly and Reassembly**

(See Figures 42 and 43.)

If replacement of the gear is required, the shrink-disc assembly must be removed from the old gear and installed on the new gear.

1. Removal of the Old Gear
  - a. Remove all locking screws.
  - b. Remove the locking collars. In the case of the MS(P)-45 gear, the inner locking collar should be pushed off (toward the gear) the taper of the inner ring before the next step.
  - c. The inner rings are split at one point. If not readily removable by hand, they may be expanded slightly for prying open the split.
2. Installation of New Gear
  - a. Refer to Figure 45 for lubrication points. Do not lubricate the gear bore or eccentric shaft outside diameter.
  - b. Check, clean and relubricate the following parts, as necessary:
    1. locking collar inside diameter holes
    2. locking collar threaded holes
    3. screw threads
    4. inner ring outside and inside diameter surfaces
    5. gear hub outside diameter only.

For the tapered surfaces one of the following lubricants should be used:

LUBRICANT (MoS <sub>2</sub> )	TYPE
Molykote 321R (lube coat)	Spray
Molykote Spray (powder spray)	Spray
Molykote G Rapid, Aemasol MO 19P	Spray or Paste
DIO-setral 75N (lube coat)	Spray or Paste

Locking screws should be lubricated with a multi-purpose grease; e.g., Molykote or similar.

- c. Assemble, as shown in Figure 42 or 43, as appropriate, with screws only finger-tight.
- d. Reassemble with eccentric shaft, as previously described.

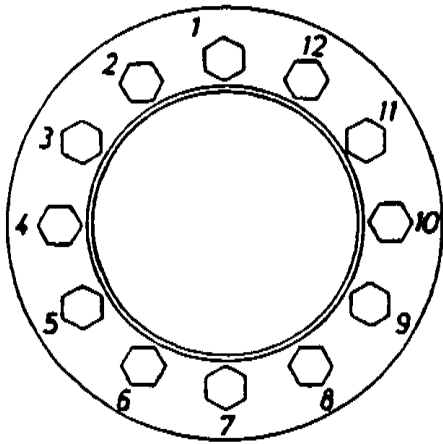


FIGURE 44

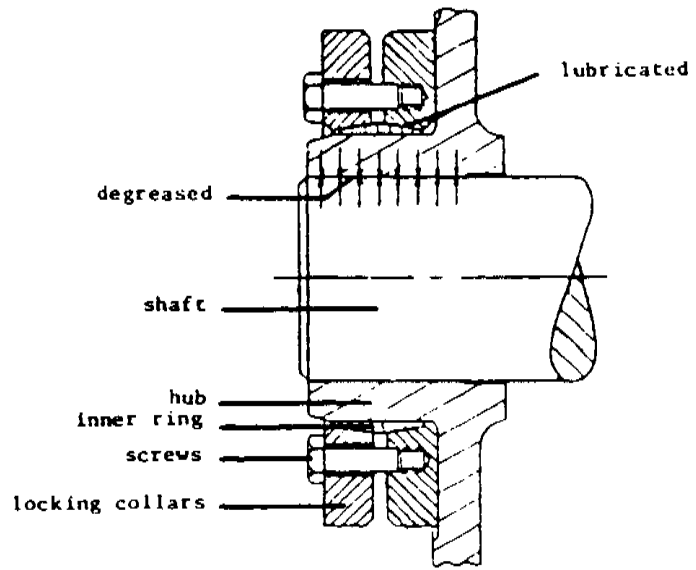


FIGURE 45

### Eccentric Shaft and Bearings

(See Figure 47.)

The eccentric shaft is made of a high strength alloy steel center shaft on which are installed ductile iron cams. The cams are located by means of keyways and dowels and are installed using a high temperature shrink-fit procedure. The driving load is taken by the interference fit not the dowels.

Because of this construction, successful removal and replacement of cams is not feasible from a practical or economic standpoint.

1. The shaft runs in two babbitt-lined, full bronze, sleeve bearings. The bearings are located in place by means of dowels in the bottom of the bearing housings. A fiber thrust-washer is mounted on each end of the shaft between the outside cam and the eccentric shaft bearings, making total end-play of the shaft between 1/32" and 1/16".
2. Oil is pumped through the center of the shaft out to each cam, so that the connecting rod bearings ride on a cushion of oil under pressure. There are plugs in both ends of the shaft.
3. If bearing replacement is required, note that the fit of the bearings in their housings requires a slight squeeze when bearing caps are pulled down tight. This requires careful checking of oil-film clearance which should be .001" per inch of diameter, minimum.
4. In the event of damage to the surfaces on the cams or end-journals, do not turn them undersize in a lathe. This would require specially sized bearings which are not available.
  - a. If the surfaces are only slightly grooved, the roughness can be removed using strips of emery cloth. Do not use emery cloth on the babbitt surface of the bearings.

- b. Even though the cams or end-journals still show light grooving, they can be safely used, because the grooves merely trap oil, just as does an oil groove in a sleeve bearing. The important thing to remember is that elevated ridges of metal thrown up when the groove developed must be removed with emery cloth or by careful draw filing.
- c. If the surfaces are severely damaged or undersized, the best method of repair is to have them metallized and remachined to original size.

#### **HVA and Lube Oil Pump or Motor Replacement**

It is very important that, when either the HVA pump, the lube oil pump or the motors that drive them are replaced, 1/16" should be added to the normal clearance between the two halves of the shaft coupling. This will prevent any end-thrust on the pump shaft, which is critical to its operation.

