

Operating manual BOS homogenisers

Machine type: MC45-150P-01
Serial number: 15H3014
Year of manufacture: 2015
Customer reference: Q-Iberica
Bos reference: 201510987

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Customer: Image S.L.

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Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

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Machine type: MC45-150P-01
 Serial No.: 15H3014
 Year of manufacture: 2015

1. Machine data

Identification plate

MODEL	MC45-150P-01	CAPACITY	15000	L/H
SERIAL NUMBER	15H3014	PRESSURE	150	BAR
POWER	100 KVA	WEIGHT	4500	KG
	400 VOLT 3Ph	WATER CONS.	180	L/H

Operating data

Pump capacity 5000 L/H at 50 Hz
 Maximum operating pressure 350 BAR
 Maximum operating temperature 95 °C
 Process Two stage homogeniser
 Product Dairy products

Base

Material Cast iron
 Design MC45
 Cladding Stainless steel
 Gear reduction 1 : 5,37

Belt drive

Ratio I = 1 : 2,64
 Driving pulley D = 212 mm
 Driven pulley D = 560 mm
 Belts 8 Pieces, Part no. B002346

Cylinder block: MC45-150P

Material 1.4418
 Plunger diameter 3.1/4"
 Plunger material / quantity 316SS + Chrome / 3 pce..
 Pump valves poppet type

Connections

Product inlet NW 65 DIN11851
 Product outlet NW 40 DIN11851
 Cooling water R3/8"

Dimensions

Dimensions L X B X H 2110 X 1255 X 1650

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Electrical data

	Main Motor	Lub. Oil Motor	Hydraulic Motor	Ventilator Motor
Voltage	400 V Δ3 Ph	400 V λ3Ph	400 V λ3Ph	
Frequency	50 Hz	50 Hz	50 Hz	
Power	75 kW	0,37 kW	0,18 kW	
Rated Current	99 A	1,05 A	0,67 A	
R.P.M.	1475 RPM	1370 O/min	1310 RPM	
Type	280M			

Pressure transducers

	Pressure Transducer 1 st	Pressure Transducer 2 nd	Pressure Transducer inlet pressure	Pressure Transducer lubrication oil
Voltage				
Curent				
Range				

Homogenising valve: ---

	FIRST STAGE	SECOND STAGE
Material	Rexalloy	
Valve Design	Pilot	
Valve Size	2"	
Valve Actuating	Hydraulic	

Settings:

Lubrication oil system:

- Nominal oil pressure (oil pressure relief valve) 3 bar

Hydraulic system:

- Relief valve 55 bar

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2. APV Manual

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Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Important

- **Oil-level:** At regular intervals the oil level should be checked. (Normal level – centre sight glass). Condensate should be regularly drained off.
- **Oil-change:** First oil-change after 100 hours operation. Subsequent oil-changes after every 1000 hours operation or every 6 months – which ever is the sooner – (to control this, we recommend the installation of a running time meter)
- **Oil-filter:** to be changed at every oil change
- **Oil-pressure:** The operational oil-pressure should be at least 1,5 - 3,0 bar. (adjustable)
- **Oil-pressure-switch:** The set point is 1,0 bar. The switch should be connected so that when the oil pressure falls below the set point, the machine is disengaged.
- **Oil-temperature:** The oil temperature must not exceed 60° C.
- **Feedpressure:** To guarantee a trouble free operation of the machine, a feed pressure of at least 2,0 bar (30 PSI) should be available, (see the red/white zone of the inlet pressure gauge).
- **Operationpressure:** The maximum operational pressure of the machine is stamped on the nameplate. The danger zone is shown in red on the Product pressure gauge.
- **Pressure gauge:** These pressure gauges are heavily damped and for this reason the machine must be slowly brought up to operational pressure. (Note: Red Danger Zone)
- **Studs:** The studs on the machine which bear heavy loads, have been installed to a predetermined torque and further screwed with „Loctite“. During maintenance the correct sealing of these studs should be carefully checked.
- **Air in product:** This condition is to be totally prevented. Damage to the machine will be the result. This may be caused by running feed tanks dry, switching of feed lines, feed pump failures etc.
- **Cleaning agents:** The recommended concentrations of cleaning agents must not be exceeded.
- **Feed-filter:** The installation of a filter in the feed line is to be recommended; preferably a change-over double sieve. In any event this must be regularly checked (see also feed pressure).
- **Spare parts:** In the construction of this machine, high strength materials have been used. For this reason manufactures original spare parts must be used for our machines.
A guarantee can only be accepted if our original spare parts have been used. When ordering spare parts the serial no. of the machine must be given.
- **Service:** This high-pressure-homogenizer machine is a precision machine. The troublefree operation of which can only be guaranteed if it is correctly maintained.

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VALVE ASSEMBLIES

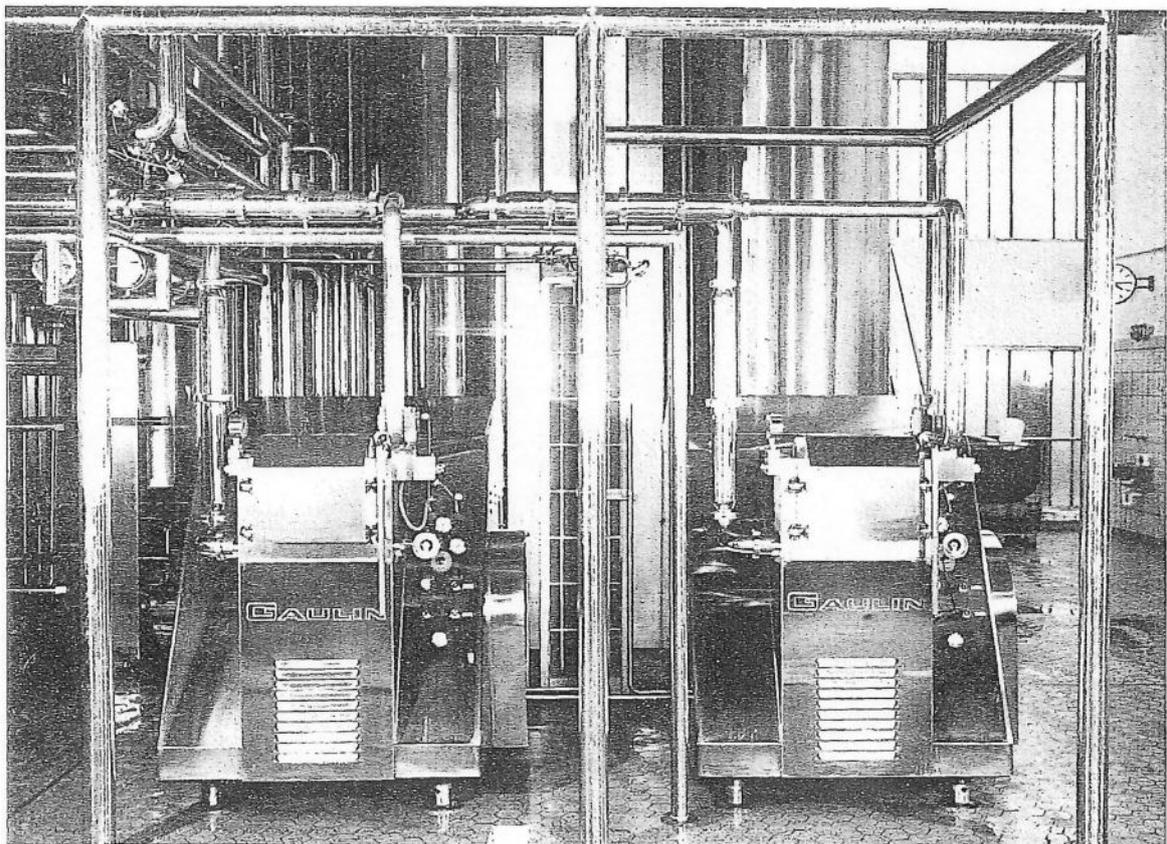
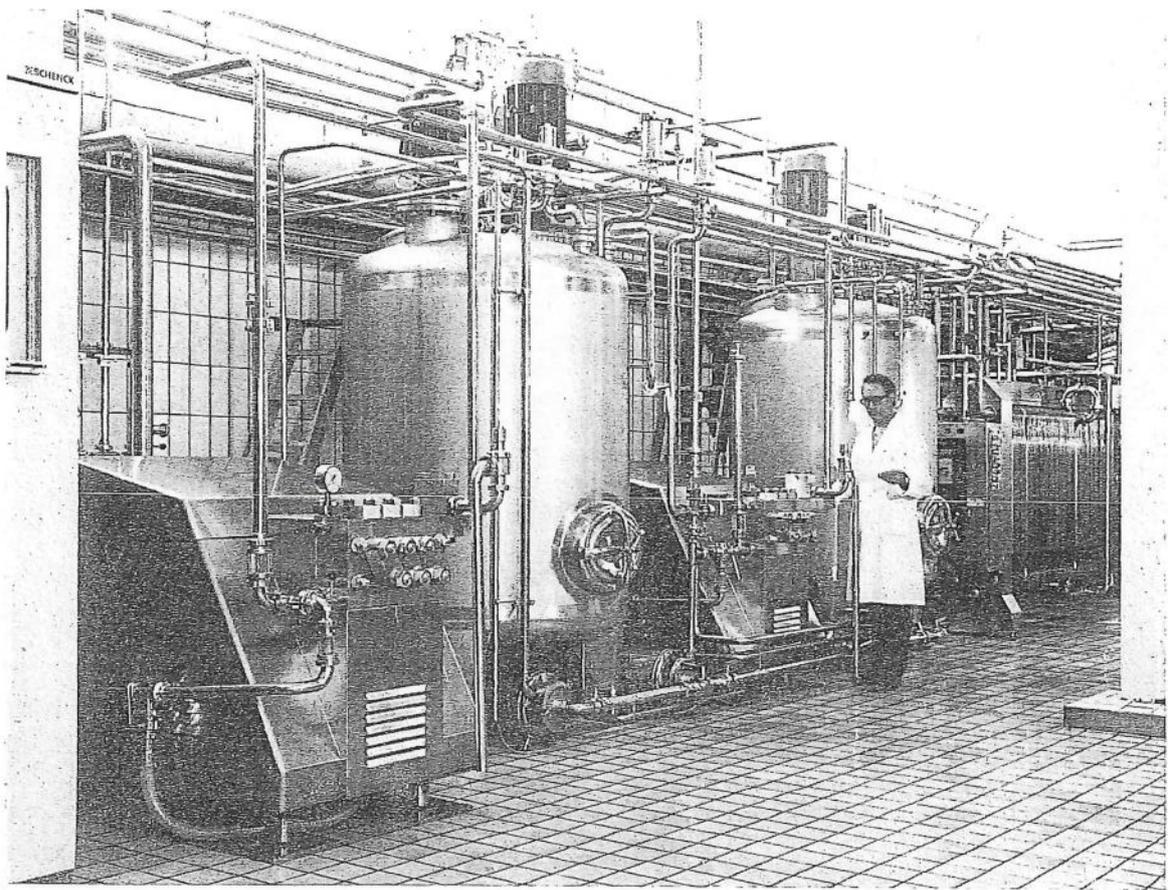
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PRIMARY INSTRUCTION DATA

Complete familiarity with your Gaulin Homogenizer 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 inadvertently suffers damage during transit or unloading procedures. Inspect the exterior of the unit carefully. If any damage is evident, file a claim with the carrier immediately and notify Gaulin.

MOVEMENT TO INSTALLATION LOCATION

The machine is mounted on skids to facilitate movement to your installation location. In order to prevent damage to the unit when moved, be sure to see that fork lifts or slings are positioned under the skids.

IF START-UP IS DELAYED MORE THAN ONE MONTH

Often, Gaulin Homogenizers are not installed and placed in operation immediately after their arrival at the job-site. The machine has been shipped in a suitable crate to prevent damage while in transit. As soon as possible after its arrival at the plant, the unit should be uncrated per instructions. After 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 to the cylinder assembly as shown on the applicable drawing. If the start up is to be delayed for more than one month, it is suggested that all cylinder metal parts and gaskets be removed and stored with spare parts and tools. When a homogenizer or relief valve is supplied, it should also be disassembled and parts stored with above. All parts should be wrapped or separated to prevent damage.

When the cylinder block is supplied of material other than stainless steel, it should be protected against rust by thoroughly coating with a corrosion proof grease.

Parts in the drive compartment have been cleaned and lightly coated with a lubricant prior to shipping as a temporary precaution against rust. On a 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 Gaulin factory agent in your area should be contacted and advised of approximate date of initial start-up so that assistance and correct reassembling instructions can be offered.

After the drive compartment has been filled with oil to the correct level, and prior to assembling the plungers and other cylinder parts, the machine should be run for approximately thirty minutes to assure proper lubrication of parts and correct adjustment of oil pressure. Instructions for these procedures are found in this manual.

SPECIAL TOOLS FOR GAULIN HOMOGENIZERS

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

HOW TO RETURN MATERIALS

Materials or equipment cannot be returned without first obtaining 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 Gaulin Corp. without damage.

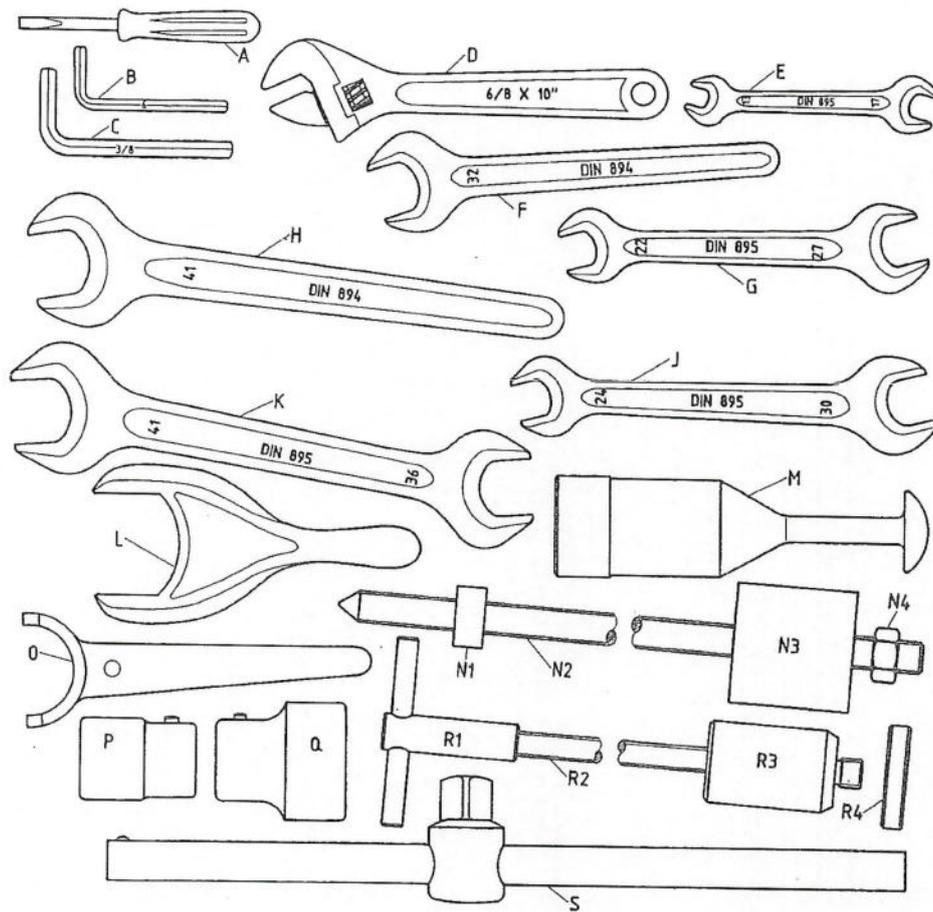
HOW TO ORDER PARTS

Help us to help you by following this procedure:

1. Identify your machine by MODEL and SERIAL NUMBER.
2. Identify parts from exploded view illustrations by CORRECT NAME only. Use item numbers where applicable.

NOTE: Your specific machine identification data is located at the front of this manual. Model and serial number will be found on the Packing List, also at the front of the manual. The serial number will be found on a nameplate at the rear of the well section.

LIST OF TOOLS



TBS-Design

TPS-Design

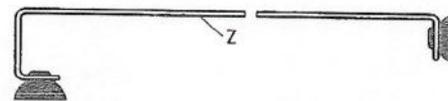
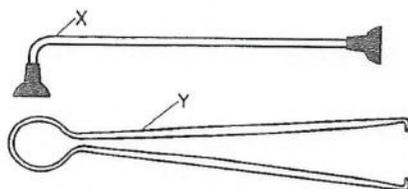


Figure 2

- A. Screw Driver for Skin
- B. Allan Key for Cross Head Screws
- C. Allan Key for TL-Bush
- D. Adjustable Wrench
- E. Wrench for Top Plate Screws
- F. Wrench for Homo Valve Nuts
- G. Wrench for Inlet Connection and Gauge Nuts
- H. Wrench for Plunger Adaptor
- J. Wrench
- K. Wrench for Plunger
- L. Baffle Screw Wrench
- M. Packing Assembly Tool
- N1. Valve Seat Removing Nut
- N2. Bar for Valve Seat Removing Tool

- N3. Spacer
- N4. Nut for Valve Seat Removing Tool
- O. Cross Head Wrench
- P. Upper Cap Nut
- Q. Front Cap Nut
- R1. Handle for Packing Removing Tool
- R2. Bar for Packing Removing Tool
- R3. Packing Removing Tool
- R4. Packing Removing Nut
- S. Handle

- W. Tool Box (not Illustrated)
- X. Valve Lifter for Ball Valve
- Y. Valve Stop Lifter
- Z. Valve Lifter for Poppet Valve

INSTALLATION

UNCRATING INSTRUCTIONS

Instructions for uncrating your machine are attached to the shipping crate. The top and sides of the crate can be removed either at the area selected for installation or at a convenient place 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 case. The Operation and Service Manual, with Packing List and Identification Sheet, will be found with spare parts in the motor compartment.

LOCATION

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

WEIGHT

The machine weight and specification information is found on Page 8 of this manual. The floor which is to support the machine should be capable of 150% of the stated weight.

FLOOR SPACE

The floor space occupied by the machine itself is also shown on the Weight and Specification sheet. Allow a minimum of 24" of space at the rear of the machine for oil changing and other maintenance. Facing the cylinder block from the front of the machine, allow extra space around the unit as indicated on the chart below:

Machine Model	Space on Left Side	Space on Right Side
MC4	30"	24"
M6	24"	40"
MC15	24"	46"
MC18/MS18	24"	46"
MC45/MS45	24"	50"
MC120	24"	61"
MC140	24"	61"

Figure 3

REMOVAL FROM SKIDS

On removing the machine from the skids, exercise extreme care to avoid damage to base or stainless steel skin. The machine must be jacked up, on the skids, to a height sufficient to permit removal of bolts going through the skid from the bottom. Before removing them, however, safe practice dictates that the base be rested firmly on wooden blocks, rather than on jacks, while the bolts are removed.