## PARTS LIST FOR FIGURES 46 and 47

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
1	Top Plate Screws	Varies	49	Seal Retainer Gasket	1
2	Top Plate Sealing Washer	Varies	55	Gear Case Gasket	1
3	Top Plate Gasket		56	Gear Case	1
6	Gear Case Cap Screw	Varies	57	Cylinder Stud	4
7	Top Plate Assembly	1	61	Pinion	1
8	Bearing Lock Ring (Pinion Side)	1	62	Crosshead Cover Cap Screw	
9	Drive Shaft Bearing (Pinion Side)	1	63	Crosshead Cover Cap Screw	4
11	Drive Shaft	1	64	Crosshead Cover	1
12	Pinion Key	1	65	Crosshead Cover Dowels	2
14	Base	1	66	Gear	1
15	Cylinder Dowel	2	67	Eccentric Shaft Thrust Washer	2
16	Cylinder Gasket	1	68	Eccentric Shaft Plug	2
17	Base Mounting Cap Screw	4	70	Eccentric Shaft Assembly	1
18	Base Mounting Lockwasher	4	71	Connecting Rod Dowel	6
19	Sub-Base	1	72	Connecting Rod Cap	3
20	Motor Rail Shaft Set Screw	2	73	Connecting Rod Bolt	6
21	Motor Rail Collar	2	74	Connecting Rod Bearing	6
22	Motor Rail	2	75	Connecting Rod Bearing Dowel	6
23	Motor Rail Shaft	1	76	Connecting Rod	3
24	Motor Rail Adjusting Screw	4	77	Connecting Rod Nut	6
25	Motor Rail Shaft Support		78	Eccentric Bearing Cap	2
26	Motor Rail Support Lockwasher	4	79	Eccentric Shaft Bearing	2
27	Motor Rail Shaft Support Cap Screw	4	80	Crosshead Bearing Ball Set Screw	6
28	Driven Sheave Assembly (includes 29, 30, 31)		81	Crosshead Bearing Retainer Nut	3
29	Drive Sheave Lockwasher	3	82	Crosshead Bearing Retainer	3
30	Driven Sheave Cap Screw	3	83	Crosshead Bearing Ball	3
31	Driven Sheave Bushing	1	84	Crosshead Bearing	3
32	Driven Sheave Key	1	85	Crosshead Set Screw	3
33	Driving Sheave Assembly (Includes 34,35,36)		86	Crosshead	3
34	Driving Sheave Lockwasher	3	87	Crosshead Extension Set Screws	6
35	Driving Sheave Cap Screw	3	88	Crosshead Extension	3
36	Driving Sheave Bushing	1	89	Packing Adjusting Screw	3
37	V-Belt		90	Baffle Seal Packing	6
38	Motor Rail Shaft Set Screw	2	90A	Baffle Wiper Ring	6
39	Motor Mounting Screw Lockwasher	4	91	Baffle Stuffing Box	3
40	Motor Mounting Screw	4	92	Eccentric Shaft Bearing Dowel	2
41	Driving Sheave Key	1	93	Eccentric Shaft Cover Plate Gasket	1
42	Motor	1	94	Eccentric Shaft Cover Plate	1
43	Drive Shaft Bearing (Drive Side)	1	95	Eccentric Shaft Cover Plate Cap Screw	6
44	Bearing Lock Ring (Drive Side)	1	96	Bearing Cap Screw	8
45	Base Foot	4-6	122	Well Cover	1
46	Drive Shaft Seal	1	127	Name Plate—Serial Number	1
47	Seal Retainer Screw	6	129	Fan Mounting Spacer	1
48	Seal Retainer	1	130	Fan	1
			131	Fan Mounting Bolt Lockwasher	1
			132	Fan Mounting Bolt	1

FIGURE 46  
TYPICAL BASE, DRIVE COMPONENTS

NOTE  
ON MS18 MODELS.  
THE SHAFT BEARING  
HOUSING MUST BE  
ASSEMBLED WITH  
THE 1/8" INDICATOR  
HOLE AT THE  
12 O'CLOCK POSITION

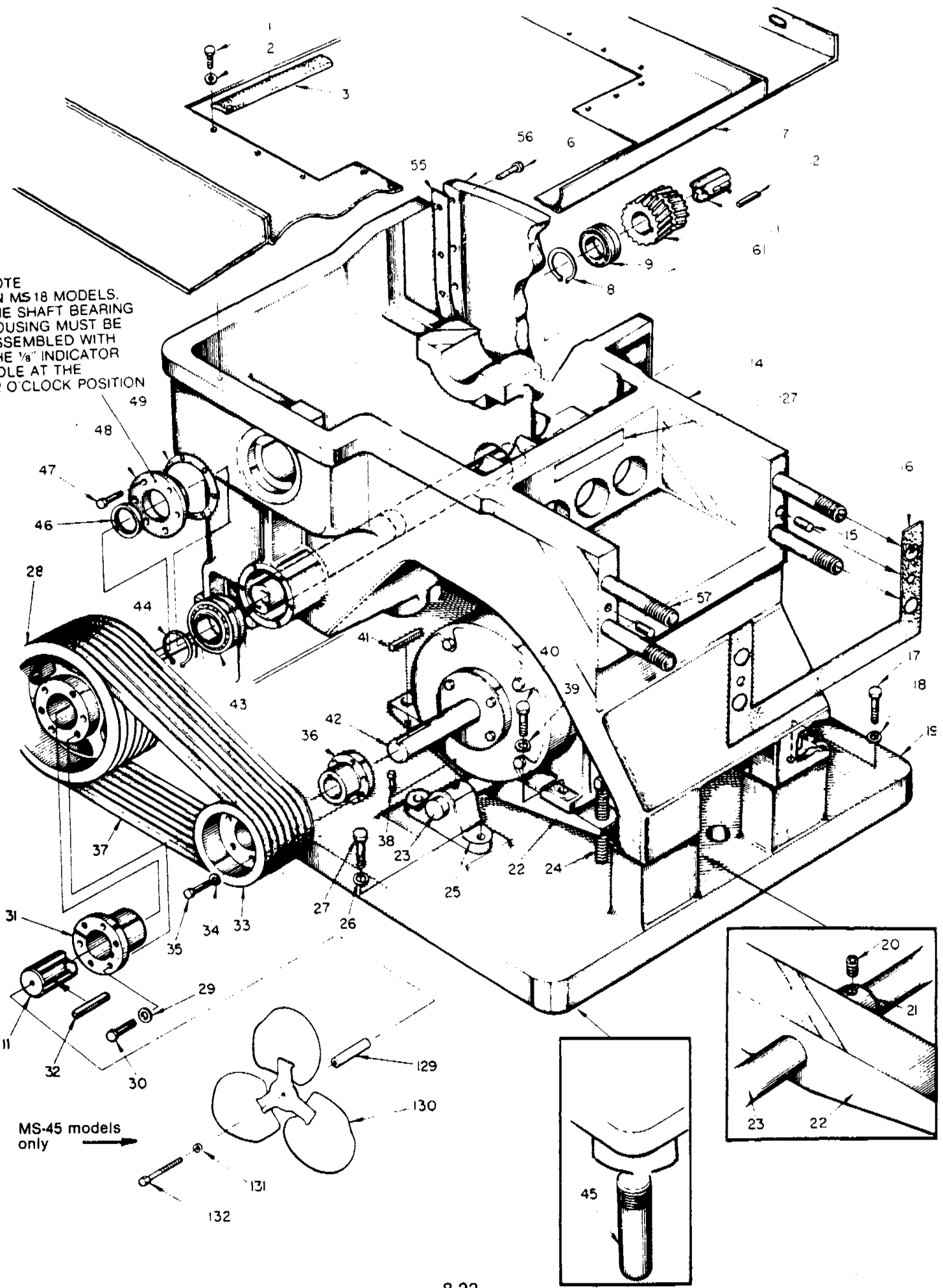
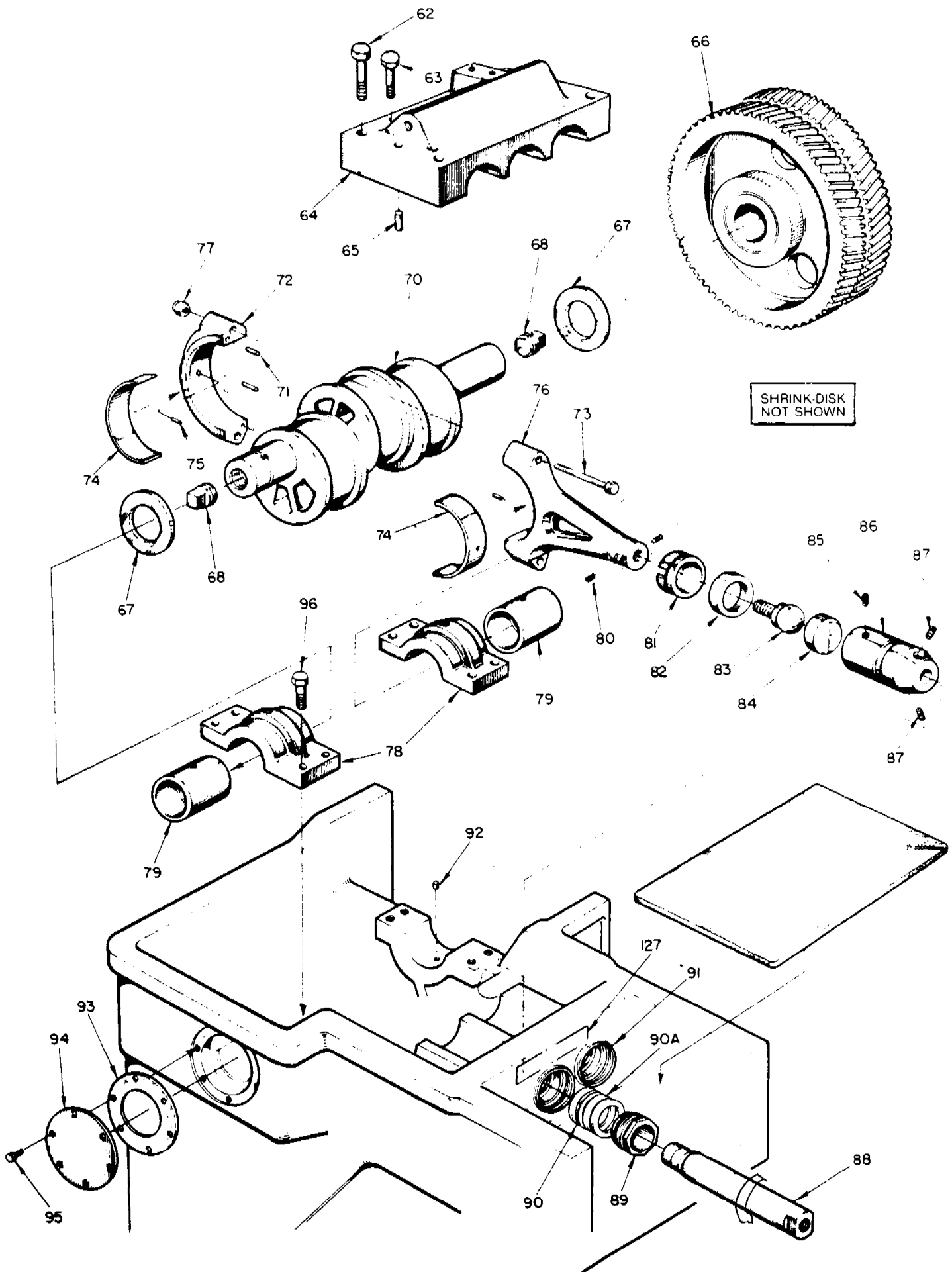


FIGURE 47  
TYPICAL BASE, DRIVE COMPONENTS



## MOTOR WIRING DIAGRAM

See Dwg. B18502, Section I, "Utility Requirements", and Section II, "Electrical".