BOLTING TO FLOOR (Lug Mounted Units)

It is not necessary to bolt the machine to the floor unless an external drive is used. On units with cast lug base, before setting anchor bolts, check actual dimensions between bolt holes as a preliminary checking procedure, and make sure anchor bolts are securely mounted in floor to accurately maintain unit in desired location.

ADJUSTABLE FEET

Mount the adjustable 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 1" total adjustment.

MACHINE LEVELING

The unit should be approximately level for best operation. Use the machined surface of the cylinder block for leveling, side-to-side and front-to-back.

IMPORTANT – PLUNGER AND PACKING REMOVAL

The plunger packing was removed from the machine prior to shipment to prevent electrolysis, and was attached to the drip tube in the well area outside of the machine. In order to assure that the plunger and packing assemblies are not damaged during the procedure for testing proper motor rotation, it is *absolutely* necessary to remove the plungers from the machine at this time. Refer to appropriate Cylinder Instructions pages as identified on "This is your Machine" page.

COOLING OR LUBRICATION WATER

Bring water supply to the Water Connection Inlet, as shown on page 13. It is recommended that a valve be installed in the water line to regulate the flow of cooling water. It is also good practice to mount a solenoid shut-off valve in the water line so that the water will be automatically turned on when the main motor is started, and will be turned off when the machine is shut down. When a hand operated valve is located in the line supplying water to the plungers, it is used to adjust the flow to the plungers.

The machine will require from three to five gallons per minute, depending upon the temperature of the water, machine size and capacity. If the machine has a separate Hydraulic Valve Actuator box unit, a separate water line must be run to that assembly (See HVA Section, page 22).

WATER PIPING

MC4 Models use water for plunger lubrication and oil cooling. (See page 13 for connection location. Inlet nipple to be furnished by customer.)

The M6 Model uses water for plunger lubrication only. (See page 13.) Inlet nipple (to be furnished by customer) connects to hole where Item #48 (Water Swing Joint) is located. If the oil cooler is supplied (option on M6 only) water connection is made similar to water connection for MC Models.

Water connections for Models MC15, MC18, MS18, MC45, MS45, MC120 and MC140 are illustrated on page 13 and 14 showing a single connection for oil cooler and plunger lubrication.

DRAIN LINE

The cooling or lubricating waste water must be connected to a line leading to the floor or to a drain. Drain piping location is shown on Lubrication System drawing, pages 13 and 14.

OIL LUBRICATION

All oil was drained from the crankcase after a run-in period at plant. It is necessary to clean and flush crankcase. Fill the crankcase to visual oil gauge level with specified oil. After the machine has been operated, it will be noted that the oil level drops. This drop in level corresponds to the amount of oil required to fill the entire oil lubrication system. Add additional oil until level reaches center mark on visual oil gauge level. The oil pressure gauge should indicate a pressure between 20 and 40 p.s.i.g. The minimum safe pressure is 20 p.s.i.g. Oil pressure will decrease as oil temperature rises. There is a relief valve built into the discharge side of the oil pump, or a separate relief valve is located in the motor compartment. These can be adjusted to give required

pressure. When an external oil pump is furnished (for eccentric shaft operation below 60 rpm) the pump and relief valve are factory installed. For oil change scheduling, see page 13.

PRESSURE LUBRICATION SYSTEM

WARNING: Do not use oil other than that specified for your particular machine. The M3, M6 and M12 Models utilize sleeve bearings on the eccentric and drive shafts. The entire MC Model series uses roller bearings on the driveshaft, and sleeve bearings on the eccentric shaft. A combination oil-splash and mist-lubrication system is used on gears and anti-friction bearings. Positive pressure lubrication is used for the sleeve bearings, eccentric cams and crossheads.

Correct crankcase oil may be purchased from the Gaulin Corporation, and the initial quantity is normally furnished with the machine when purchased. The correct oil is available in 5 gallon cans or in 54 gallon drums.

There are two types of oil used; one for Gaulin machines when operating at an eccentric shaft speed *below* 150 revolutions per minute, and another for speeds *above* 150 revolutions per minute. They are identified, as follows:

(Eccentric shaft RPM is the same as the number of strokes per minute made by one plunger. Gaulin will furnish, on request, the speed of a given machine, and the specific oil recommendation for your machine.)

Eccentric speed *below* 150 RPM — 5 Gallon Cans #811100.

SPECIFICATION: A premium grade industrial lubricating oil (not automotive), paraffinic base with a defoaming agent, oxidation and corrosion inhibitors, viscosity of 1000 to 1500 SSU at 100°F viscosity of 95 - 105 SSU at 210°F, with a minimum viscosity index of 85, pour max. +10°F, carbon max. .03%, flash open cup 450°F minimum.

Eccentric speed *above* 150 RPM — 5 Gallon Cans #811800.

SPECIFICATION: A premium grade industrial lubricating oil (not automotive), paraffinic base with a defoaming agent, oxidation and corrosion inhibitors, viscosity of 396 SSU at 100°F, viscosity of 59.3 SSU at 210°F with a minimum viscosity index of 105, pour max. +15°F, carbon max. .03%, flash open cup 465°F minimum.

OIL CAPACITY CHART

FRAME SIZE	OIL CAPACITY
MC4	11,5 Liter oder 3 US-Gallonen
M6	23 Liter oder 6 US-Gallonen
MC15/MC18/MS18	14 Liter oder 3½ US-Gallonen
MC45/MS45	32 Liter oder 8½ US-Gallonen
MC120	50 Liter oder 13 US-Gallonen
MC140	80 Liter oder 21 US-Gallonen

Figure 4

The rear frame, housing the eccentric shaft, the drive shaft and the crossheads are gasketed and tightly covered. Although this cavity 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 oil under pressure, the following procedure is recommended. After machine has been shut down overnight, to permit the water to separate from the oil, open the petcock at the lower rear frame and drain the flow into a container until the flow of water stops and the flow of oil begins. Close the petcock. Discard the contents of the container. Check the oil level and add fresh oil, if needed.

OIL CHANGING

The frequency of oil change depends upon the type of service. On intermittent service, oil should be changed every 500 hours or 6 months. On continuous duty, if free of contamination and moisture, the oil may be used for 2,000 hours. Whenever oil is changed, clean oil compartment with steam, kerosene, etc. On MC models, clean the primary strainer at the bottom of the oil sump and replace filter cartridge.

LUBRICATION AND WATER PIPING DIAGRAMS

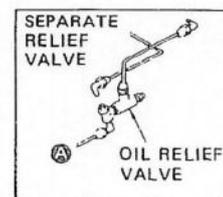
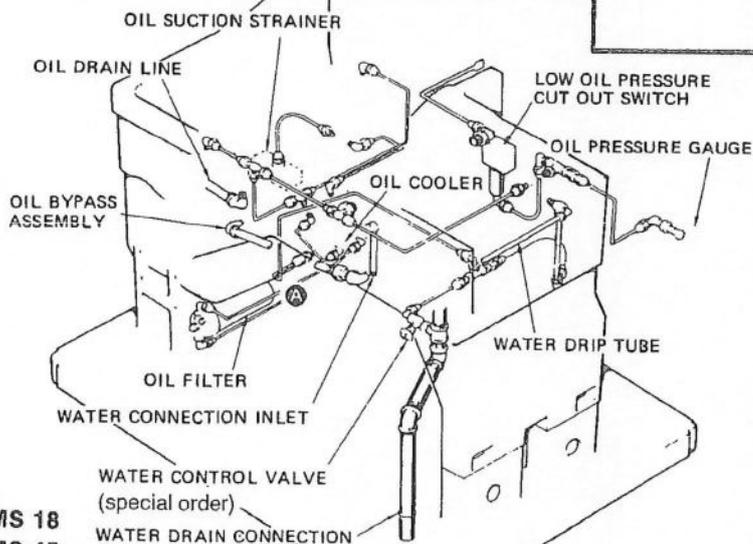
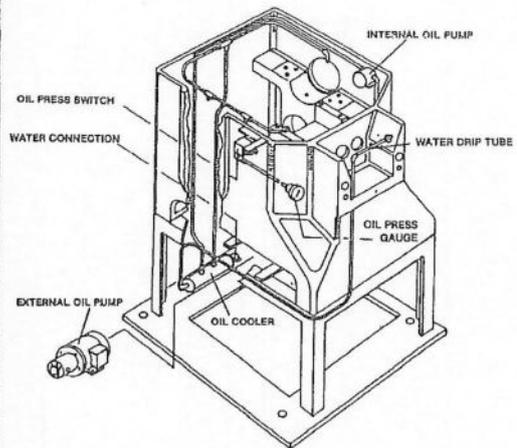
APV SCHRÖDER GMBH

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Following or equivalent lubricants are suitable for homogenizer gear lubrication:

ARAL	DEGOL TU 220
BP	ENERGOL GR-XP 220
ESSO	SPARTAN EP 220
FINA	GIRAN 220
FUCHS	RENEP COMPOUND 106
SHELL	OMALA OEL 220
TEXACO	URSA OIL P-220/MEROPA 220

MC 4



MC 15
MC 18/MS 18
MC 45/MS 45
MC 120

Figure 5

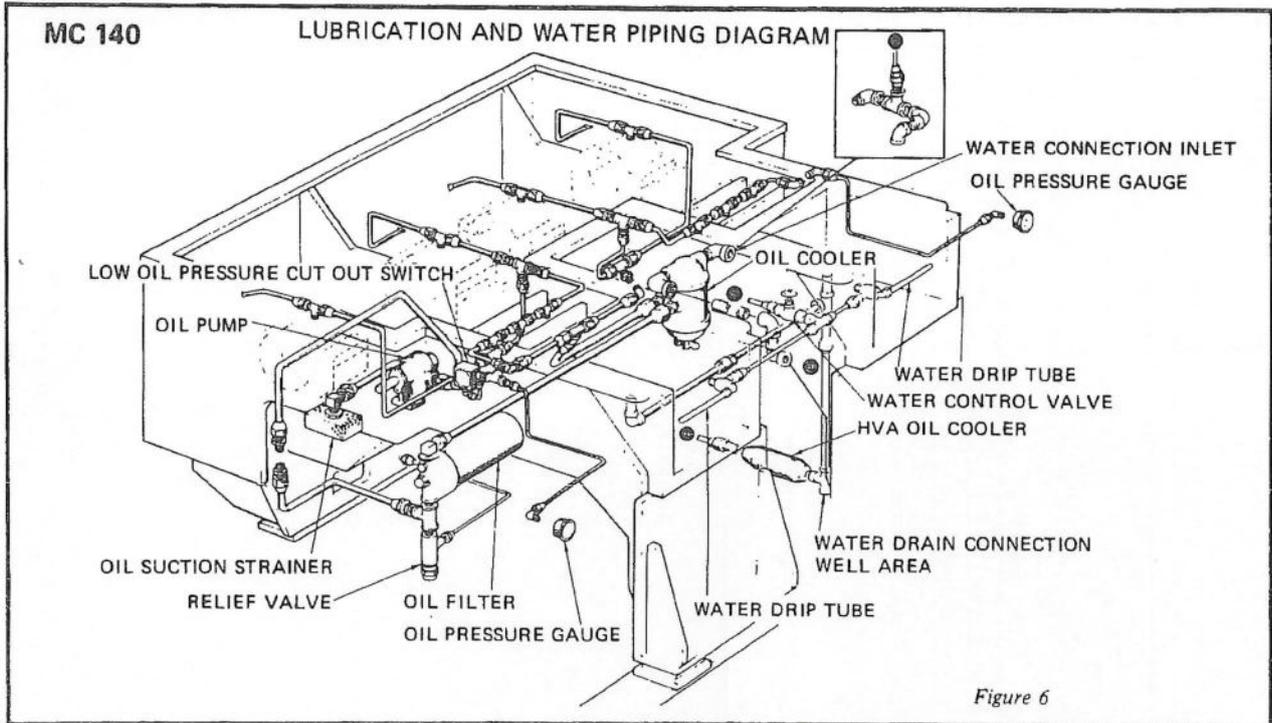


Figure 6

ELECTRICAL CONNECTIONS

WARNING Before connecting motor, be sure that the Plunger and Packing Assemblies have been removed from the cylinder block, as described on page (9).

The services of a competent industrial electrician are recommended for the installation of wiring and for making certain of correct motor rotation. Directional arrow will be found on the motor, or driveshaft for external drives.

After the wiring has been completed, remove the belt guard cover and check the sheaves and belts. These may have been loosened in transit. Adjust if necessary.

On all MC models, plastic start/stop switch covers are furnished with the machine. Upon completion of wiring install the switch covers.

MULTI-PURPOSE LOW OIL PRESSURE CUT-OUT SWITCH

This switch will prevent operation of the machine under an inadequate lubrication condition. (See figure 8, page 15 for installation instructions.)

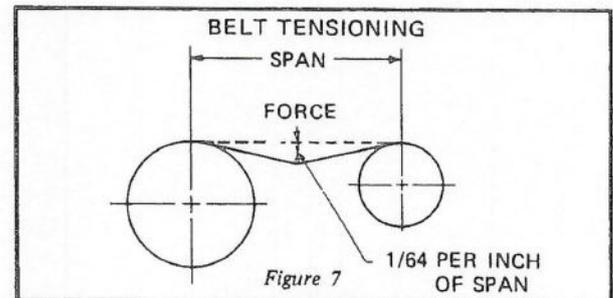
When starting the machine, the START button must be held in until the oil pressure reaches the minimum set point.

Correct operation of the low pressure cut-out switch should be checked, as follows: Loosen the oil line connection at the switch to decrease the oil flow. If the switch is wired correctly the machine will stop.

If, during operation, the oil pressure drops below the minimum safety setting, the flow of electrical current to the motor is interrupted and remains so until the deficiency is corrected. Failure of the oil pressure gauge to register may be traceable to improper gauge connections, inadequate oil supply in the reservoir, the presence in the oil of excessive moisture, or the reversing of motor connections causing the oil pump to operate in reverse.

CORRECT BELT TENSION

In order to check for correct belt tension, place a bar across the face of all belts and apply hand pressure at a central point between the sheaves. A deflection of 1/64 per inch of span is correct. (See drawing below).

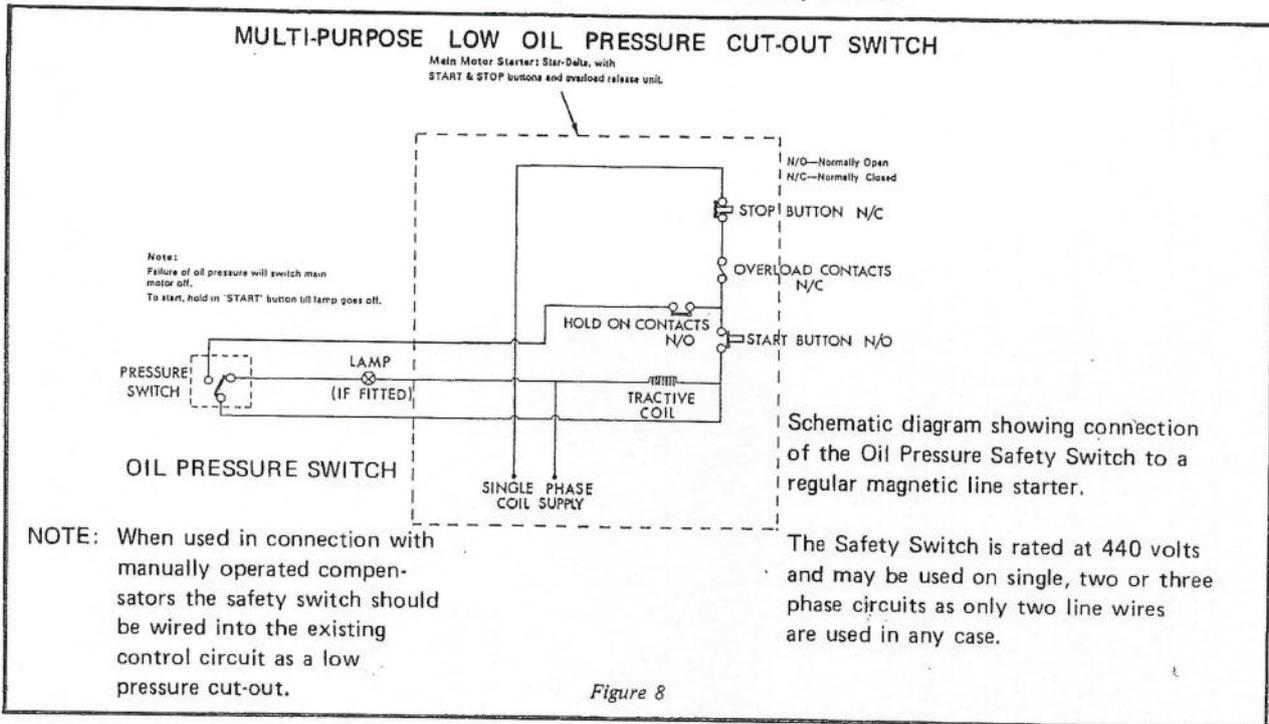


MOTOR LUBRICATION

The motor, if provided, with the machine has been selected to meet load requirements, and is covered by the warranty issued by the motor manufacturer. The motor should be lubricated in accordance with manufacturers

recommendations. Although unlikely, should difficulty arise, immediately contact the local representative of the motor manufacturer, our representative or factory. If

modification or repair, not authorized by the MOTOR MANUFACTURER, is undertaken, the warranty is automatically waived.



MOTOR TEMPERATURE

If the motor appears to run hot, attach a thermocouple or thermometer to the very top of the motor. ADD 10°F to the reading to determine the actual temperature of the motor.

NOTE: NEMA motor specifications do not include a temperature rise factor. Motor manufacturer's limitation on temperature rise is air temperature surrounding motor. This should not exceed 40°C, unless special motors are supplied.

Model MC45, MC120 and MC140 machines are equipped with a fan attached to the end of the drive shaft inside the driven sheave. In hot climates or areas of high temperature (above 40°C.), a fan might be required on the smaller Gaulin machines. Please contact the factory if this question arises.

HYDRAULIC VALVE ACTUATOR (HVA) SYSTEM

If your machine is furnished with an integral or box type HVA System, the procedures below should be followed:

1. Wire the motor. It can be wired independently of the machine, or can be tied in with the unit's starter. If it is tied in with the starting circuit, a time delay switch should be provided to permit the machine to commence pumping prior to the application of HVA pressure to the valve assembly.

2. Clean the inside of the actuator oil reservoir sump before filling with oil.

3. Fill the HVA oil reservoir with hydraulic oil. Type of oil used must be the same as specified for machines operating in excess of 150 R.P.M. (See page 12.) Fill the box unit reservoir, if supplied, to the center of the oil level sight glass. On the integral reservoir type, fill approximately three-quarters full (1½ gallons.)