**CAUTION:** It is suggested that a licensed electrician be employed to properly wire in accordance with local codes.

Main disconnect and branch circuit protection as required. Size and type per the National Electrical Code (NEC) and/or local electrical codes.

Wire, conduit and all other electrical materials required for connection of APV Gaulin equipment to be sized and selected based on the NEC and/or local electrical codes for the specific installation.

Disconnect all electrical power to the homogenizer or pump prior disassembly.

This drawing is a suggested electrical wiring diagram and does not apply to special installations. Contact APV Gaulin, if further assistance is required.

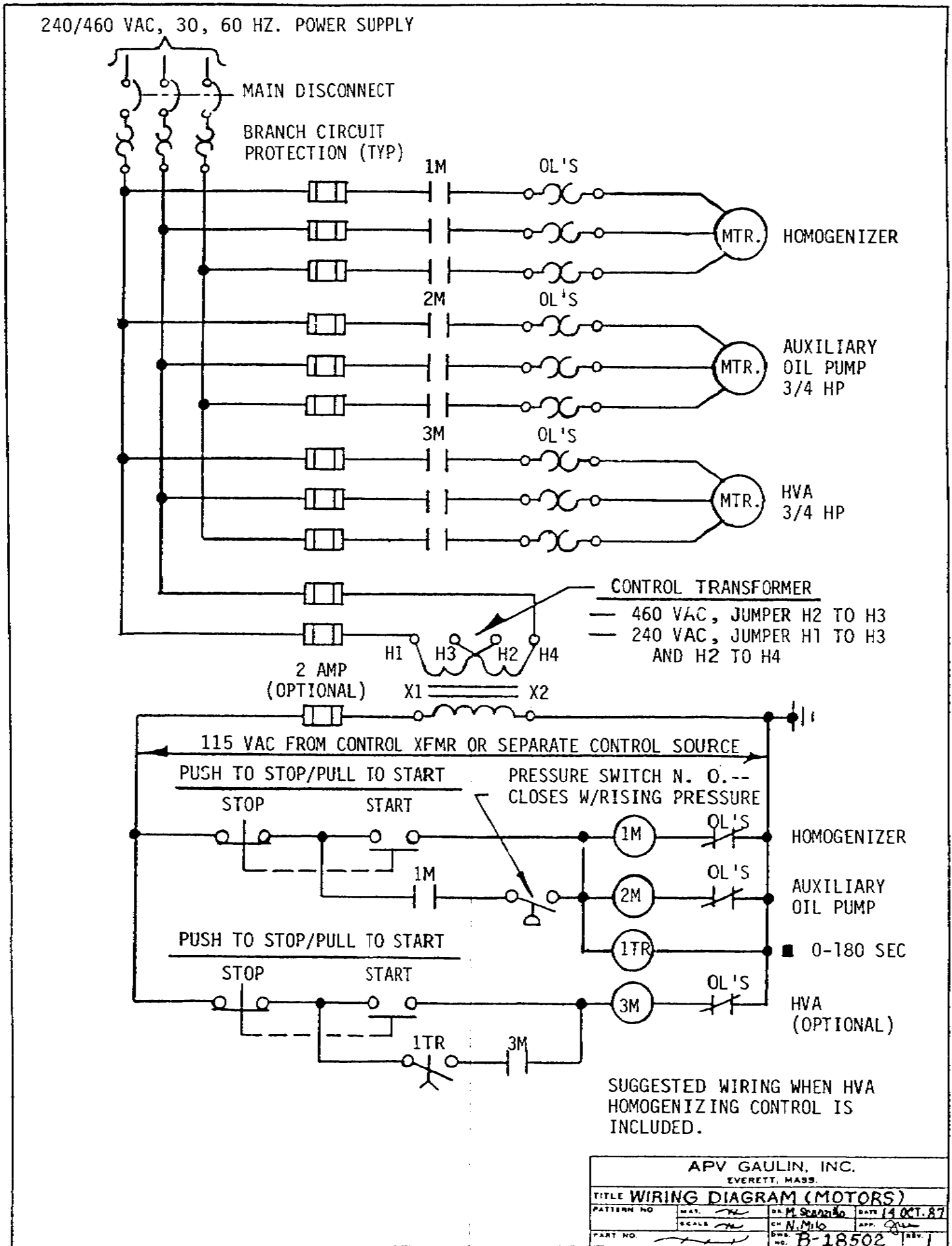
### SEQUENCE OF OPERATION

#### Homogenizer/Pump

1. Pull the "Start" homogenizer button, energizing the homogenizer/pump drive motor starter coil (1M).
2. Simultaneously, the oil pump motor starter coil (2M) energizes, engaging the oil pump motor supplying oil to the homogenizer/pump drive.
3. Delay timer (1TR) energizes, preventing the hydraulic pump from starting until the homogenizer/pump is running (included if unit is fitted with HVA).
4. Contact 1M closes. The pressure switch (wired normally-open) closes when the oil pump produces the correct oil pressure.
5. When 1M and the pressure switch are closed, the holding control circuit is established.
6. The start button is only a momentary contact. It must be held closed until both 1M and the pressure switch are closed.
7. At this point the homogenizer/pump drive motor and the oil pump are running, and oil is being supplied to the homogenizer/pump drive at a pressure that satisfies the pressure switch.
8. If the oil pressure drops below the minimum pressure required, the oil pressure switch will open, and the homogenizer/pump and the oil pump will stop.
9. Push homogenizer/pump "Stop" button to stop homogenizer/pump and oil pump.

#### Hydraulic Pump (HVA)

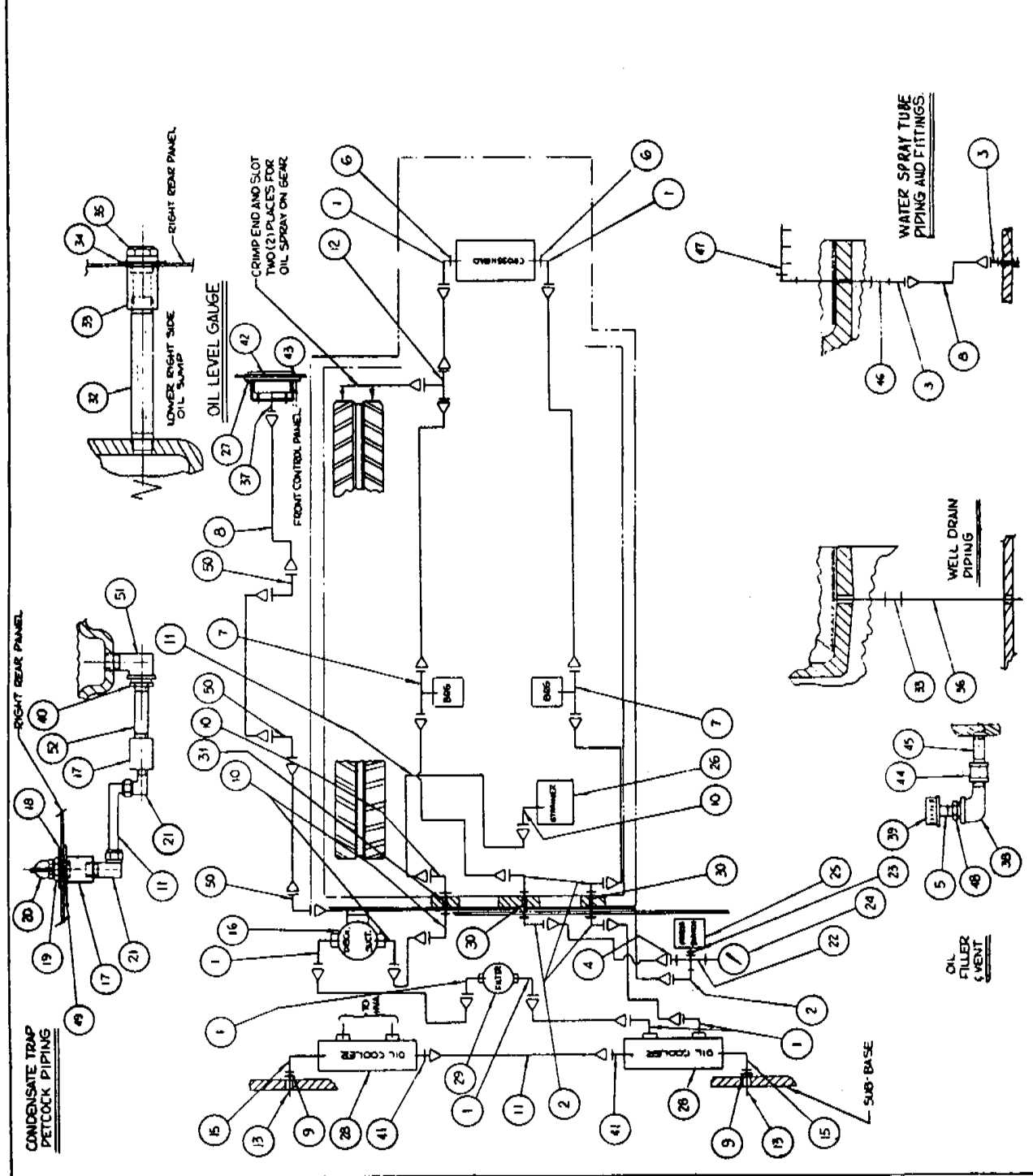
1. Pull the "START" HVA button, energizing the HVA motor starter (3M) and starting the HVA pump motor.
2. Contact 3M closes. The timer (1TR) must time out, before holding control circuit is established. Time should be long enough to allow homogenizer/pump to be operating with sufficient flow through pump section. At this point, the holding control circuit is established and HVA pump is running.
3. Push HVA "Stop" button to stop HVA pump.