4. On factory-installed HVA Systems, all water and hydraulic connections have been completed. A common water supply line has been furnished for both the HVA and the machine oil coolers, as well as the plunger packing cooling system.

5. On separate box units, install (customer furnished) fittings, and pipe from the water supply to the oil cooler and from the oil cooler to the water drain.

PRELIMINARY MACHINE CHECKOUT

Now that all electrical, cooling, and lubrication requirements have been completed, and prior to assembling the plungers and other cylinder parts, the machine should be run for at least thirty minutes to assure proper lubrication of parts and correct adjustment of oil pressure.

CYLINDER REASSEMBLY

If the machine is to be operated within a two-week period, the plunger assembly parts should be assembled with plunger packing.

If the machine is not to be operated within two-weeks, the plunger assembly should be reinstalled, but without the plunger packing.

Refer to the appropriate Cylinder Instructions pages for your machine.

PRODUCT PIPING CONNECTIONS

IMPORTANT: A shut-off valve or other device for restricting discharge must *never* be placed in the discharge line, unless a suitable relief valve is placed between the shut-off valve and the machine.

WARNING: It is essential that proper product piping to the machine be provided. Piping size will be governed by the product and the process. The suction pipe size must *never* be smaller than the suction inlet connection.

When processing viscous materials, 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 machine.

The product infeed pressure should always be greater than the vapor pressure.

Gaulin recommends a pressure gauge be installed at the suction inlet connection.

A test for correct suction feed pressure is accomplished as follows: Operate the machine on water. Determine the capacity. Operate the unit on the product at the same pressure and capacity. If the product capacity is 3% or more lower than the water capacity, the machine is being starved and the suction head must be increased.

If a suction strainer is to be used, it can be installed either in the suction manifold of the cylinder block or as close as feasible to the suction inlet connection, with a pressure gauge installed between the strainer and cylinder. The discharge piping should be the same size or larger than the discharge fitting.

When the machine is furnished with sanitary fittings, the connections may be larger than the pipe size shown for a specific model. In these cases, a reducer may be used to equal the discharge pipe size. See charts shown below for correct pipe sizes.

Back pressures in the discharge line, up to 500 p.s.i.g., will not affect processing efficiency of the machine. On units furnished with sanitary discharge fittings, back pressure is limited to 100 p.s.i.g. due to the pressure rating of the fittings.

STANDARD PIPING CONNECTIONS

Model	Suction connections	Discharge Connections
MC4	DN 32	DN 32/25
M6	DN 40	DN 40
MC15	DN 50	DN 40
MC18/MS18	DN 50	DN 40
MC45/MS45	DN 65	DN 40
MC120/MC140	DN 80	DN 50

Figure 9

PRE-OPERATIONAL INFORMATION

GENERAL INSTRUCTIONS

To help you understand the following instructions, please refer to these drawings:

Plate C213 - Cylinders and Parts

Plate V216 - Single Stage Homogenizer or SMD Assemblies

Plate V217 - Two stage Homogenizer or SMD Assemblies

NOTE: The Pressure Gauge (#41) shipped with your machine is a delicate instrument and is easily subject to damage through careless handling.

PRESSURE GAUGE RANGE – Gauges are supplied in four standard ranges:

0 to 1000 p.s.i.g. - for operation up to 600 p.s.i.g.

0 to 5000 p.s.i.g. - for operation up to 3000 p.s.i.g.

0 to 10,000 p.s.i.g. - for operation up to 5000 or 8000 p.s.i.g.

0 to 15,000 p.s.i.g. - for operation up to 10,000 p.s.i.g.

NOTE: The Red Pointer (#45) on gauge is preset at the factory and indicates maximum allowable operating pressure for which your machine was designed.

The actual operating pressure of the machine must be accurately known in order to produce a satisfactory product and to avoid over-loading the motor or the unit. Serious machine breakdowns have occurred due to overloading of the unit, because gauge does not record actual operational pressure. To avoid trouble in this respect, it is advisable to have a spare gauge which would be used *only for testing* the gauge used for production.

An alternative method is to check the gauge furnished with the unit, during the initial installation of the new machine, and record actual gauge pressures and corresponding ampere readings of the motor while operating at three or more different operating gauge pressures. Then, draw a pressure-versus-ampere curve for use in the event of suspected gauge failure. The ampere reading will be sufficiently accurate for operation of the machine and processing in the event of gauge failure. In addition, it is an excellent future check on the gauge to determine the accuracy of the instrument.

To prevent the possible occurrence of electrolytic action or breakage during transit, Plunger Packing (#25) was removed from the machine. Packing assemblies must be installed properly (see Cylinder Reassembly, Plate C213) before any attempt is made to operate the machine.

Visible leakage of product from the rear of the cylinder indicates the need for adjusting or replacing the plunger packing.

WARNING: Continued operation with leaking packing will cause rapid and serious damage to the inside diameter of the Packing Adjusting Ring (#27) which, in turn, will markedly reduce the life of both the packing and the plungers.

The power-end section (see Plates B-163-170), housing the eccentric shaft, the drive shaft, and the crossheads, is lubricated by oil under pressure. The well area, located directly behind the cylinder, houses the plungers, which are cooled and lubricated by a water spray. The cylinder block accommodates the product being processed under high pressure.

The proper packing or gaskets for use in each area can be identified by comparing size and shape with the opening to be packed, and by referring to Plates C213, V216 and V217 in the manual.

The insertion of packing or gasket seals presents an excellent opportunity to become familiar with the nomenclature and construction of the unit. The manual clearly identifies each component by name and item number, thus providing useful information for the maintenance of the unit and for ordering replacements.

To aid in identification and to assure availability when needed, it is wise to clearly tape and label all spare parts with name and item number, and keep them neatly stored near the unit.

When the need for a replacement part arises, it is wise to order an extra for future needs.

All personnel who will operate or maintain the unit should be given an opportunity to disassemble, clean and reassemble the machine several times for initial familiarity.

In the cylinder block (Plate C213) and homogenizing or SMD valve assembly (Plates V216, V217) components have been precision machined. Care must be taken not to damage parts by rough handling. If a part does not go into place under gentle pressure, remove it and check the manual rather than attempt force.

NOTE: Your specific machine identification data is located at the front of this manual. Model and serial number will be found on the Packing List, also at the front of the manual. The serial number will be found on a nameplate at the rear of the well section.

Note that the cylinder block (Plate C213) is precision-machined from a single piece of stainless steel as standard construction, or special cylinder block material when specified. The cylinder ports are bored horizontally and closed with plunger packing assemblies at the rear, and gasketed caps at the front. The valve ports, bored vertically through the cylinders, contain pump valve assemblies and are closed on top by gasketed caps. The suction manifold, bored horizontally through the lower part of the cylinder block, is closed at one end by a gasketed cap and is fitted at the other end with an inlet connection (#17). These are interchangeable. The discharge manifold, bored horizontally through the upper part of the cylinder block, is of smaller diameter than the suction manifold and is fitted at one end for the homogenizer or SMD assembly (Plates V216 or Plates V217) and at the other end for the product gauge assembly or recorder assembly, or both.

All caps and assemblies on the cylinder block must be carefully secured with the special tools provided, due to the high product pressures developed in the block.

NOTE: The cylinder caps are machined to assure self-centering. In assembling the stud nuts which secure the cylinder caps, the pressure gauge block, the homogenizing valve or SMD assembly, and the suction manifold fittings, be sure to hand-tighten before applying a wrench. Then, use the special wrenches provided to complete tightening, being careful to tighten alternately in order to obtain uniform tension.

NOTE: A 3-way valve, designated for continuous open position is recommended for altering the flow-direction of processed material discharged directly from the unit. Never use a flow-control valve. The flow of processed material must never be restricted or stopped while the machine is in operation. The processed material can be flowed directly to shipping containers or storage tanks.

Avoid the introduction of excess air in the material being supplied to the unit.

NOTE: The presence of excess air will cause loud knocking, in both the cylinder and the homogenizing valve or SMD assembly, as well as erratic fluctuation of the pressure gauge indicator. Continued operation of the unit with gauge fluctuation will shorten gauge life and, if continued, may damage the cylinder and cause fatigue to other metal parts due to shock-loading. Pressure feed is necessary for high viscosity material. Gravity feed for some low viscosity materials may be satisfactory if the temperature is below 150°F.

CYLINDER DISASSEMBLY, CLEANING, REASSEMBLY

In order to facilitate this function, complete instructions for cylinder disassembly, cleaning and reassembly are contained in Plates C213, Cylinders and Parts.

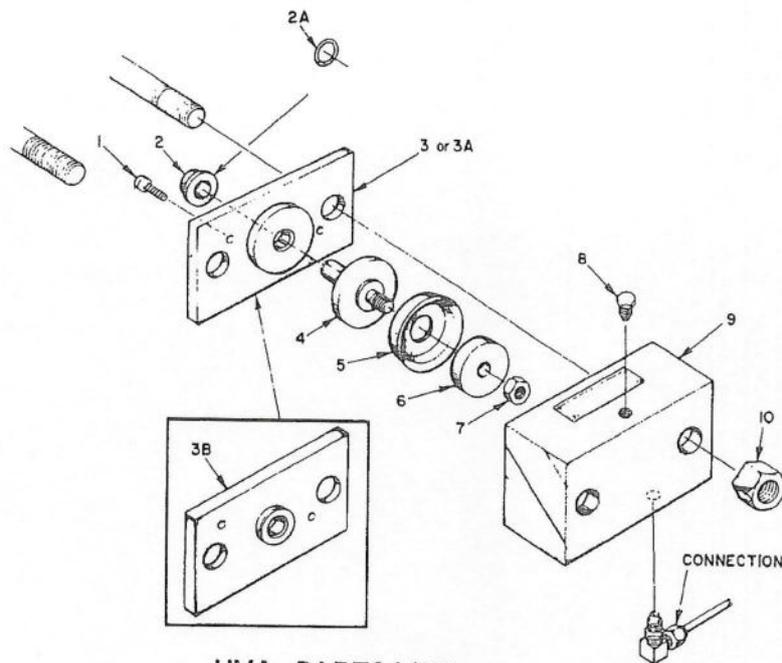
HOMOGENIZER VALVE DISASSEMBLY, CLEANING, REASSEMBLY

In order to facilitate these functions, complete instructions for disassembly, cleaning and reassembly of manually operated homogenizer valve parts are contained on Plates V216 (Single-Stage Valves) and V217 (Two-Stage Valves).

NOTE: If the pressure drop downstream from the discharge is higher than 20 psi, it usually is necessary to install a tightly capped air stand pipe or commercially available hydraulic accumulator to minimize the line vibration. (This may become necessary on the suction line side of machines running at high capacities or when long and complex suction lines are used.)

PLATE V220
HYDRAULIC VALVE ACTUATOR ASSEMBLY
(HVA)

For Single-Stage Homogenizing Valve or S.M.D. Valve Body Assembly,
and for 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 10

HVA DISASSEMBLY

1. HVA pressure must be off, and motor stopped, before disassembly.
2. Remove Valve Body Stud Nuts (#10).
3. Disconnect the Quick-Apart couplings which connect the hydraulic lines to the Actuator Body.
4. Remove the Actuator Body Assembly.

Note: For removal of the Homogenizer Valve Assembly, refer to the detailed instructions described in the Single-Stage or Two-Stage Homogenizing Valve or SMD Disassembly data (Plates V216, V217).

HVA REASSEMBLY

Reverse the procedure, outlined to the left, by completing these steps:

1. Replace the Actuator Bodies (#9) as an assembly.
2. Reconnect the Quick-Apart couplings.
3. Install Valve Body Stud Nuts (#10) and tighten evenly and securely.

GENERAL OPERATION

TEST OPERATIONS

All foreign matter in piping or supply system must be flushed out and removed from system before machine is put into operation. Turn on water for plunger lubrication, adjusting flow by control valve. After checking the entire unit for tight assembly, test operation can begin.

Note: Clean water should be used for initial testing of the homogenizer, closely observing for leakage and loss of operating pressure. If leakage does occur, correction can be easily accomplished. During the water test run, a capacity check should be made to determine if the machine is operating at its rated flow.

Manually controlled single or two-stage Homogenizing Valve – Slowly turn second-stage handwheel clockwise until product pressure gauge reads desired pressure. Then, turn first-stage handwheel clockwise until it reaches the maximum rated pressure for the machine. As the pressure rises, check cylinder caps, etc. for leaks. If any leaks occur, tighten nuts. With cold water, it is sometimes difficult to completely stop leakage around nylon gaskets, but they will quickly seat themselves when hot product is run, or, tighten further.

Hydraulic Valve Actuator (HVA) Homogenizing Valve – Complete instructions for operation of HVA machines is contained on pages 23-25.

Recommended: This is the opportune time to construct a Pressure/Amperage Curve to facilitate future occasional checkout of gauge accuracy or when gauge fails. It is a

simple procedure. Merely record on the graph furnished below, three or four pressure gauge readings, up to the maximum for the machine, as well as the corresponding amperage reading determined by your electrician as each of the pressures is reached. Future amperage readings should correspond with the pressures indicated by the gauge.

PRODUCT OPERATION

Start feed pump, if one is in use. Adjust flow of cooling water and check oil level. Before starting the machine, make certain the Handwheel (#9) on the valve assembly (Plate V216 or V217) is turned counter clockwise to the open position, permitting the product to flow through the valve assembly without pressure. Start machine motor. Open product supply valve. After the product is pumping smoothly through the machine, gradually turn the valve Handwheel (#9) clockwise toward the closed position until the desired pressure is indicated on the Gauge (#41) (Plate C213). At this point, the unit will be functioning as intended. With the exception of listening for abnormal noises and checking the Gauge (#41) for excessive pressure or fluctuation, no further attention is needed. If operation is not smooth, immediately turn the valve Handwheel (#9) counterclockwise to the open position. Repeat the procedure followed initially. This will permit complete removal of air from the system. Before starting, and during operations for the first several days, additional tightening of the Upper and Front Stud Nuts (#1 and #30) (Plate C213) is strongly advised. This procedure should properly seat the Upper Cylinder Gaskets (#3) and Front Cap Gasket (#28) (Plate C213).

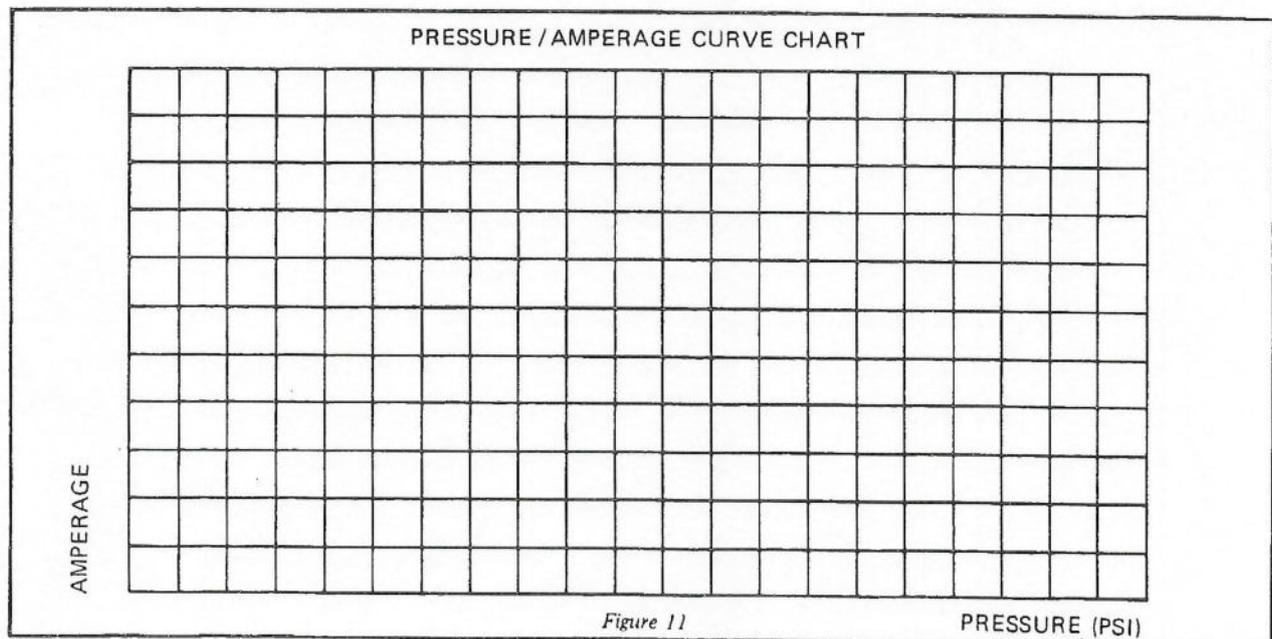
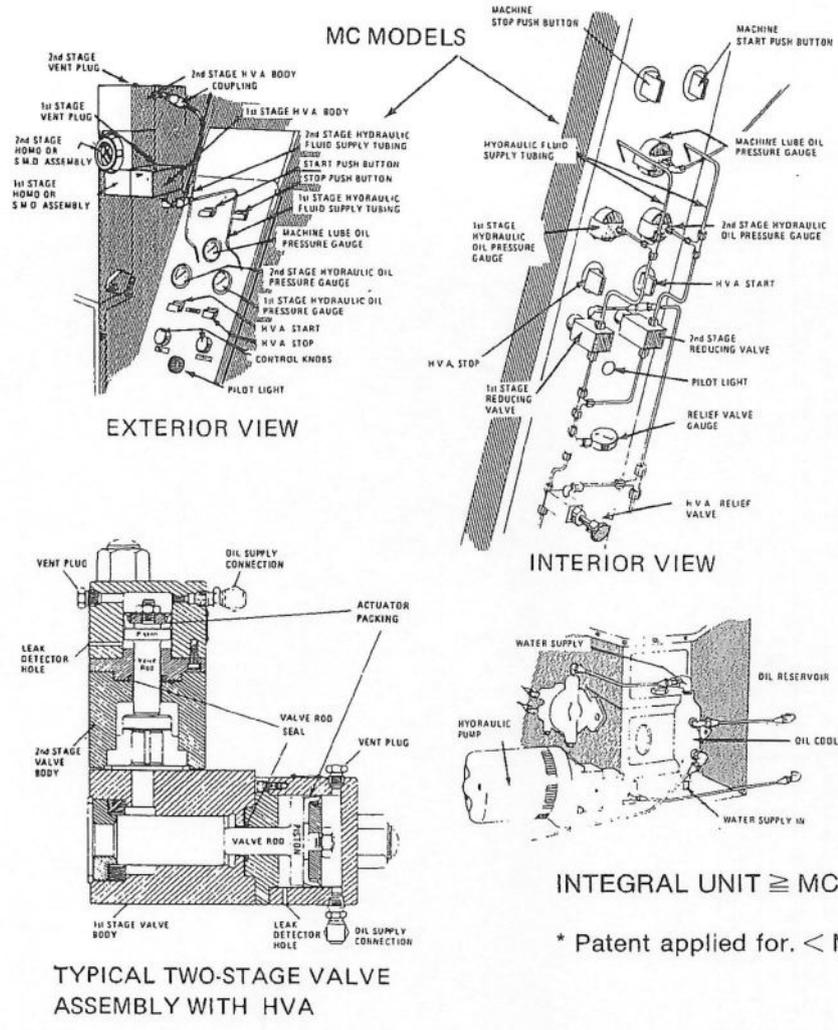


PLATE V221
HVA Hydraulic Actuator - Piping



* Patent applied for. < MC4 - MC15

Figure 12

HVA OPERATION

The Hydraulic Valve Actuated (HVA) System includes a hydraulic relief valve which has been carefully set to control the maximum desired homogenizing pressure, or the maximum safe operating pressure of the machine.