NO.	QTY.	DESCRIPTION
52	1	NIPPLE (PIPE)
51	1	STREET ELBOW
50	3	UNION ELBOW
49	1	WASHER (PLAT)
48	1	REDUCING BUSHING
47	1	WATER SPRAY TUBE SUB-ASSY.
46	1	REDUCING COUPLING
45	1	NIPPLE (PIPE)
44	1	FULL COUPLING
43	1	GASKET (OIL PRESS. GAUGE)
42	1	PRESSURE GAUGE (OIL)
41	2	MALE CONNECTOR
40	1	REDUCING BUSHING
39	1	FILLER BREATHER & VENT
38	1	STREET ELBOW
37	1	FEMALE CONNECTOR
36	1	NIPPLE (PIPE)
35	1	LEVEL GAUGE
34	1	WASHER
33	2	FULL COUPLING
32	1	NIPPLE (PIPE)
31	1	BULKHEAD ADAPTER
30	2	BULKHEAD ADAPTER
29	1	FILTER
28	2	COOLER (HEAT EXCHANGER)
27	1	GASKET (SHIELD)
26	1	STRAINER
25	1	PRESSURE SWITCH
24	1	PRESSURE GAUGE
23	1	PIPE NIPPLE
22	1	PIPE CROSS
21	2	MALE ELBOW
20	1	PETCOCK (T-HANDLE)
19	1	REDUCING BUSHING
18	1	WASHER
17	2	FULL COUPLING
16	1	OIL PUMP
15	2	STREET ELBOW
14		N/A
13	2	NIPPLE (PIPE)
12	1	UNION TEE
11	3 FT.	TUBING
10	4	MALE CONNECTOR
9	2	REDUCING BUSHING
8	17 FT.	TUBING
7	2	MALE BRANCH TEE
6	2	REDUCING BUSHING
5	1	NIPPLE (PIPE)
4	1	MALE CONNECTOR
3	2	MALE CONNECTOR
2	5	MALE ELBOW
1	7	MALE ELBOW
		DESCRIPTION

NOTES: 1. SEE APPLICABLE OIL LINES BILL OF MATERIAL FOR MFG. HARDWARE NOT LISTED ABOVE.  
2. ALL TUBING FITTINGS ARE COMPRESSION TYPE.

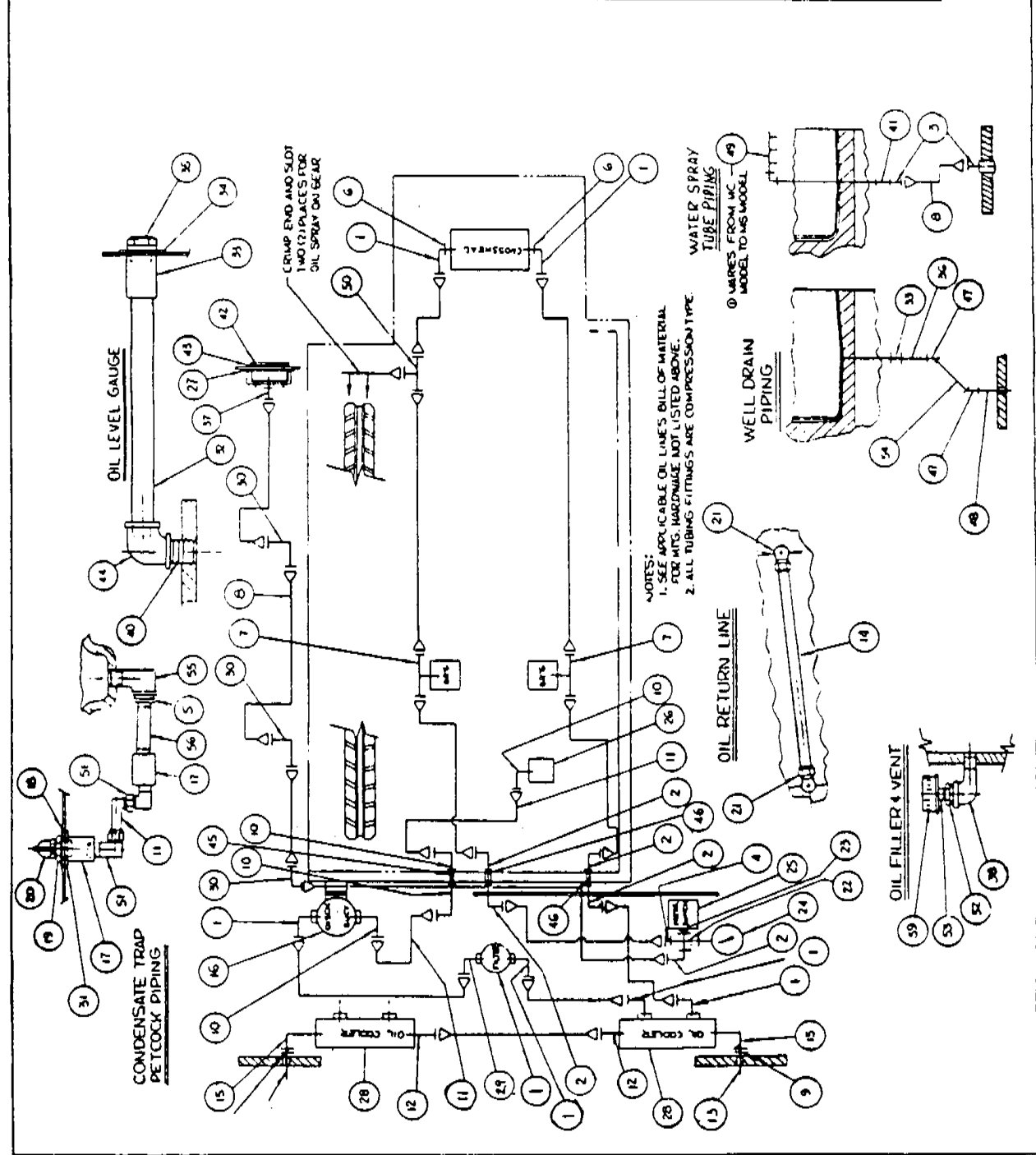
APV GAULIN, INC.  
MS-18  
DRAWING D17483





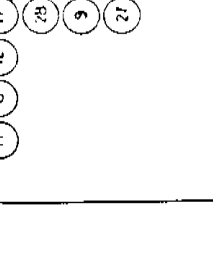
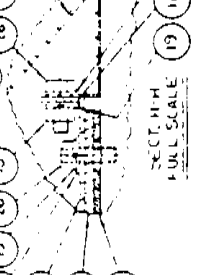
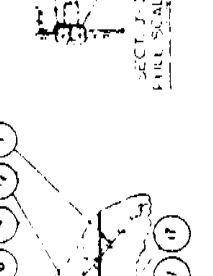
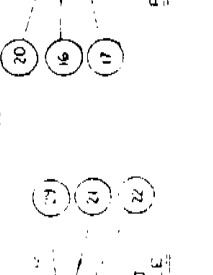
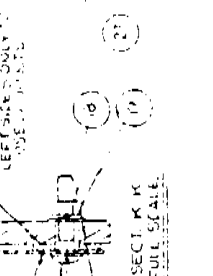
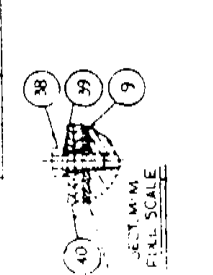
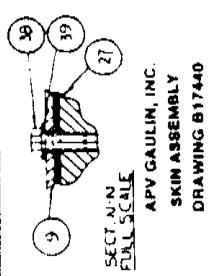
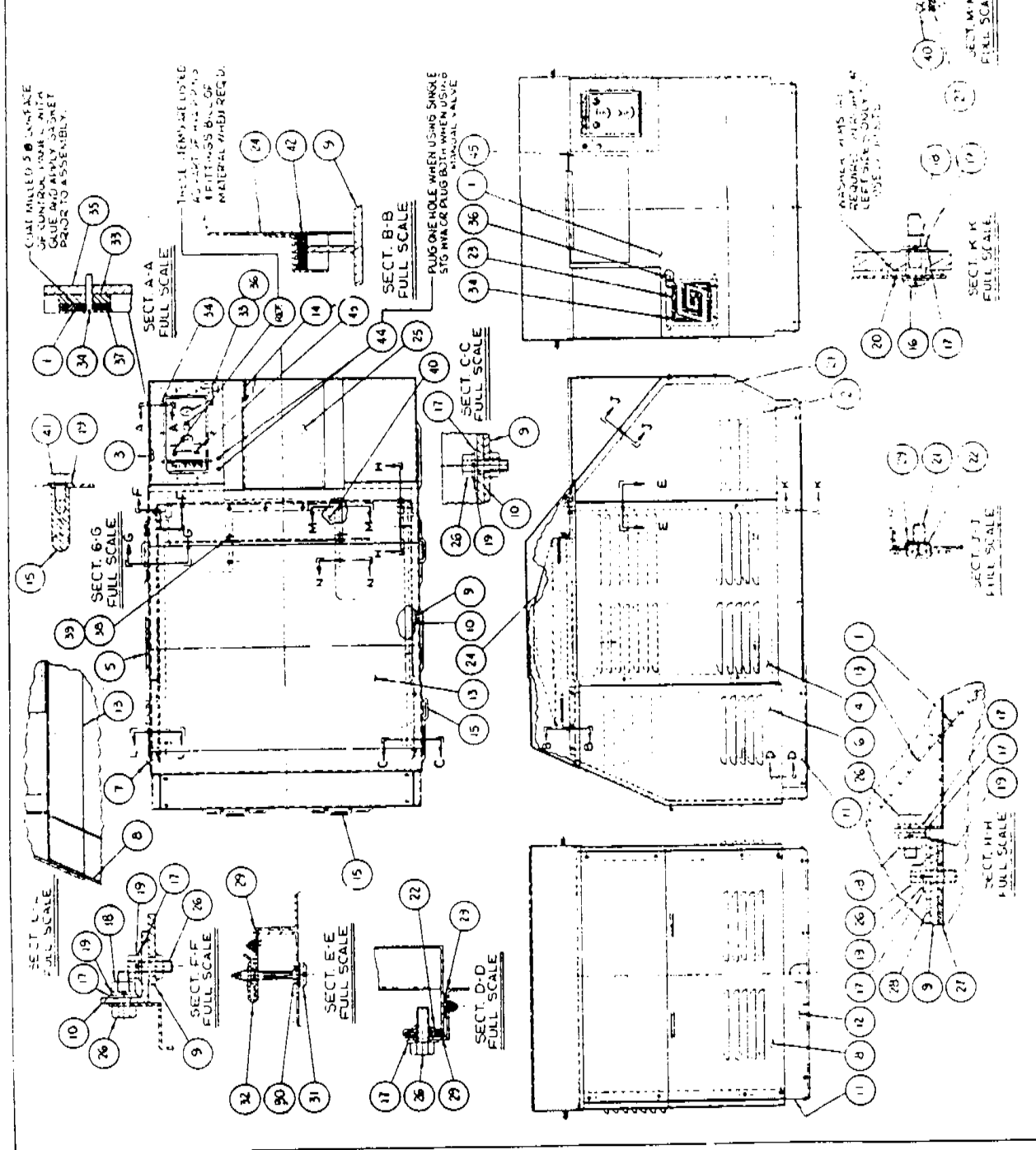
56	1	NIPPLE (PIPE)
53	1	STREET ELBOW
54	1	PIPE NIPPLE
53	1	PIPE NIPPLE
52	1	REDUCING BUSHING
51	2	MALE ELBOW
50	1	UNION TEE
49	1	WATER SPRAY TUBE SUB-ASSY.
48	2	NIPPLE (PIPE)
47	2	ELBOW (45° FEMALE PIPE)
46	2	BULKHEAD ADAPTER
45	1	BULKHEAD ADAPTER
44	1	ELBOW (90° FEMALE PIPE)
43	1	GASKET (OIL PRESS. GAUGE)
42	1	PRESSURE GAUGE (OIL)
41	1	REDUCING COUPLING
40	1	PIPE NIPPLE
39	1	FILLER BREATHER & VENT
38	1	STREET ELBOW
37	1	FEMALE CONNECTOR
36	1	NIPPLE
35	1	LEVEL GAUGE
34	1	WASHER
33	2	FULL COUPLING
32	1	NIPPLE (PIPE)
31	1	PLAT WASHER
30	3	TUBING ELBOW
29	1	FILTER
28	2	COOLER (HEAT EXCHANGER)
27	1	GASKET (SHIELD)
26	1	STRAINER
25	1	PRESSURE SWITCH
24	1	PRESSURE GAUGE
23	1	PIPE NIPPLE
22	1	PIPE CROSS
21	2	MALE ELBOW
20	1	PETCOCK (T-HANDLE)
19	1	REDUCING BUSHING
18	1	WASHER
17	2	FULL COUPLING
16	1	OIL PUMP
15	2	STREET ELBOW
14	2FT.	TUBING
13	2	NIPPLE (PIPE)
12	2	MALE CONNECTOR
11	3FT.	TUBING
10	4	MALE ELBOW
9	2	REDUCING BUSHING
8	30FT.	TUBING
7	2	MALE BRANCH TEE
6	2	REDUCING BUSHING
5	1	REDUCING BUSHING
4	1	MALE CONNECTOR
3	1	MALE CONNECTOR
2	5	MALE ELBOW
1	7	MALE ELBOW
	NO.	DESCRIPTION
	QTY.	