Each stage of a two-stage homogenizing valve is controlled by a separate pressure reducing valve permitting independent control of each stage.

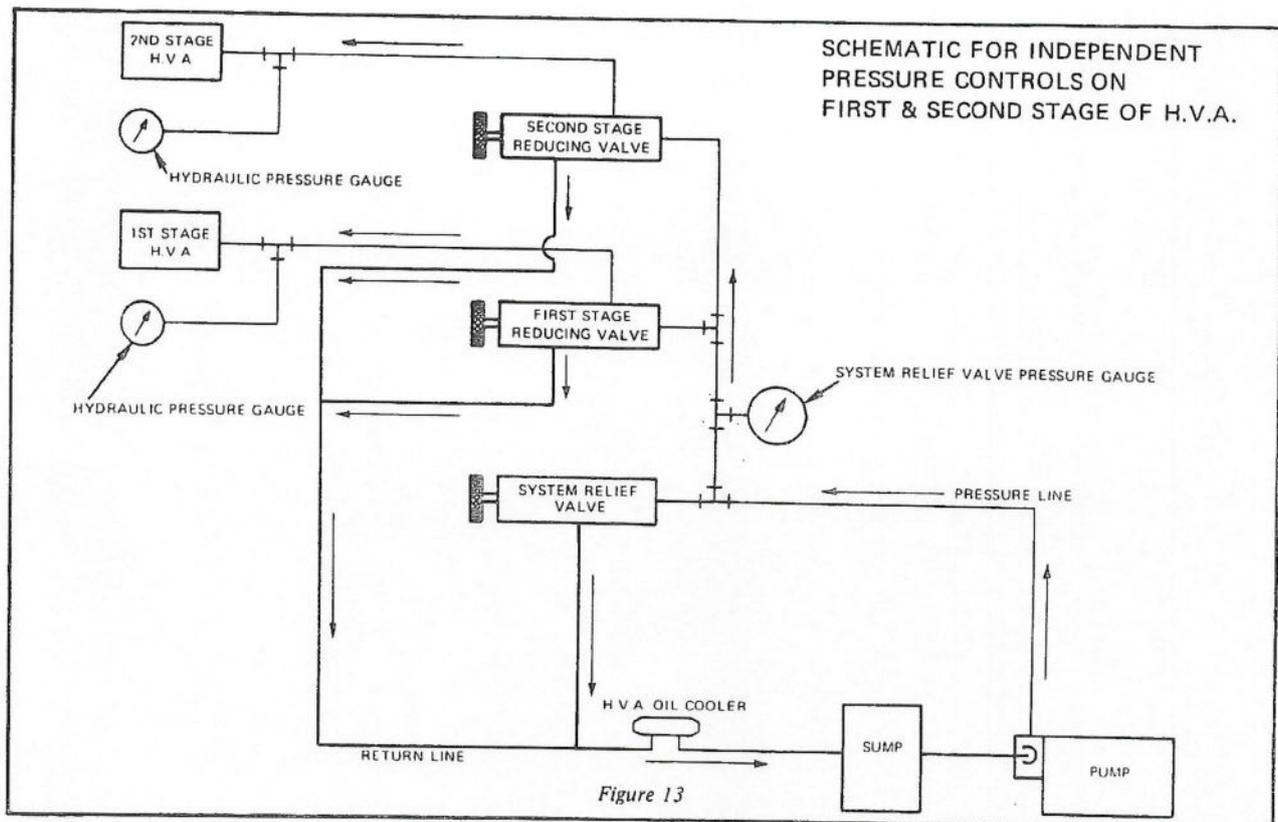
The relief valve and reducing valves in a two-stage machine are piped in series. Therefore, pressure must be created by the relief valve before the reducing valves can be operated.

On initial start-up after installation of the Hydraulic Valve Actuator, 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 the 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 box (or sump in the integral HVA systems) be avoided.

The model MC4 and M6 machines use HVA remote box units. The MC models, if factory equipped with HVA, will have a 2-gallon oil reservoir mounted in the base of the unit. When HVA is field installed, it must be a remote box unit identical to the MC4 and M6 units.

Installation instructions for two-stage HVA system

1. Clean and wipe out inside of actuator oil reservoir sump before filling with oil.
2. Fill HVA oil reservoir with hydraulic oil. Type of oil used must be same specifications as the oil recommended for machines operating in excess of 150 r.p.m. (See page 12). On box units, fill to center of oil level sight glass. On integral reservoir units, fill three quarters full (approximately 1½ gallons).
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, and plunger packing cooling system.
4. On remote box units, install customer furnished fittings and pipe from water supply to oil cooler and from oil cooler to water drain.
5. Wire motor. Motor may be wired independent of homogenizer or tied in with homogenizer starter. If it is tied in with the starting circuit of the homogenizer, a time delay switch should be provided to permit the homogenizer to commence pumping prior to the application of HVA pressure to the homogenizing valve.
6. The HVA remote box unit may be located anywhere adjacent to the machine, within limits of the length of hydraulic tubing supplied.
7. If remote panel operation is desired, additional tubing may be purchased.
8. The HVA remote box units are supplied with the necessary tubing and fittings. It is necessary, however, to cut tubing to the required length and install fittings. The tubing fittings are installed by:
 - a. Cut tubing off square.
 - b. Slip nut over end of tubing.
 - c. Slip ferrule over end of tubing, slotted end first.
 - d. Using a tube flaring tool, slightly flare end of tubing to prevent ferrule from sliding off.
 - e. Screw nut onto male fitting on HVA box and tighten.
 - f. Repeat same procedure on opposite end of tubing using Quick-Apart connector. Mating piece to Quick-Apart connector is attached to HVA unit mounted on homogenizing valve.



Initial start-up of HVA two-stage Homogenizing Valve Assembly — When starting and calibrating machines equipped with two stage homogenizing valve assembly, proceed as outlined below:

1. Loosen, but do not remove vent plugs on top of first and second-stage actuator bodies.
2. Turn first and second-stage 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 relief valve, located inside the base of MC machines or in the oil reservoir on box units, has been preset for operation. If it becomes necessary to readjust the relief valve, turn the control knob clockwise until 800 to 1000 p.s.i.g. registers on the relief valve pressure gauge located on the pressure line leading to the reducing valves.
5. Turn first and second-stage 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 fluid escaping through the loosened vent plugs.
7. Tighten the vent plugs.
8. Turn first and second-stage reducing valve control knobs counterclockwise until hydraulic pressure gauges come to rest at the minimum point. This reading should not exceed 20 to 30 p.s.i.g. on either gauge.
9. Stop HVA pump and motor.
10. Start homogenizer 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 system. Failure to observe this precaution can cause serious damage to the homogenizer by shock loading.

11. On the two-stage homogenizing valve assembly, the second-stage processing pressure should be adjusted first. Turn the second-stage reducing valve control knob clockwise until the desired second-stage pressure is indicated on the product pressure gauge.

12. Turn the first-stage reducing valve control knob clockwise until total desired processing pressure is indicated on the product pressure gauge.

13. If the desired product processing pressure cannot be obtained, there may not be sufficient hydraulic pressure available. Proceed as follows:

Turn first stage reducing valve control knob counter-clockwise until product pressure gauge reaches the minimum point or setting of second-stage pressure. Slowly turn the relief valve control knob clockwise to increase the pressure created by the relief valve. This should be increased about 200 p.s.i.g. at a time. Turn the first-stage reducing valve control knob clockwise and observe pressure on the product pressure gauge. Repeat these steps until desired product processing pressure is obtained.

14. Read hydraulic pressure gauge and record the pressure. Tighten the control knob locknut on the relief valve control knob. 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 reducing valve control knobs on first and second-stage reducing valves counter-clockwise until hydraulic pressure gauges come back to minimum position.

15. Repeat steps 11 and 12. Record the hydraulic pressure indicated on the gauges for the desired product operating pressure. The pressures should remain constant for the product operating pressure.

16. Tighten the control knob locknuts on the first and second-stage 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 combinations, steps 11 and 12 should be repeated for each product. Manual adjustment of the reducing valve control knobs will be required when product changes are made.

SPECIAL INSTRUCTIONS FOR DAIRY OPERATION

HOMOGENIZER IN AN HTST SYSTEM

The homogenizer can be operated in many different locations in an HTST or UHT system, such as: between the raw regenerator and heating sections, midway through regenerator section, after the heating section, after the holding tube, after a vacuum treatment unit, after a centrifugal pump, after a positive displacement metering pump, after a centrifugal pump in a standardizing separator.

Each location changes the temperature, infeed and discharge pressure conditions, thus changing the piping hook-up requirements. Accordingly, there is no single right way to start up and operate the machine.

CONSTANT REQUIREMENTS

No matter where the homogenizer is located, efficient, safe operation demands the following:

1. Homogenizing temperature above 140°F., (except evap.).
2. Maintain minimum infeed pressure above 10 p.s.i.g. or greater as dictated by product temperature, viscosity, and flow rates.
3. Air entrainment in product must be kept to absolute minimum possible (2% or less) to avoid serious damage from shock loading.
4. Do not start machine under pressure.
5. Do not apply pressure until machine is pumping smoothly, with air expelled from cylinder and infeed lines.
6. Uninterrupted supply required so machine cannot operate with pressure applied while product runs out.

HOMOGENIZER IN A BATCH SYSTEM

The same constant requirements as described above are in order. Because such systems are usually not designed for continuous operation, more care is required in operation. If system allows, it should be automated to re-cycle instead of running out of product. At the very least, a low-level alarm system should be installed to signal the operator when the time has come to remove pressure. Proceed as follows:

1. Turn on cooling water for plungers and oil cooler.
2. Check oil level gauge at back of machine. It should show a level in the center of the gauge glass.
3. Before starting the homogenizer every day, make a practice of opening the petcock at the back of the oil sump to drain off any condensation which has separated from the oil while machine was shut down.
4. Back off (counter-clockwise) handwheel(s) or HVA control knob(s) several full turns.
5. Open re-cycle valve (if one is in system) so product can flow back to homogenizer infeed line (while pressure is being applied.)
6. Open product valve, start feed pump and homogenizer.
7. When air is expelled and machine is pumping smoothly, turn clockwise, second-stage handwheel or control knob bringing pressure up to desired setting (see table of suggested pressures below.)

NOTE: The second stage handwheel is the wheel located next to the discharge fitting.

8. Turn the first-stage handwheel or control knob down for required total gauge pressure.
9. For the first several days, additional tightening of the upper and front cylinder cap nuts is advised. This will help to seat the upper and front cap gaskets.

HOMOGENIZING PRESSURE

The pressure required will depend on: product temperature, nature of product, shelf life desired, amount of air in product, heat history of product, homogenizing valve condition & type and even the condition of pump valves & seats. Accordingly, the following table lists only the normal range. Actual pressures will be determined by trial and error for the optimum efficiency possible, with the product, the machine, and the system involved.

In order to shut down the homogenizer, back off handwheel(s) or turn off HVA switch. Usually, machine and piping system is flushed out before stopping the homogenizer.

MAXIMUM OPERATING PRESSURE FOR YOUR MACHINE

This point cannot be emphasized too strongly because of the serious consequences which will result if the warnings are not understood and observed. See name plate and sheet, "This is Your Machine", for your machine maximum pressure. (stamped on machine name plate!)

The controlling factors which limit the operating pressure of the machine are in either the cylinder end, the power drive end, or the motor. Plunger diameter (area) will determine the loading on the power drive end. Cylinder block design limits its loading to a specific value. The available motor horsepower in the machine will limit the pressure even if the power drive end and cylinder are capable of higher pressure. The coding on the name plate will give the maximum pressure allowed by the cylinder or the power drive end, whichever is lower. The red pointer setting on the product pressure gauge attached to the cylinder will give the maximum safe pressure.

SUGGESTED OPERATING PRESSURES FOR DAIRY PRODUCTS

PRODUCT	2ND STAGE	1ST STAGE/TOTAL GAUGE READING
Fluid Milk	300 to 500 psi	1500 to 2500 psi
Half and Half Milk	500	1800 to 3000 psi
Coffee Cream	(Use pressure on 1st stage only)	500 to 1000 psi
		none
Soured Cream	optional	1500 to 2500 psi
Evaporated Milk	300 to 500 psi	2000 to 3000 psi
Soft Serve Mix	300 to 500 psi	2000 to 3000 psi
10-12% I.C. Mix	300 to 500 psi	2000 to 3000 psi
16% I.C. Mix	300 to 500 psi	1500 to 2500 psi
Sterile Milk	300 to 500 psi	2500 to 5000 psi

Figure 14

If the machine capacity is increased to a point where the motor horsepower limits the pressure below the red pointer setting, the red pointer can be easily changed. In no case, however, should it ever be moved above the name plate designation.

Homogenizers are designed and manufactured for maximum operating pressures up to and including 10,000 psi. When your machine was ordered, it was designed and built to allow operating pressures to the top limit specified on your order. If a future need arises which requires a higher operating pressure, the machine can often be converted to operate at higher pressure. When this is possible, it usually requires smaller diameter plungers and associated parts. In other cases it might require a complete new cylinder assembly designed for the higher pressure.

Never attempt to operate beyond the present limits of your machine without consulting the factory or a factory representative or authorized dealer.

ASEPTIC HOMOGENIZER CYLINDER DESIGNS

Aseptic homogenizer construction consists primarily of a means of confining the plungers in an atmosphere where sterility is maintained (usually by means of steam.)

The cylinder is constructed with one steam fitting which supplies steam to each sterilizing chamber through one common steam cavity connecting all plunger bores. The steam is directed into each plunger bore and confined between sets of primary and secondary high temperature plunger packing.

The primary packing assembly is spring loaded and is used to seal the product being pumped in the pumping

chamber. It is also used to form a part of the steam sterilizing chamber.

The secondary packing assembly is also spring loaded and helps to complete the individual steam chamber around each plunger.

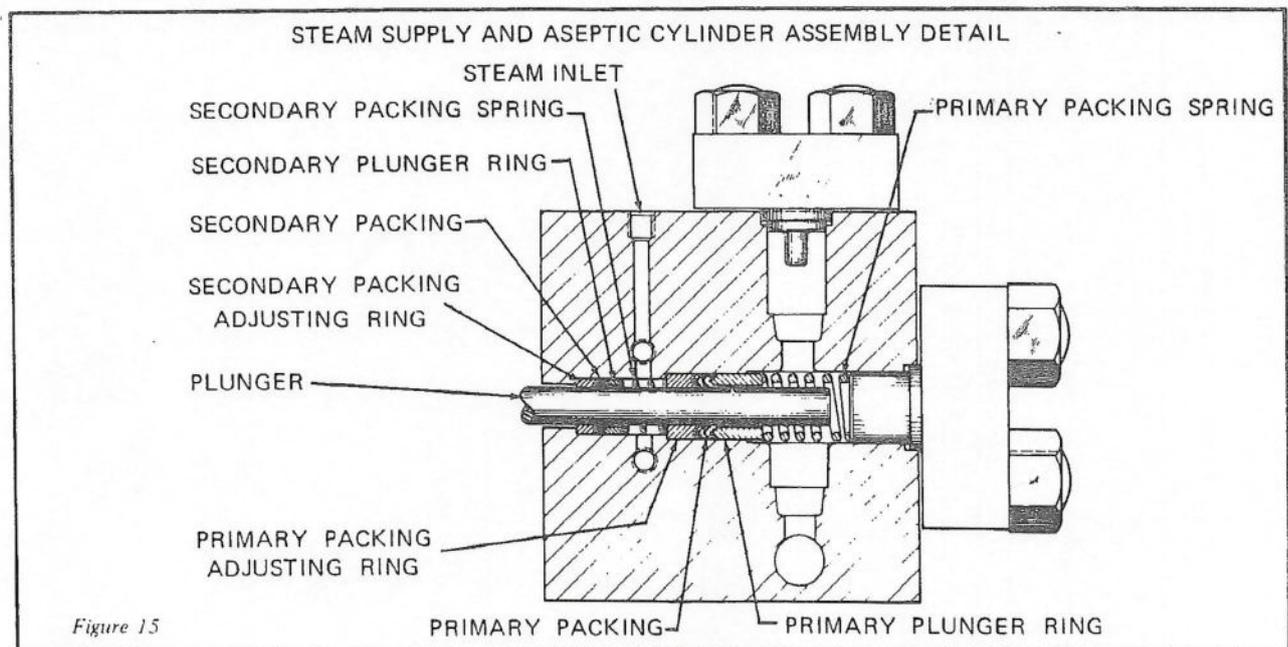
The depth of the cylinder is designed to prevent any part of the plunger, normally in contact with the product, from being withdrawn from the sterile chamber.

The customer should supply the steam line, including pressure reducing valve, check valve, globe valve, pressure gauge, and strainer to the 1/4" N.P.T. fitting supplied in the top of the cylinder. Condensate piping and trap are included with the machine and are factory connected to drain line.

For sterilizing the cylinder, wet steam or hot water at temperatures up to 300°F. is normally used. Because of the high temperatures and the lack of lubricity behind the product plunger packing, 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 highly polished for best packing life.

In operation, steam at 10 to 15 psig is fed into the top of cylinder and the condensate is removed through the built-in steam trap. Never allow steam pressure to exceed product infeed pressure while processing.

In order to help prolong packing life, steam feeding to plunger seals must be stopped during in-place cleaning cycles.



RECOMMENDED REGULAR MAINTENANCE SCHEDULE

DAILY INSPECTION

1. Check oil level, visible through oil level sight glass on back of machine, and add oil if required.
2. Drain condensate from oil sump through petcock on back of machine.
3. Check oil pressure (20 - 40 PSI) and adjust, if necessary. See page 12.
4. Check water lubrication and cooling system.
5. Check for any leaks from cylinder or base.
6. With machine running, listen for any abnormal sound.

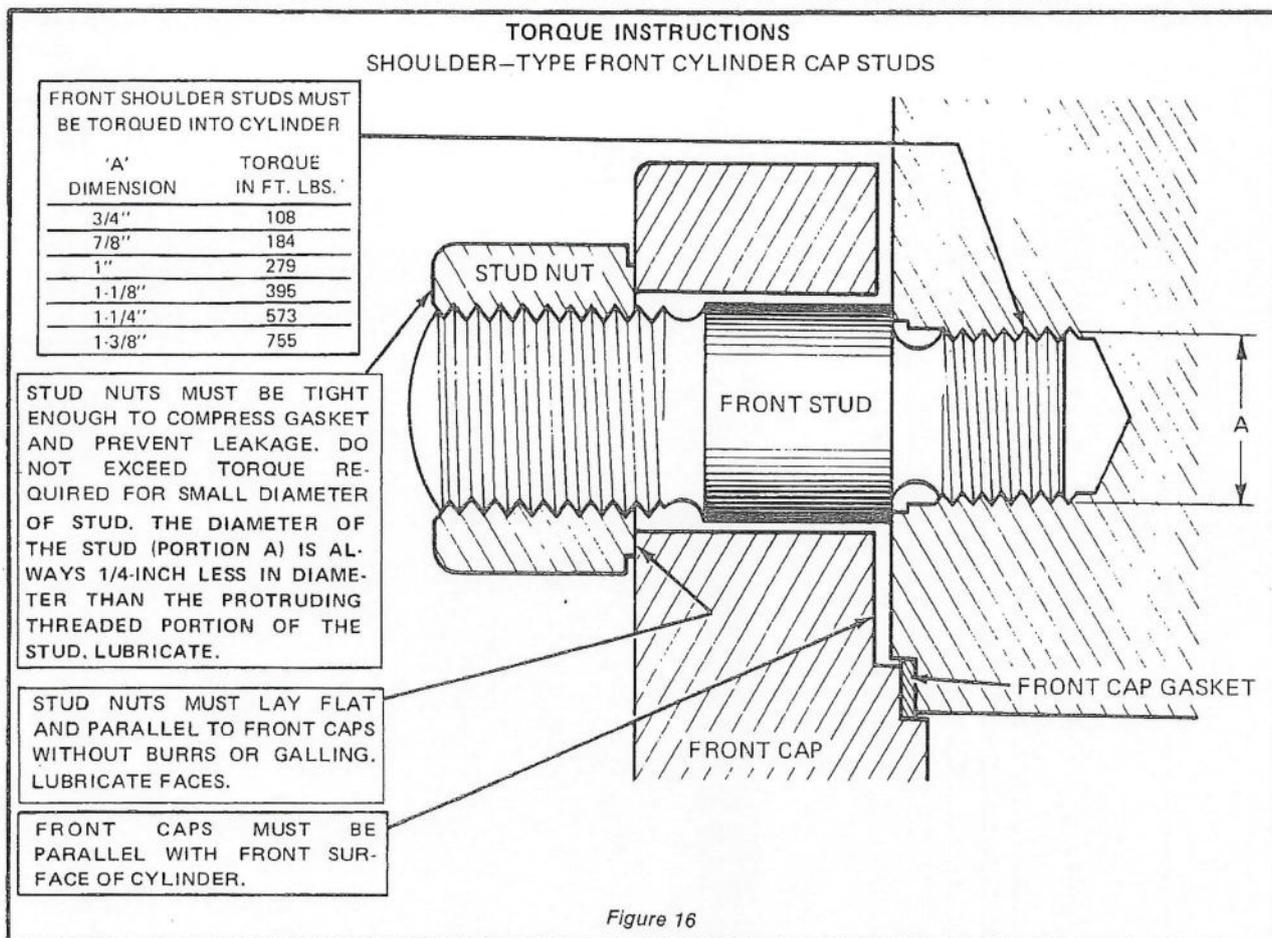
MONTHLY INSPECTION

1. Check tightness of all bolts, nuts and fittings.
2. Check oil pressure and adjust if necessary. See page 12.
3. Check for oil leaks.
4. Check water lubrication and cooling system.
5. Check belt tightness and adjust if necessary. See page 14.
6. Disassemble and inspect all homogenizing valve and cylinder parts for wear and damage.
7. Inspect seals or packing around plunger adapters and replace if necessary. On adjustable type, tighten adjusting nut.
8. Replace all gaskets and packing.
9. Inspect all gasket counterbores and repair if needed.

SIX MONTH OR YEARLY INSPECTION

1. Drain oil, clean crankcase, gear case, and oil level sight glass. If machine uses oil filter, replace cartridge. Fill with oil to proper level. See page 13 for frequency of oil change.
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. See pages 41, 46. MC 4 models are not equipped with replaceable inserts.
5. On all MC Model machines, inspect and adjust crosshead ball joints. See page 47.
6. Re-torque front cylinder cap studs. See page 31 for procedure.
7. Re-torque crosshead bearing ball into connecting rod. See page 47 for correct torque.
8. Tighten cylinder to base.
9. Check operation of low-oil pressure switch.
10. Report mishandling of parts to supervisor.

MAINTENANCE PROCEDURES



FLUID-END MAINTENANCE - ALL MODELS

TORQUE INSTRUCTIONS

All current machines are furnished with shoulder-type front cylinder cap studs which have been properly torqued at time of factory assembly. It is important to re-torque each stud every six months. Correct installation and torque data is illustrated above.

PLUNGER PACKING MAINTENANCE

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 17-4 PH S.S., hard chrome plated S.S., Colmonoy coated, solid ceramic as standard construction, 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 temperature packings demand highly polished, hard surfaced plungers.

When new, clearance between the plunger and metal packing adjusting rings is .002". 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 Ball Valve Seat Cylinder (TBA) features a packing adjustment screw. For proper adjustment, refer to plate C213D, Pages 71-73.

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

The seats for the suction and discharge valves in the cylinder are of three types:

1. "TPS" cylinder construction uses Rexalloy (stellite) field removable valve seats with 17-4 PH hardened poppet valves. If erosion grooves form across the seating surface, use tool item (K) , to remove seats. Remove round nut on bottom, insert rod down through seat, hold round nut with (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. For regrinding, Gaulin recommends that seats be returned to factory.

In replacing seats make certain that tapers on seats and cylinder bores are clean. Pack seats 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.

2. "TBS" 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. Sub Micron Disperser (SMD) units use tungsten carbide seats.

For valve seat refacing in the field, Rexalloy seats may be refaced on a lathe using carbide tool kit, and that Carbide seats should be refaced by special grinding shops.

PUMP VALVES

These are of several materials and designs:

1. 17-4 PH hardened stainless steel valves are standard in "TPS" cylinders. They will withstand much more abrasion than 18-8 valves. If problems develop, treat them the same as 18-8 S.S. valves.
2. Rexalloy (stellite) ball valves, used in "TBS" construction only, should be inspected regularly. Pits, dents or surface cracking will quickly lead to erosion of the valve seats and the ball valves should, therefore, 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 by-pass 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. 2000 gph or lower can be measured successfully in a 10 gallon can. Divide 36,000 by the number of seconds for U.S.G.P.H.
3. Repeat at maximum pressure. If more than a 3% difference occurs, the problem may lie in the condition of pump valves and seats, or belt slippage. (Use 5% for TBS.) In addition, product compressibility may be a factor, or there may be gas in the product.

PRODUCT PRESSURE GAUGE

Gauge problems are primarily due 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 page 21) 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 5 times) has been obtained by installing a remotely mounted gauge. These units come equipped with a five fast long capillary tube with a sensing bulb which fits the standard gauge block on the machine.

HOMOGENIZING VALVE PARTS

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.

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.

VALVE SPRING — Valve springs can take a set, break, and although they are plated, can 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.

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.

VALVE AND VALVE SEAT — The valves will be of Rexalloy (stellite), tungsten carbide, or similar very hard materials. The wear patterns shown on page 34 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 19, item 5 the valve and seat require relapping or regrinding.

1. 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 3 or 4 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 Number 2 pattern shown in the Wear Pattern Guide (next page.)
2. 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.
3. Tungsten Carbide or Kennametal valves and seats are the hardest metal available and require a diamond lapping compound which is available from Gaulin in 2-gram tubes. A small amount of this compound on the seats will show a mirror finish at the contact areas after lapping. Any break in the mirror finish indicates that the valve and seat will require regrinding.
4. When seating surfaces are permitted to develop erosion channels, as shown on pattern number 5, they cannot be corrected by lapping and Factory regrinding will be required.

IMPACT RINGS — These are available in Rexalloy (stellite) and other materials and are designed for one or both of two purposes. They help prevent the high-speed stream, upon leaving the faces of the valve and seat, from cutting deep grooves in the stainless steel valve bodies. In the homogenizing process, the impact ring plays an important role in helping to further break up the product particles striking it. 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.

VALVE SEAT GASKETS — 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.

TYPICAL TWO-STAGE HOMOGENIZING VALVE ASSEMBLY

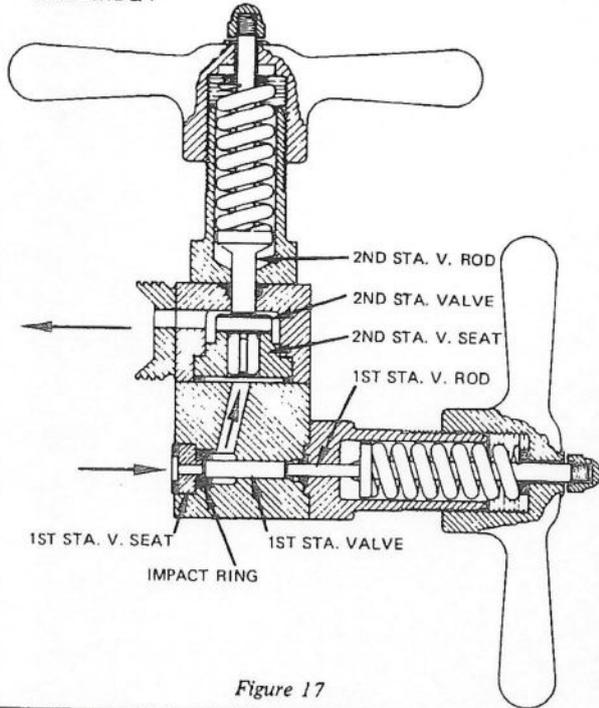
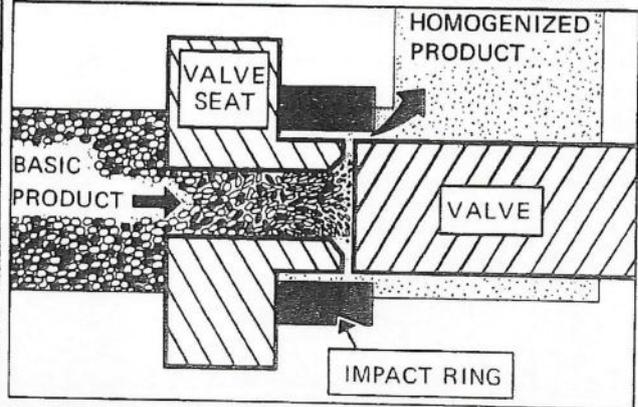


Figure 17

THE GAULIN HOMOGENIZING VALVE EXPLAINED

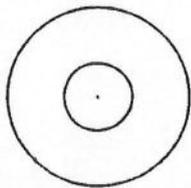


A Gaulin homogenizing valve section as basic product enters the area at high pressure. The pressure forces open the pre-loaded adjustable valve and the product passes through the aperture where an instantaneous pressure drop to less than atmospheric occurs, causing shearing action and cavitation bubbles. The product then strikes the impact ring at a velocity of 57,000 ft./min., further shattering the particles by impact and implosion of the bubbles. The homogenized product is discharged at a pressure sufficient for movement to the next processing stage.

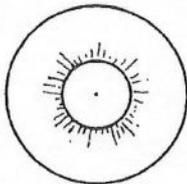
Figure 18

HOMOGENIZING VALVE WEAR PATTERN GUIDE

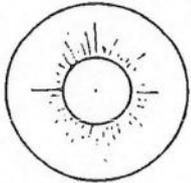
Standard commercial finish is satin in appearance. Where required, valves can be factory mirror finished as an optional extra.



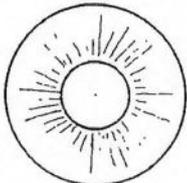
1. NEW VALVE – Complete bearing across whole face



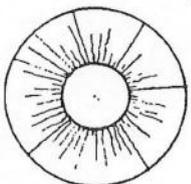
2. USED VALVE – 1/2 of face still bearing – no channels
– in excellent condition



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 19

POWER-END MAINTENANCE - ALL MODELS

OIL CHANGING

Frequency of oil changing depends on the type of service required. (Oil specifications are found on page 12).

On intermittent service, change oil every 500 operating hours or 6 months, whichever comes sooner. Always change oil if it has become emulsified with water.

On continuous service, if oil is free of contamination and emulsification with condensate, it can be used for 2000 hours.

After draining oil always clean oil compartment (use steam, kerosene, etc.). Change oil filter cartridge and clean the primary strainer on bottom of pump inlet pipe (if three items are supplied.)

NOTE: Excessive water on oil sump is caused by: leaking oil cooler, worn baffle seals or packing, defective top cover gasket, or excessive humidity.

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

MOTOR LUBRICATION

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

OIL PUMP AND RELIEF VALVE ADJUSTMENT

The lubrication oil pump is mounted on a pad in the drive compartment and is driven by a gear on the driveshaft. The relief valve is either built-in, attached to the pump or mounted in the oil pump's discharge piping. The assembly consists of a poppet valve held against an integral valve seat by a spring, an adjustment screw, a copper washer and a hex-sided cap.

1. Oil pressure is raised by removing the cap and turning down (clockwise) on the screw to increase spring tension 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.
3. If the problem still persists, check all oil line fittings for tightness and cracks, all lubricated points for excess oil loss due to wear, and packing gland on oil pump shaft for tightness. Replace oil pump only as a last resort.

OIL PUMP GEARS

If pump drive gears fail, split oil pump driven gears are available for MC models as replacement parts. This eliminates the need to remove the driveshaft and drive-shaft bearing.

LOW OIL PRESSURE SAFETY SWITCH

This switch is connected to the lubrication system and is electrically connected to the motor starter. (See pages 14 and 15). Its function is to shut the machine down if the oil pressure drops below the set point. The machine will not restart until the oil pressure rises above the set point. To adjust:

1. Remove the switch cover plate which is held on by four screws.
2. Adjustment is made by turning the knurled nut up or down.
3. The point at which the oil pressure will stop the machine should be checked at least every six months. Remove top covers from the machine and install a cardboard or sheet metal guard over the gears to stop oil splash. Start machine and loosen an oil fitting to allow the oil pressure to drop gradually. As it drops, observe the point on the gauge at which the machine shuts down.

OIL TEMPERATURE

In continuous operation the oil temperature can safely run as high as 155°F. When a question arises regarding oil temperature, measure the actual oil temperature before contacting the factory. Do not guess. Unless the room temperature is very high, oil temperature during normal plant operation will be under 140°F.

1. If oil temperature is abnormally high, the first question to be resolved is whether the heat is coming from the motor or from friction in the drive end. If the motor compartment temperature is below the oil temperature, the problem can be assumed to be in the oil compartment drive components.
2. High oil temperature can be caused by: high oil pressure, too tight or too rough bearing surfaces, incorrect oil.
3. Check (page 12) for oil information and the following pages for information on the drive parts.

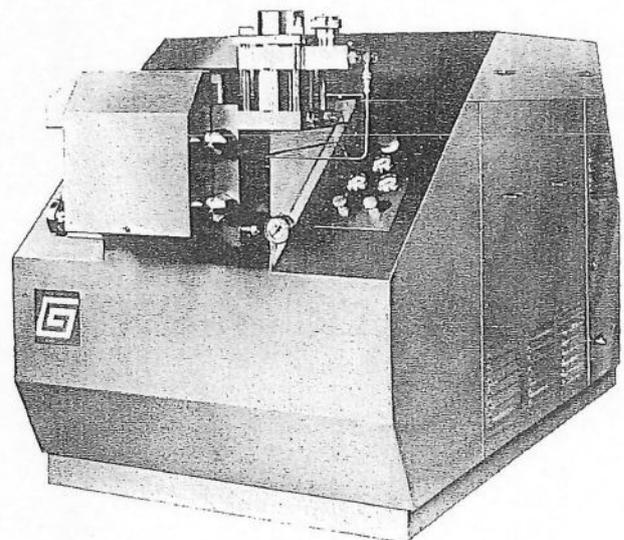
HELICAL GEAR & PINION (Figure 20, Plates B163, B164)

1. Normal rotation of the large gear is counter-clockwise, when observed from the gear side (right side) of the machine.
2. It may become necessary, because of wear or excessive gear noise, to replace the gears. Do not attempt to reverse rotation without contacting the factory. Helical gears create an end-thrust and are designed to take this thrust in only one direction.
3. Gear wear will occur naturally over a long period of usage. It usually takes the form of a developing series 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 overloading the machine.
4. Overloading 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, but only when there is a serious amount of air or starvation. Serious trouble can still be caused by, air or poor infeed pressure when the knocking sound is only faintly audible.

Model MC 4



Model MS 45



5. Gear noise will develop with gear wear. It will appear as a "growl" or "rumbling" sound and will be synchronous with one revolution of the large gear (one full stroke of one plunger). It usually becomes louder when pressure is applied to the machine.

a. Clearance between the gear, driveshaft bearing and pinion gear is determined as follows:

1. Remove top cover and belt guard cover.
2. By hand turn large driven sheave, on end of driveshaft, back and forth pushing sheave and driveshaft in as far as it can go.
3. Remove Allen Set Screw (item #13) in Driveshaft Collar (item #12) and slide collar to the right against end thrust bearing in the pillow block. Lock set screw. Be sure that there is approximately 1/32" of end play in the driveshaft.
4. If the position of the driveshaft was moved to any significant extent, recheck the alignment of the drive and driven sheaves, correcting if necessary.

b. If there is no significant gear wear evident, check clearance in the eccentric shaft bearing on gear side as follows:

1. Using a crow bar attempt to force gear upwards, away from pinion. Since the normal total oil film clearance in the eccentric shaft bearings is .001" per inch of diameter, it can now be determined if there is excessive lift (indicating excessive bearing wear, rather than gear wear).
6. If gear teeth are worn, the gears can be replaced. Because it is never good practice to replace only one half of a set of gears which have run together for any length of time, it is strongly recommended that both the pinion and large helical gear be replaced at the same time.

a. Removal of large gear can be accomplished as follows:

1. After top cover, belt guard and motor compartment door are removed, loosen and remove "V" belts by loosening motor Adjustment Screw Check Nut (item 48).

2. Loosen driveshaft collar and pinion gear by removing set screws.

3. Remove Driven Sheave (item 26) and Key (item 23).

4. Pull drive shaft out, being careful to remove pinion key.

5. Remove the three Connecting Rod Caps (item 73) being careful to keep the shims with each cap in order, so that they can be replaced in exactly the same location.

6. Remove the gear oil-guard and slide the connecting rod assemblies toward the front of the machine away from the eccentric shaft.

7. By means of a chain fall, lift clear of the machine the entire assembly, consisting of the eccentric shaft, eccentric gear and the two pillow blocks. CAUTION: The pillow blocks, containing the eccentric shaft and driveshaft sleeve bearings, are free to slide off and should be held in place until the assembly is placed on a table or floor.

8. The large gear is a press fit and can be removed with an arbor press or gear puller.

DRIVESHAFT ASSEMBLY (Plates B163, B164)

The driveshaft assembly consists of the Driveshaft (item # 10) and the Pinion Gear (item # 60). The pinion gear is removable and is held in place by means of Allen set screws.

1. The driveshaft is supported in two bronze, flanged, Sleeve Bearings (# item 83) which are held in removable Pillow Blocks (item 80).

2. Shaft removal can only be made toward the V-belt sheave side of the machine.

3. The oil pump is mounted on a pad and turned by the oil pump Driven Gear (item 7) which meshes with the driveshaft pinion.

4. The bronze sleeve bearings are a press fit in pillow blocks. They can be installed after drilling oil holes by shrinking in dry ice. Alternatively, they can be installed with an arbor press, but the oil hole should be drilled after installation. Bearings are prevented from turning by means of an Allen set screw tightened in a tapped hole between the bearing and the bearing housing.

ECCENTRIC SHAFT & BEARINGS (Plate B164)

The eccentric shaft is made from a heavy, one-piece high-strength alloy casting.

1. The shaft runs in two full, bronze sleeve-type bearings. The bearings are prevented from turning by means of an Allen set screw tightened in a tapped hole between the bearing and the bearing housing. They can be installed as described above.
2. The shaft is gun drilled and oil is pumped through the center of the shaft and out to each cam so that the connecting rod bearings ride on a cushion of oil under pressure. There is a plug in the end of the shaft.
3. If bearing replacement is ever required after installation, in order to obtain the necessary oil film clearance (about .003" minimum) they probably should be reamed or honed.
4. In the event of damage to bearing 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 surfaces are only slightly grooved, the roughness can be removed using strips of emery cloth.
 - b. Even though they 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 by emery cloth or draw filing.
 - c. If surfaces are severely damaged or undersized, the best method of repair is to have them metalized and remachined to original size.

CONNECTING ROD & CROSSHEADS (Plate B164)

The connecting rod sub-assembly consists of the two halves of the Connecting Rod (items 67 & 77, two bolts with Lock Nuts (items 76 & 66) and the Wrist Pin Bearing (item 78). The crosshead is a single piece with the plunger adapter integral to it. The wrist pin is separate and must be ordered as an individual item.

1. The connecting rods are of cast iron with adjustment for oil film clearance being made by means of the laminated shims. The proper

clearance is .001" per inch of diameter. When connecting rods or crossheads are removed, always be sure to install them with the oil hole on top. The oil hole in the connecting rod is drilled through the wrist pin bearing.

2. After connecting rod bolt lock nuts are removed & replaced a number of times, the lock nuts will begin to slip and loosen up. When annual or semi-annual inspection reveals this, replace promptly with new ones.
3. The crosshead clearance for oil film is .002" to .003" between each surface (measured dry). The pressure lubrication system pumps oil down through the crosshead cover plate, through the hole in the top of the crosshead and into the hole in the connecting rod to lubricate the wrist pin and bearing.
4. Wrist pins are a press fit in the crossheads. When assembling them, some crosshead metal, around the wrist pin hole, is sometimes upset and should be cleaned up with a few strokes of a fine mill file.

PLUNGER ADAPTER & BAFFLE SEAL PACKING (Plate 164)

The plunger adapter on this model is part of the crosshead and cannot be removed or replaced separately. The very critical plunger alignment starts with the crosshead. It is, therefore, important that the adapter not be bent and the threaded end be square and undamaged.

1. The shoulder of the plunger, tightened against the shoulder of the threaded end of the adapter, extends the alignment from the crosshead.
2. Damage to the threads of the relatively soft nickel alloy should generally be repaired by cutting away the damaged thread. A tap can be used to correct the thread.
3. The baffle packing consists of an oil seal with the lips facing toward the plunger well to stop the entrance of water. These can be installed without damage by using the Packing Assembly Tool (Page 10), item 0 after the cylinder block is removed.
4. To remove the connecting rods from this model, after the connecting rod caps have been removed, it will be necessary to loosen up the acorn nuts holding the cylinder block to the frame and either totally remove cylinder or move it away from the frame about two inches.

MODELS M6 HERRINGBONE GEAR & PINION (Plates B166, B167)

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, undamaged side of the gear teeth will carry the load. To reverse rotation, change any two motor leads (in a three-phase circuit) thus, changing motor direction. Also, interchange suction and discharge line connections at the lubrication pump. The relief valve must always be located on the discharge side.
3. Gear wear will occur over a long period of useage. It usually takes the form of a developing series 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 overloading the machine.
4. Overloading 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 — but only when there is an extremely serious amount of air or starvation. Serious trouble can still be caused by these factors when the knocking sound is only faintly audible.
5. Gear noise will develop with gear wear. It will appear as a "growl" or "rumbling" sound and will be synchronous with one revolution of the large gear (one full stroke of one plunger). It usually becomes louder when pressure is applied to the machine.
 - a. Clearance between gear and pinion should be checked by measuring driveshaft end-play as follows:
 1. Remove cover on belt drive side.
 2. By hand, turn large driven sheave, on end of drive shaft, back and forth while pushing sheave and driveshaft in as far as it can go.
 3. With a pencil, mark the driveshaft against the drive shaft oil drain cover plate.
 4. Pull the sheave and driveshaft back, out away from the base as far as it can go, turning it back and forth at the same time.
 5. Again mark the shaft.
6. Measure the distance between the two marks. The minimum should be $1/32''$, with $3/32''$ the maximum before excess gear or bearing wear is indicated.
 - b. If drive shaft end-play is excessive, even though gears do not appear worn, check clearance in eccentric shaft bearing on gear side as follows:
 1. Remove covers to expose large gear.
 2. With a crow bar, attempt to force gear upwards, away from pinion. Since the normal total oil film clearance in the eccentric shaft bearings is $.001''$ per inch of diameter, it can be now determined if there is excessive lift (indicating excessive bearing wear — rather than gear wear.)
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, it, therefore, means that the gear, pinion and driveshaft should be replaced, when one part requires it.
7. Herringbone gear removal is best accomplished with a hydraulic puller and pusher. The end of the eccentric shaft on the gear side is drilled and tapped to accept a threaded rod to aid in pushing gear on. A 30-ton unit is satisfactory. An alternate method is to take the shaft to a shop where the gear can be removed and replaced in a large arbor press.
8. If pinion and driveshaft assembly is also to be removed when the driven sheave, (item 18) has been removed, the driveshaft assembly will slide out with the large gear as the gear puller moves the gear out.

DRIVESHAFT ASSEMBLY (Plates B166, B167)

The driveshaft assembly consists of the driveshaft with a pinion gear heat-shrunk in place. It is supported in two babbitt-lined full bronze sleeve bearings.

1. The assembly can only be removed and replaced from the gear side.
2. The driveshaft floats to find its own position, dictated by the mesh of the herringbone gears.
3. The sleeve bearings are a drive fit in the housings and are secured against turning by a set screw in a hole which is drilled and tapped, half in the bearing and half in the bearing housing, parallel with the bearing.
4. Remove old bearings (after removing set screws) with a puller made with a threaded rod, washers

and nuts, to serve as a jack screw. They can also be removed with a block of hard wood and a sledge hammer.

5. Make sure oil holes are located properly in new bearings. Shrink them in dry ice for 30 minutes. Bearings can be then installed quickly with oil holes lined up. Drill, tap and install new set screws.
6. Babbitt-lined bearings must be scraped rather than honed. The oil film clearance is the standard "rule of thumb", .001" per inch of diameter.
7. When finally installing driveshaft, make sure that the gear is lined up properly with the oil pump driven gear.
8. To remove driveshaft and pinion only, loosen or remove eccentric cap bearing screws and lift, with a chain fall or bar, eccentric gear up out of mesh with pinion. After driven sheave is removed and oil pump driving gear set screw is loosened, the assembly then can be pulled out toward pinion side.

ECCENTRIC SHAFT & BEARINGS (Plate B167)

The eccentric shaft is a heavy, one piece, high strength alloy casting.

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.
2. The shaft is gun-drilled and oil is pumped through the center of the shaft and out to each cam so that the connecting rod bearings ride on a cushion of oil under pressure. There is a plug on one end of the shaft.
3. If bearing replacement is ever 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 one inch of diameter minimum. NOTE: babbitted bearings must be scraped, not honed.
4. In the event of damage to bearing 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 surfaces are only slightly grooved, the roughness can be removed using strips of emery cloth.
 - b. Even though they 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 groove developed, must be removed by emery cloth or draw filing.

- c. If surfaces are severely damaged or undersized, the best method of repair is to have them metalized and remachined to original size.

CONNECTING ROD AND CROSSHEADS (Figure 22, Plate B167)

The connecting rod sub-assembly consists of two halves of the Connecting Rod (Items 74 & 89), a set of two steel backed, babbitted Bearing Halves (Item 81) two Bolts with lock nuts (90 & 75) and a Wrist Pin Bushing with set screw. The crosshead sub assembly consists of the Crosshead (Item 86) two Wrist Pin Set Screws (91) and one Adapter Set Screw (Item 93). The wrist pin is not part of the sub-assembly and must be ordered separately.

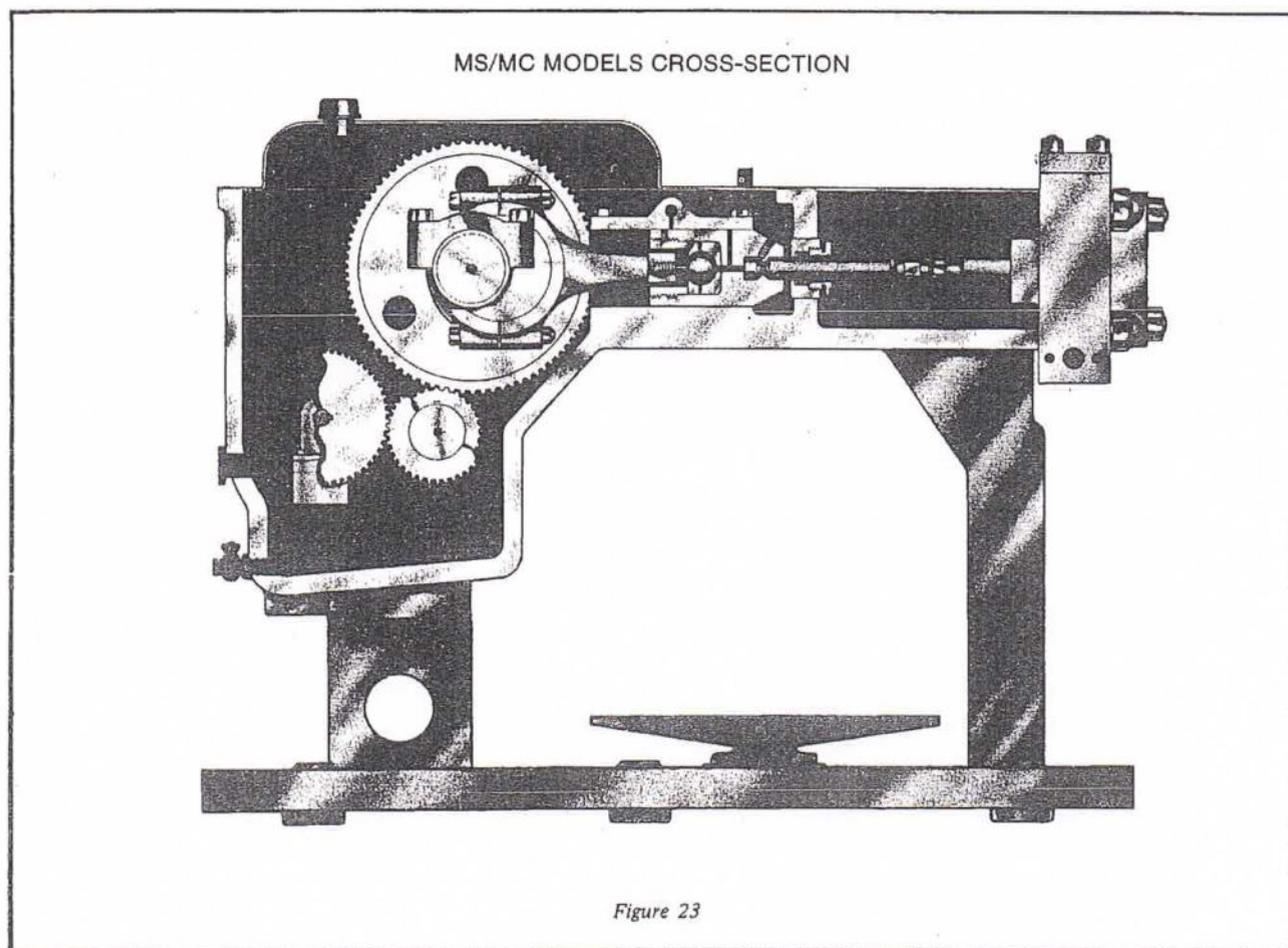
1. Connecting rod bearing halves must be used as a set, but they can be interchanged in the same connecting rod. They are automatically located by dowels. *Caution:* make sure dowels are bottomed in holes in connecting rod. Oil film clearance should be approximately .001" per inch of diameter when bolts 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 shimmed out or replaced.
2. After connecting rod bolt lock nuts are removed and replaced a number of times, the lock nuts will begin to slip and loosen up. When annual or semi-annual inspection reveals this, replace promptly with new ones.
3. The crosshead clearance for oil film is .002" to .003" between each surface (measured dry).

PLUNGER ADAPTER & BAFFLE SEAL PACKING (Plate B167)

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

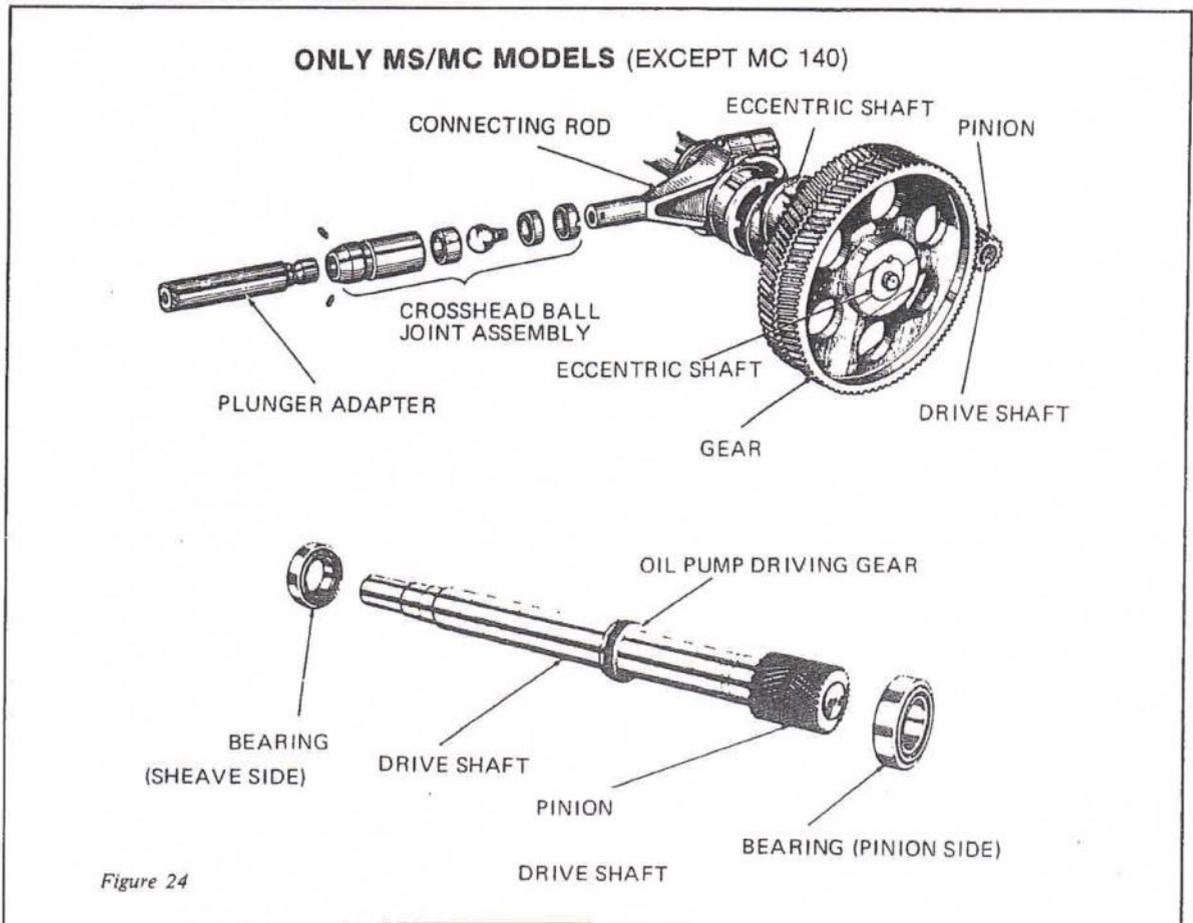
1. Tightening the Set Screw (item 93) pulls adapter back against square end of crosshead, holding adapters in alignment.
2. The shoulder of the plunger, tightened against the shoulder on the threaded end of the adapter, maintains and extends the alignment to the plunger.
3. Damage to threads in the stainless steel adapter generally should only be repaired by grinding or cutting away the damaged thread. A tap can be used to correct the threads.
4. Baffle packing consists of one oil seal facing in towards the oil and another one facing out toward the plunger well and the water. They can be installed without damage by using the Packing Assembly Tool (item O).

MS/MC MODELS ONLY

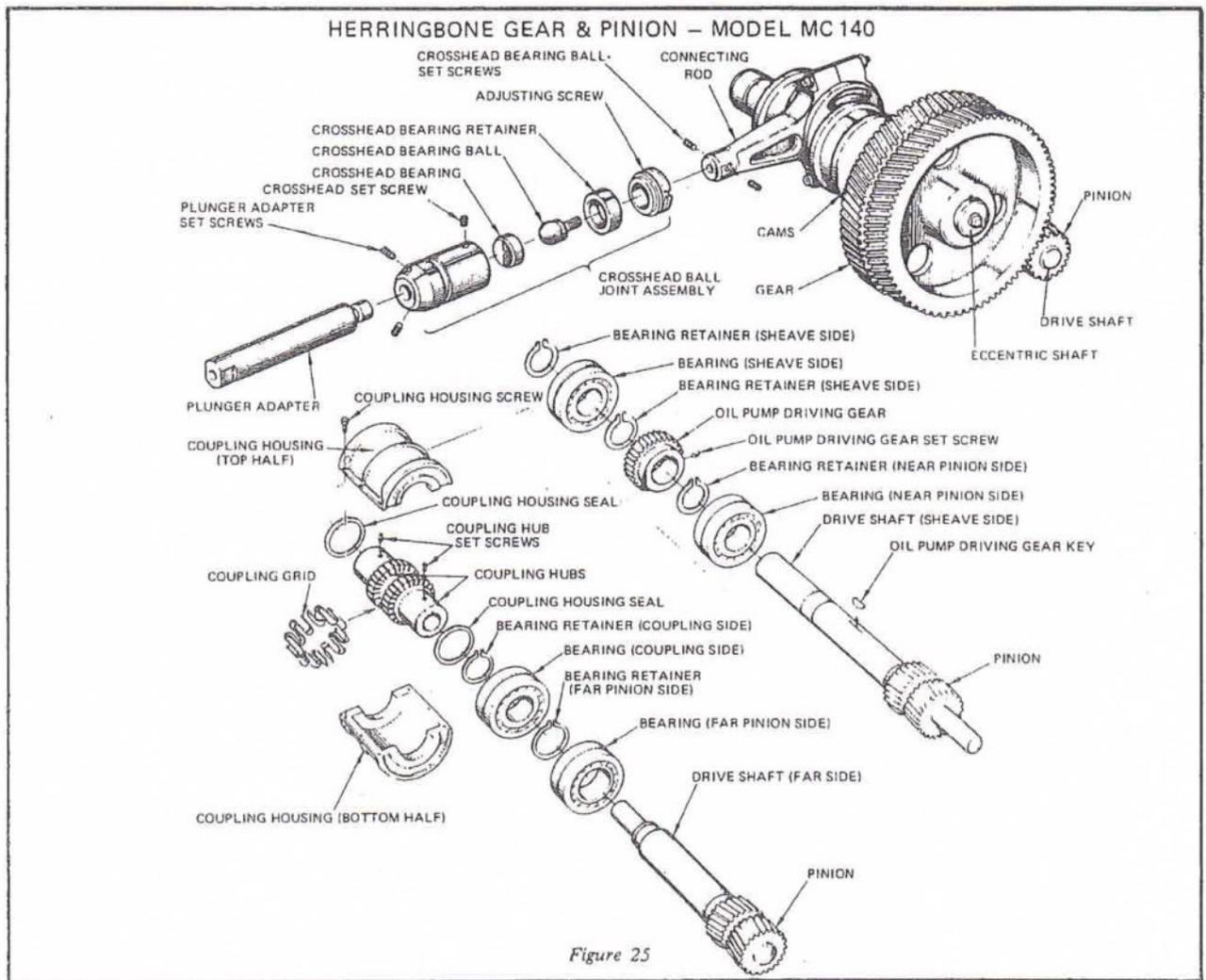


HERRINGBONE GEAR & PINION (Figure 24, Plates B168, B169)

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, undamaged side of the gear teeth will carry the load. To reverse rotation, change any two motor leads (in a three phase circuit) thus changing motor direction, also, interchange suction and discharge line connections at the lubrication oil pump. The relief valve must always be located on the discharge side.
3. Gear wear will occur over a long period of usage. It usually takes the form of a developing 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 overloading the machine.
4. Overloading 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 — but only when there is an extremely serious amount of air or starvation. Serious trouble can still be caused by these factors when the knocking sound is only faintly audible.



5. Gear noise will develop with gear wear. It will appear as a "growl" or "rumbling" sound and will be synchronous with one revolution of the large gear (one full stroke of one plunger). It usually becomes louder when pressure is applied to the machine.
 - a. Clearance between gear and pinion should be checked by measuring driveshaft end play as follows: (Note: applies to Models MC 15, MC 18/MS 18, MC 45/MS 45, MC 120)
 1. Remove cover on belt drive side.
 2. By hand, turn large driven sheave, on end of drive shaft, back and forth while pushing sheave and driveshaft in as far as it can go. If it will not slide in or out by hand, use a block of hard wood or soft metal and a sledge hammer to tap it in as far as the mesh of the gears will allow.
 3. With a pencil, mark the driveshaft against the seal retainer plate.
 4. With a large bar, force the sheave and driveshaft back out away from the base, as far as it can go
 5. Again mark the shaft.
 - b. Gear and pinion clearance for Model MC 140: Because the machine uses two separate eccentric shafts and gears, it is difficult to check clearance between the gears and pinions as can be done with the smaller machines. Therefore, instead of checking drive shaft end play, it will be necessary to use a feeler gauge as follows:
 1. Remove cover on belt drive side, stainless steel top cover and splash cover.
 2. By hand, turn large driven sheave clockwise so that pinion teeth are in contact with teeth of large herringbone gears.
 3. The clearance between the teeth will now be toward the back side of the machine.
 4. With feeler gauge, measure the clearance by inserting the gauge from the sides between the pinion gear teeth and the large gear teeth. It should measure
6. Measure the distance between the two marks. The minimum should be $1/32''$, with $3/32''$ the maximum before excess gear or bearing wear is indicated.



between .008" and .010" on the outboard edge.

5. If clearance is excessive, even though gears do not appear worn, check clearance in eccentric shaft bearings next to gears as follows:
 6. One gear at a time, using a crow bar, attempt to force gear upwards, away from pinion. Since the normal total oil film clearance in the eccentric shaft bearings is .001" per inch of diameter, it can now be determined if there is excessive lift (indicating excessive bearing wear rather than gear wear).
- c. If driveshaft end-play is excessive, even though gears do not appear worn, check clearance in eccentric shaft bearing on gear side as follows: (Note: applies to Models MC 15, 18, 45 and 120 only.)

1. Remove covers to expose large gear.

With a crow bar, attempt to force gear

upwards, away from pinion. Since the normal total oil film clearance in the eccentric shaft bearings is .001" per inch of diameter, it can now be determined if there is excessive lift (indicating excessive bearing wear rather than gear wear.).

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 one part requires replacement.
7. Herringbone gear removal is best accomplished with a hydraulic puller and pusher or, alternatively a large arbor press. In any case, each eccentric shaft and gear assembly will have to be lifted out of the machine as a unit. In preparation for this, remove the bearing caps, remove the back half of the connecting rods and slide the connecting rods toward the front end of the machine to clear the eccentric cams:

DRIVESHAFT ASSEMBLY (Figure 24, Plate B168) (Models MC 15, 18, 45, 120, MS 18, 45)

The drive shaft 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, oil pump driving gear, and drive shaft oil seal.

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 drive shaft by heating them in oil to 250°F.
4. Slide pinion end bearing into place on shaft against shoulder and install lock ring.
5. Slide oil pump driving gear into place and lock set screw against key securely.
6. Slide opposite end-bearing into place and install lock ring.
7. To remove driveshaft and pinion only, loosen or remove eccentric cap bearing screws and lift, with a chain fall or bar, eccentric gear up out of mesh with pinion. After driven sheave and seal retainer are removed, the assembly then can be driven out toward pinion side.
5. New bearings are installed on the shafts by heating them in oil to 250°F.
4. To assemble the "belt side shaft" bearings, slide the correct bearing (the smaller O.D.) from the sheave end of the shaft all the way to the shoulder next to the pinion gear. Place correct bearing lock ring in groove next to bearing.
5. Slide oil pump driving gear in place over key and lock set screw.
6. Install correct bearing lock ring in inner groove and slide outboard bearing up against it. Install second bearing lock ring in its groove.
7. "Far side shaft" bearings have different I.D.'s as well as O.D.'s so the bearing with the larger I.D. is mounted first up against the shoulder next to the pinion gear. Then install bearing lock ring. Slide inboard bearing against shoulder and install bearing lock ring.
8. Mount each half of the coupling over shafts with keys in place and tighten set screws against keys securely.
9. Each drive shaft assembly can now be installed in place from its own side.
10. See page 46 for instructions for properly synchronizing shafts.

DRIVE SHAFT ASSEMBLY (Figure 25)

Note: applies to Model MC140 only.

The drive shaft assembly consists of two separate shafts, each with its own pinion gear heat shrunk in place, two self-aligning roller bearings on each shaft (these are not the same size), bearing lock rings for each bearing, one oil pump driving gear and one drive shaft oil seal. The two shafts are connected with a mechanical coupling.

1. For purposes of identification, the shaft on which the driven sheave is located will be called the "belt side shaft" and the opposite one is the "far side shaft." Each one may be removed only through its own side.
2. The O.D. of the outboard bearing on each side is slightly larger than that of the inboard bearing. The outer bearing races have only a slight interference in the bearing housings so that the shafts can float to be self aligning. The mesh of the gears will move the shafts into alignment.

ECCENTRIC SHAFT & BEARINGS (Plate B169).

(Note - The Model MC140 uses two eccentric shafts.)

The eccentric shaft is made of a heavy, 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. Some shafts are also welded between cams for further stiffening.

1. The shaft runs in two babbit 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 the total end play of the shaft between 1/32" and 1/16".

2. The shaft is gun drilled and 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 shaft.
3. If bearing replacement is ever 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 one inch of diameter minimum. *Note:* Babbitted bearings must be scraped — not honed.

Note: on MC18 models the shaft bearing housing must be assembled with the 1/8" indicator hole at the 12 o'clock position.

4. In the event of damage to bearing 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 surfaces are only slightly grooved, the roughness can be removed using strips of emery cloth.
 - b. Even though they 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 draw filing.
 - c. If surfaces are severely damaged or undersized, the best method of repair is to have them metallized and remachined to original size.

METHOD OF SYNCHRONIZING MC140 ECCENTRIC SHAFTS

Because the Model MC140 uses two separate eccentric shafts, each with three cams spaced at 120°, it might be assumed that correct synchronization would require the two shafts to be set so that the cams would be 60° apart (6 plungers/360°). The optimum setting, however, is one which will produce the least pulsation and the lowest rate of vibration.

Through exhaustive testing and calculations the angle which has been found best in order to achieve the smoothest operation is 37° rather than 60°. If, for any reason, it is necessary to disconnect the coupling which fastens the two driveshafts together or to lift the gear (#101) up and out of mesh from the Driveshaft and Pinion (#25 & #26), the shafts must be carefully re-positioned as follows:

NOTE: When reference is made to the left or the right side of the machine or to a certain plunger assembly, stand in front of the cylinder assemblies and identify from left to right.

- a. The drive parts of both sections of the machine must be assembled.
- b. Each half of the coupling with the cover and seal must be loosely assembled to each respective drive shaft.
- c. The coupling gap between each half, as well as alignment, must be carefully set. Contact factory for detailed instructions.
- d. Once the gap and alignment are determined, the positioning of the shafts can be accomplished to best synchronize both assemblies.
- e. See "Note" above. Rotate eccentric shafts until number one and six Crosshead assemblies are at their maximum forward positions.
- f. Facing the righthand side of the machine, at the eccentric gear, rest the base of a machinist's or carpenter's square on the top edge of the base casting. Sight up the side of the square and locate the gear tooth which is positioned at top dead center (12 o'clock).
- g. Rotate the gear assembly backward (clockwise) approximately 18 teeth.
- h. The two grooves of the coupling halves are then aligned for installation of the grids.
- i. Make certain the grids and covers are fixed firmly to avoid vibration.

For further installation and maintenance instructions regarding the MC140 Drive Shaft Coupling, refer to the attached sheet.

CONNECTING ROD & CROSSHEAD ASSEMBLIES (Figures 24, 25 and Plate B169).

On all MC Models except the MC140, connecting rod sub-assembly consists of the two halves of the Connecting Rod, (Items 72 & 76) a set of two steel-backed, babbitted Bearing Halves (Item 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 (84) must be ordered as a separate part.

On the Model MC 140 (Figure 25) the connecting rod sub-assemblies consist of the two halves of the Connecting Rod, a set of two steel-backed, babbitted Bearing Halves, two Bolts with Lock Nuts, a Crosshead

Bearing Retainer Nut, Bearing Retainer and Ball. The Crosshead Sub-Assembly includes only the Crosshead and Set Screws. The Crosshead Bearing must be ordered as a separate part.

1. 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 dowels. *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 shimmed out or replaced.
2. After connecting rod-bolt locknuts are removed and replaced a number of times, the locknuts will begin to slip and loosen up. When annual or semi-annual inspection reveals this, replace them promptly with new ones.
3. On Model MC 18 machines, the torque requirement for tightening the crosshead bearing ball into the connecting rod is 130 foot pounds, unlubricated. (Loosen set screws before tightening.)

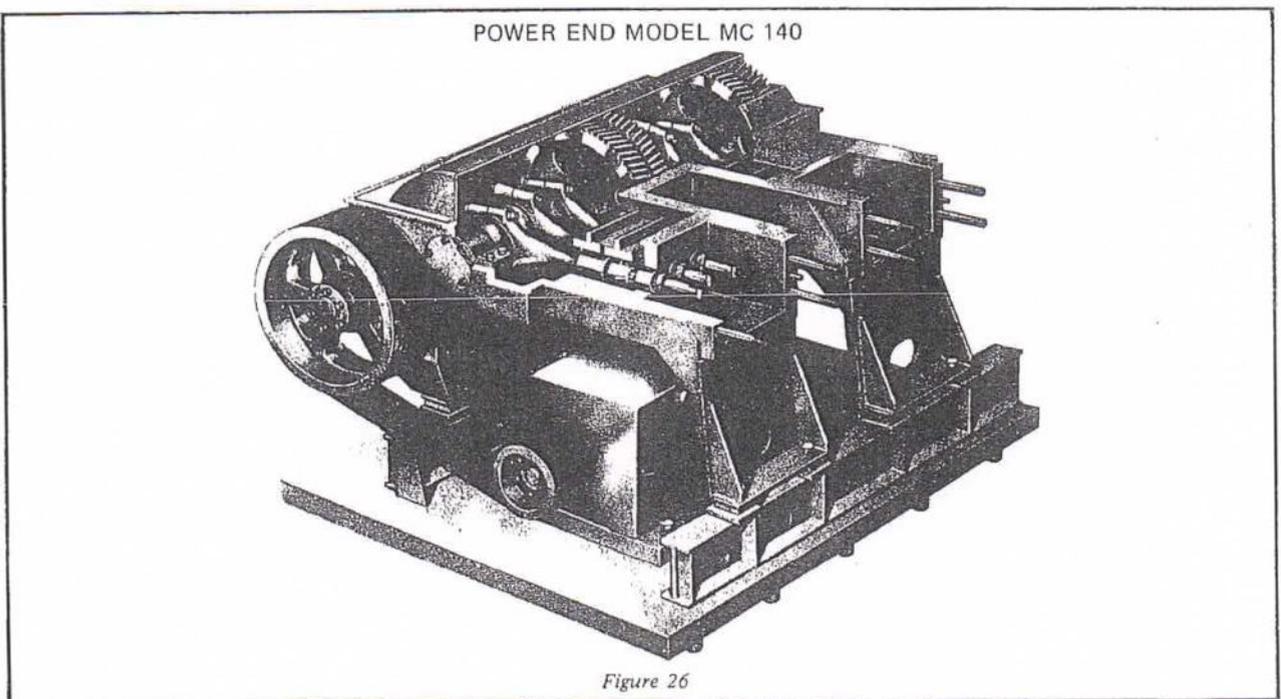
On all other Model MC machines, the torque requirement is 370 foot pounds, unlubricated. (Loosen set screws before tightening.)

4. The crosshead ball and socket adjustment should be kept properly adjusted since wear increases rapidly if they are allowed to slap. Adjust as follows:
 - a. Remove oil line and crosshead cover.
 - b. On MC Models, turn crosshead by means of Plunger Adapter Item (88) until Crosshead Set Screw (85) is exposed.
 - c. On MC140, turn crosshead by means of Plunger Adapter until Crosshead Set Screw is exposed.
 - d. Loosen set screw.
 - e. Hold Bearing Retainer Nut with spanner wrench while slowly turning plunger adapter with its wrench, until a slight drag is noticed on plunger adapter.
 - f. Lock set screw at that point.
 - g. Repeat with others and replace cover plate and oil lines.

PLUNGER ADAPTER & BAFFLE SEAL PACKING (Plates B169, B172)

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

1. Tighten the two Plunger Adapter Set Screws to pull adapter back against square end of crosshead, holding adapter in alignment.



2. The shoulder of the plunger, tightened against the shoulder on the threaded end of the adapter, maintains and extends the alignment to the plunger.
3. Damage to threads in the stainless-steel adapter generally should only be repaired by grinding or cutting away the damaged thread. A tap can be used to correct the thread.
4. Baffle packing consists of one teflon washer, two pieces of square braided packing and one more teflon washer, in that order. With the adapter in place, install parts in the baffle gland being careful that they go completely into place. Tighten adjusting nut firmly while machine is running.

TROUBLE SHOOTING GUIDE

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3. Pump valve sticking		32
4. Air lock		24, 25, 26
5. Loose ball joints		47
6. Connecting rod bearings		38, 41, 46
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8. Loose plunger		38, 41, 47
9. Loose plunger adapter		38, 41, 47
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Squealing sound		
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3. Motor bearings		14, 35
4. Loose belts		14
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1. Driving sheaves loose	Realign & tighten	
2. Gear oil guard loose	Tighten	
Machine labors or slows down		
1. Overload on machine		17
2. Loose belts		14
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Too low		
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From front caps	Check gasket and gasket seat areas for grooves, scores, etc.	31, 32
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1. Bad gasket	Replace	
2. Damaged gasket seat	Smooth up scratches	
From valve assembly		
1. Valve seat-gasket	Replace	
2. Valve rod gasket	Replace	
Around plungers		
1. Plunger packing failure		31

CAUSE	CORRECTION	PAGE
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1. Front caps misassembled		31
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3. Shoulder studs (two diameter) break	New studs must be torqued into cylinder.	31
4. Any cylinder stud failure	New studs must be torqued into cylinder.	31
PRODUCT PRESSURE GAUGE		
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4. Air lock		24, 25, 26
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1. Product pressure gauge		33
Pressure drops		
1. Thermal expansion	When valve assembly temperature becomes stable, pressure should remain constant.	
Pressure wanders up & down		
1. Product lodged between pump valve and seat	Clear valve by changing adjustment up and down or by disassembling to clean.	
2. Build up, making pump valve bind	Disassemble and clean.	
Gauge does not return to 0		
1. Defective gauge	Replace	
Cannot obtain required pressure		
1. Homogenizing valve and seat worn		33, 34
2. Air in product		18, 33
3. Starved inlet		16
4. Air lock		24, 25, 26
5. Valve rod binding	Remove any burrs with emery cloth. If rod is bent, replace.	
6. Homogenizing Valve binding	Clean product build up and polish off any burrs.	
HEAT EXCESSIVE		
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1. Eccentric shaft bearings damaged		38, 41, 45, 46
2. Drive shaft bearings		37, 40, 45
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5. Insufficient oil		12
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HOMOGENIZING EFFICIENCY

Gradually becomes worse over period of weeks

- | | | |
|--|---|--------|
| 1. Valve & seat wearing | 1st stage of 2 stage assembly only | 33, 34 |
| 2. Valve or valve rod developing | Clean up parts with emery cloth
galling or burrs | |

Varies up and down from day to day or hour to hour

- | | | |
|--|---|--------|
| 1. Symptom of intermittent air | Entrained air in product destroys efficiency and
incorporation | 18, 33 |
| 2. If product high pressure gauge wanders, . . . | Check for product build up in valve
valve is not remaining stable | |

Efficiency drops suddenly and does not improve

- | | | |
|--|--|--------|
| 1. Valve or valve seat damaged | | 33, 34 |
| 2. Gauge defective | | 21, 33 |
| 3. Ingredients in a manufactured | Formulation may be different. If new
product have changed or are from
a new lot. | 26 |
| 4. Change in process system | Evaluate possible new machine requirements. | 26 |
| 5. Damage to pump valve or seat | Replace or regrind faulty pump valve and seat. | 32 |

LUBRICATION OIL

Pressure gauge shows drop in pressure

- | | | |
|---|--|--|
| 1. Pressure always drops as oil | It should level off to a pressure of 20-40
heats up and thins | |
| 2. Relief valve adjustment | Disassemble relief valve in oil pump and free it
sticking | |
| 3. Oil filter cartridge clogging | Replace cartridge
or collapsing | |
| 4. Oil line fitting has become loose, | Check all lines and tighten or replace as neces-
sary. | |

Oil becomes milky colored

- | | | |
|-------------------------------|--|----|
| 1. Water in the oil | | 13 |
|-------------------------------|--|----|

Gauge fluctuates

- | | | |
|--|---|----|
| 1. Air in lube system | Loosen gauge with machine running to bleed
off air. | |
| 2. Connecting rod bearings damaged | Replace | 47 |
| 3. Ball joint loose | | |
| 4. Dampener screw in gauge | Screws sometimes back out due to vibration.
inlet not in place | |
| 5. Gauge defective | Tighten
Replace | |

Oil level drops too fast.

- | | | |
|---|--|------------|
| 1. Leaking through baffle packing | | 38, 41, 47 |
| 2. Leaking into oil cooler if water | Indicates cooler is defective. Replace.
pressure is low | |
| 3. Too much oil being drained when | Caution operator
petcock is open to drain water | |

Oil temperature too high.

- | | | |
|--|---|--------|
| 1. Wear in drive parts | | 12, 13 |
| 2. Oil pressure set too high | | 35, 36 |
| 3. Cooling water temperature | Water temperature above 85° F. requires that larger
too high | |

CAUSE

CORRECTION

PAGE

VIBRATION

Machine vibrates

- 1. Legs not all tight to the floor Relevel machine.
- 2. Balance weights missing If mark of missing weight is visible, sheave
from sheaves must be balanced.
- 3. Air in product or starved inlet 16, 18, 33

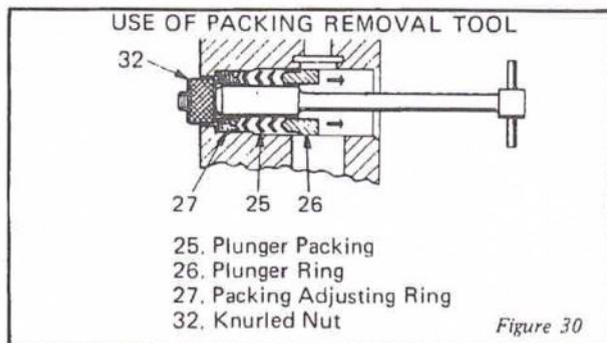
Suction or discharge lines vibrate

- 1. Pressure too high in lines 18

TPS CYLINDER INSTRUCTIONS

CYLINDER DISASSEMBLY

1. Remove the Gauge Stud Nuts (#43) and remove Gauge (#41).
2. Remove the Gauge Block Stud Nuts (#40) and remove Gauge Block (#37).
3. Remove Inlet Stud Nuts (#18) from Inlet Connection (#17) and from Cylinder Inlet Cap (#31) on the opposite end of the cylinder.
4. Remove Inlet Connection (#17), Inlet Cap (#31) and Inlet Gaskets (#16).
5. Remove Upper Cylinder Cap Nuts (#1), Upper Cylinder Caps (#2) and Upper Cylinder Cap Gaskets (#3).
6. Remove Discharge Valve Springs (#5).
7. Remove Front Cylinder Cap Nuts (#30).
8. Remove Front Cylinder Caps (#29) and Front Cylinder Cap Gaskets (#28).
9. Remove Packing Adjusting Springs (#24).
10. With wrench provided, attach to the flats of each Plunger Adapter (#88) (see Plate B169 for MC Models only, not necessary on MC 4, M6 Models.) Loosen and remove Plungers (#11) with plunger wrench.
11. Remove Packings (#25) by using Packing Removal Tool (N) (see drawing below). First remove knurled nut from tool. Next, slide tool through packing assembly. Replace knurled nut and remove each packing assembly, consisting of Plunger Ring (#26) and Packing (#25) if previously inserted, and Packing Adjusting Ring (#27).



12. With Valve Removing Tool (B), lift and remove Suction Valves (#20) and Discharge Valves (#8).

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

After cleaning all cylinder parts, please perform the following reassembly procedures:

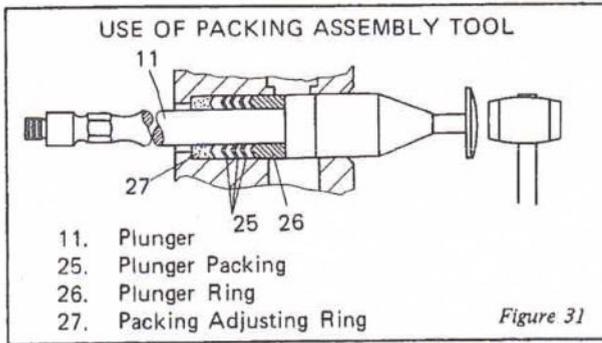
1. With tool provided, install Suction and Discharge Valves.
2. Install Discharge Valve Springs (#5) on center of Discharge Valves (#8).
3. Attach Upper Cylinder Cap Gaskets (#3) onto Upper Cylinder Caps (#2).
4. Install Upper Cylinder Caps (#2) with Gaskets (#3), making sure that stems on the underside 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:

(Note: Before assembly, these parts should be coated with a lubricant which is compatible with the product to be processed. Also, all threads and nut faces should be coated with an acceptable lubricant.)

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.

PLATE C213 (B)

- Carefully insert plunger and packing assemblies through the front of the cylinder ports and thread and tighten Plunger (#11), into Plunger Adapters (#88). (See attached drawing for correct positioning of parts.)



- Using Packing Assembly Tool (0) and hammer, gently tap packing assemblies into cylinder bores until solid seating is obtained.
- Install Packing Adjusting Springs (#24).
- Install Front Cylinder Cap Gaskets (#28), on Caps (#29) and on Cap Studs (#23), and replace

Front Cylinder Cap Nuts (#30). Tighten firmly and evenly by hand before securing with a wrench. 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. Cap 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.

- Install Gauge Block Gasket (#39) and assemble Gauge Block (#37) to Cylinder (#10). Tighten securely.
- Install Gauge Gasket (#42) and Gauge (#41) to Gauge Block (#37). Tighten nuts uniformly.
- Replace Inlet Gaskets (#16) on Inlet Connection (#17) and Inlet Cap (#31).
- Install and tighten Inlet connection and inlet Cap Stud Nuts (#18).

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

TPS CYLINDER PARTS LIST

Item No.	Part Name	MC15			Item No.	Part Name	MC15		
		MC4	MC140 (2x45)	MC120			MC4	MC140 (2x45)	MC120
1	Upper Cap Stud Nut	6	6	10	24	Packing Spring	3	3	5
2	Upper Cap	3	3	5	25	Plunger Packing	vary	vary	vary
3	Upper Cap Gasket	3	3	5	26	Plunger Ring	3	3	5
5	Discharge Valve Spring	3	3	5	27	Packing Adjusting Ring	3	3	5
8	Discharge Poppet Valve	3	3	5	28	Front Cap Gasket	3	3	5
9	Tapered Discharge Valve Seat	3	3	5	29	Front Cap	3	3	5
10	Cylinderblock	1	1	1	30	Front Cap Stud Nut	6	6/12	20
11	Plunger	3	3	5	31	Inlet Cap Gauge	—	1	1
14	Upper Cap Stud	6	6	10	37	Gaugeblock	—	1	—
15	Inlet Connection Stud	2	4	4	38	Gauge Stud	2	2	2
16	Inlet Connection Gasket	1	2	2	39	Gauge Block Gasket	—	1	—
17	Inlet Connection	1	1	1	40	Gauge Block Stud Nut	—	2	—
18	Inlet Connection Stud Nut	2	4	4	41	Gauge with Flange	1	1	1
19	Tapered Suction Valve Seat	3	3	5	42	Gauge Gasket	1	1	1
20	Suction Poppet Valve	3	3	5	43	Gauge Stud Nut	2	2	2
23	Front Cap Stud	6	6/12	20	46	Gauge Block Stud	—	2	—

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

TAPERED SEAT POPPET VALVE CYLINDER (TPS)

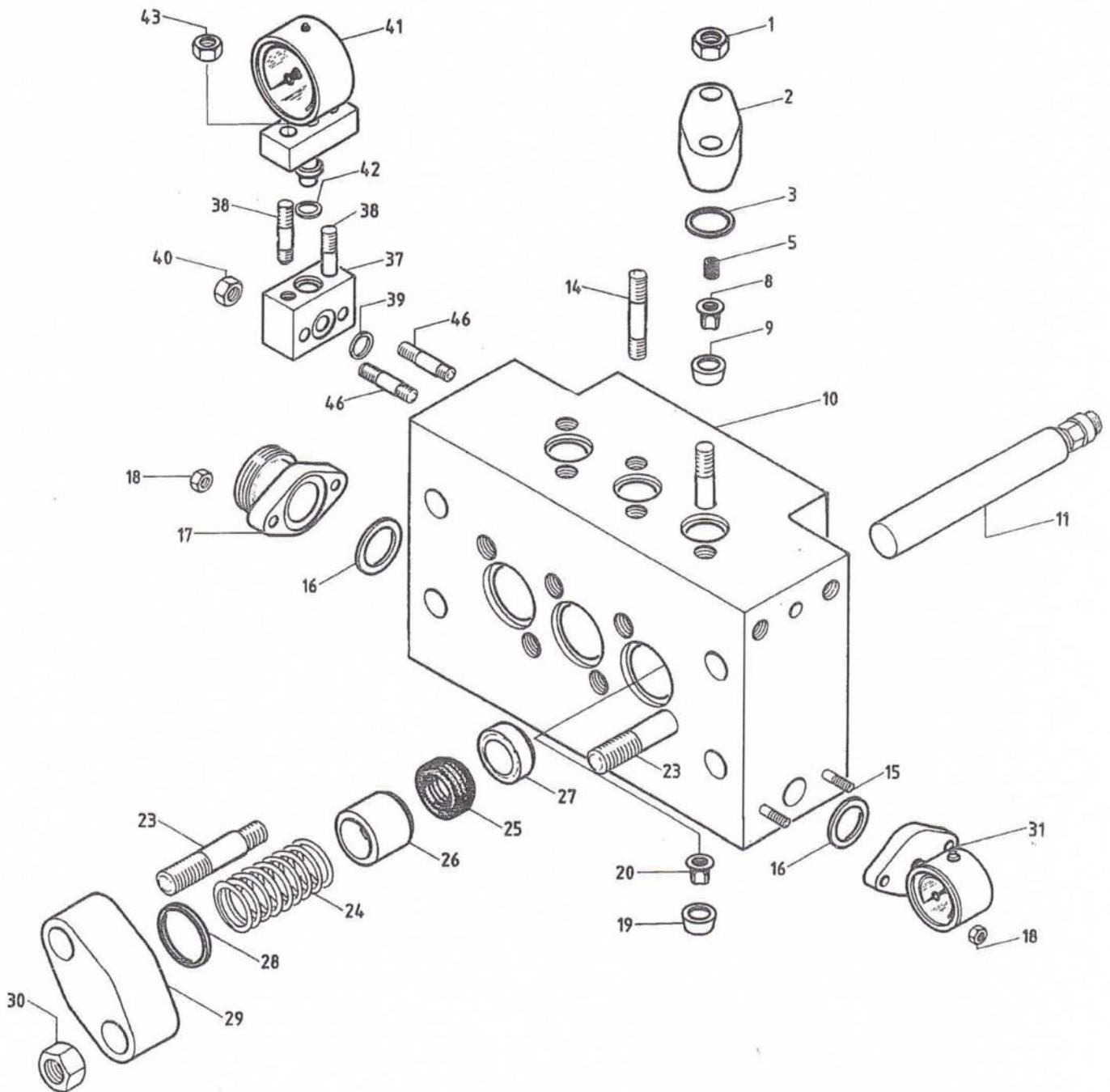


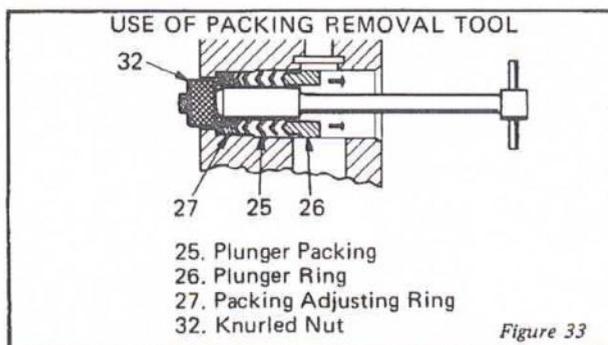
Illustration is for Triplex Units, applicable to Quintuplex Models.

Figure 32

TBS CYLINDER INSTRUCTIONS

CYLINDER DISASSEMBLY

1. Remove the Gauge Stud Nuts (#43) and remove Gauge (#41).
2. Remove the Gauge Block Stud Nuts (#40) and remove Gauge Block (#37).
3. Remove Inlet Stud Nuts (#18) from Inlet Connection (#17) and from Cylinder Inlet Cap (#31) on the opposite end of the cylinder.
4. Remove Inlet Connection (#17), Inlet Cap (#31) and Inlet Gaskets (#16).
5. Remove Upper Cylinder Cap Nuts (#1), Upper Cylinder Caps (#2) and Upper Cylinder Cap Gaskets (#3).
6. Remove Front Cylinder Cap Nuts (#30).
7. Remove Front Cylinder Caps (#29) and Front Cylinder Cap Gaskets (#28).
8. Remove Packing Adjusting Springs (#24).
9. With wrench provided, attach to the flats of each Plunger Adapter (#88) (see Plate B169 for MC Models only, not necessary on M6 Models.) Loosen and remove Plungers (#11) with plunger wrench.
10. Remove Packings (#25) by using Packing Removal Tool (N) (see drawing below). First, remove knurled nut from tool. Next, slide tool through packing assembly. Replace knurled nut and remove each packing assembly, consisting of Plunger Ring (#26) and Packing (#25) if previously inserted, and Packing Adjusting Ring (#27).



11. Remove discharge valve springs (#5), spring buttons (#6).

12. Remove discharge valve guide retaining springs (#4).
13. With valve stop removing tool (M), remove suction valve stops (#22).
14. With valve removing tool (A), lift and remove suction valves (#20) and discharge valves (#8).
15. With valve guide removing tool (C) remove suction valve guides (#21) and discharge valve guides (#7).

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.

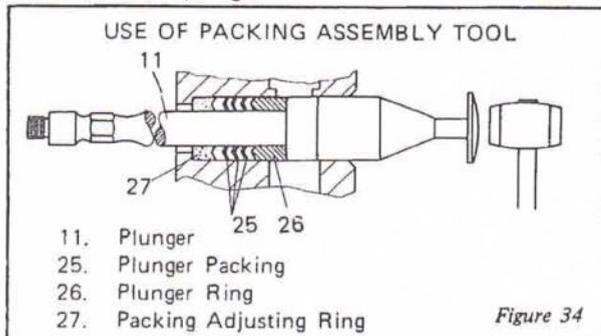
CYLINDER REASSEMBLY

After cleaning cylinder and parts please perform the following reassembly procedure.

1. With tool provided install suction valves (#20) and discharge valves (#8).
2. Install suction valve guides (#21) and discharge valve guides (#7).
3. Install suction valve stops (#22) with valve stop removing tool (M).
4. Install discharge valve guide retaining springs (#4).
5. Attach discharge valve springs (#5) to spring buttons (#6) and assemble to top of discharge valves (#8).
6. Install upper cylinder cap gaskets (#3) into gasket recesses and install upper cylinder caps (#2) making sure that stems on the underside of caps enter discharge valve springs (#5).
7. When possible use an acceptable lubricant on packing assembly parts, plunger ring (#26) plunger packing (#25) and packing adjusting ring (#27) and assemble as a unit on to plunger (#11).

PLATE C213 (C)

8. Slide front end of plunger (#11) through the packing assembly, starting from the packing adjusting ring side, through the plunger packing and plunger ring.
9. Carefully insert plunger (#11) with the packing assembled, into the cylinder port from the front and securely tighten plungers (#11) to plunger adapters (#88) with wrenches provided. Repeat with all plungers.



10. Using packing assembly tool (O) drive packing assemblies home as far as they will go into cylinder bores. Refer to sketch. Repeat with all assemblies.
11. Install packing adjusting springs (#24).
12. Install front cylinder cap gaskets (#28) into gasket recesses and place front cylinder caps (#29) on the front cylinder cap studs (#23).

13. Lubricate all threads and flat faces on nuts and install front cylinder cap nuts (#30) to studs (#23) upper cylinder cap nuts (#1) to studs (#14). Tighten firmly and evenly by hand and then securely with wrench. Be sure that nuts are tight and that caps are NOT TIPPED. THEY MUST BE PARALLEL TO FACE OF CYLINDER. If they are not square with the cylinder, the studs can bend in operation and they will fail from metal fatigue.
14. Install cylinder inlet gaskets (#16) on inlet connection (#17) and inlet cap (#31) and install on inlet studs (#15).
15. Install inlet stud nuts (#18) on inlet studs (#15) and tighten evenly and firmly.
16. Install gauge block gasket (#39) into gasket recess and assemble gauge block (#37) onto gauge block studs (#46).
17. Install gauge block nuts (#40) onto gauge block studs (#46) and tighten evenly and firmly.
18. Install gauge gasket (#42) into gasket recess and assemble gauge and flange to gauge studs (#38).
19. Install gauge stud nuts (#43) and tighten evenly and firmly.

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

TBS CYLINDER PARTS LIST

Item No.	Part Name	MC15			Item No.	Part Name	MC15		
		MC4	MC140 (2x45)	MC120			MC4	MC140 (2x45)	MC120
1	Upper Cap Stud Nut	6	6	