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OIL & WATERING PIPING & FITTINGS  
MS-45  
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NO.	QTY.	DESCRIPTION	MATL.
42	1	GASKET	NEOPRENE
41	12	BOLTS	STEEL
40	1	TOP COVER ADAPTER PLATE	STEEL
39	21	WASHER	STEEL (BAR)
38	27	BOLTS	STEEL
37	4	GASKET	NEOPRENE
36	4	ADAPTER STRIP	STEEL
35	2	ADAPTER STRIP	STEEL
34	14	SCREWS	S.S.
33	1	CONTROL PANEL	LEMAN
32	4	RECEPTACLE (PIPE CLIP ON)	S.S.
31	14	FASTENER SCREW	S.S.
30	14	FASTENER RETAINER	S.S.
29	56	MOLDED BUMPER	RUBBER
28	2	BRACKET	STEEL
27	12	GASKET	NEOPRENE
26	22	BOLTS	STEEL
25	1	WELL COVER	LEMAN
24	1	SPASH GUARD COVER	STEEL
23	1	LOGO "G"	LEMAN
22	12	FASTENER (SELF-RETAINING)	STEEL
21	4	SCREWS	S.S.
20	10	FLAT WASHER	STEEL
19	43	LOCK WASHER	STEEL
18	25	NUTS	STEEL
17	41	FLAT WASHER	STEEL
16	17	SCREWS	S.S.
15	6	HANDLES	S.S.
14	1	WELL LINER	S.S.
13	1	COVER (TOP)	S.S.
12	1	PANEL GUIDE (BOTTOM REAR)	S.S.
11	2	PANEL GUIDES (BOTTOM LEFT OR RIGHT)	S.S.
10	2	PANEL GUIDES (UPPER LEFT OR RIGHT)	STEEL
9	1	TOP COVER (PANEL SUPPORT)	STEEL
8	1	PANEL (REAR)	S.S.
7	1	PANEL (RIGHT REAR)	S.S.
6	1	PANEL (LEFT REAR)	S.S.
5	1	PANEL (RIGHT CENTER)	S.S.
4	1	PANEL (LEFT CENTER)	S.S.
3	1	PANEL (RIGHT FRONT)	S.S.
2	1	PANEL (LEFT FRONT)	S.S.
1	1	PANEL (FRONT)	S.S.

NO.	QTY.	DESCRIPTION	MATL.
43	1	SWITCH START/STOP (PULL/PUSH) (HOMO)	ALUMINUM
44	2	PLUGS (HOLE)	NYLON
45	4	GASKET (CYL. BACK) PATTERN 7 WIDE	NEOPRENE



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SKIN ASSEMBLY  
DRAWING B17440

## **SECTION IX**

### **AUXILIARY PRODUCTS AVAILABLE**

APV Gaulin produces several products which can benefit you in the operation of your homogenizer.

The APV Gaulin EQA™ . . . a reliable, easy-to-use instrument that enables you to quickly and accurately determine the emulsion quality of your homogenized milk products. The EQA will quickly tell you when your homogenization is not up to your standards during processing.

The APV Gaulin EPM™ . . . enables you to replace standard, machine-mounted pressure gauges on your homogenizer with superbly durable transducers and a remotely mounted monitor to achieve truly high accuracy and reliability in monitoring operating pressure.

The APV Gaulin Sanitary Pipeline Pulsation Dampener . . . a simple, field-proven device that effectively attacks both the high and low frequency vibrations commonly experienced in pipelines where homogenizers and transfer pumps are utilized. The sanitary dampener is rated for operation with c.i.p. procedures.

Full technical details regarding these fine products are available from your APV Gaulin regional office, your local distributor or from the APV Gaulin Factory.







Your local contact:



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For more information about our worldwide locations, approvals, certifications, and local representatives, please visit [www.apv.com](http://www.apv.com).

SPX Corporation reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing.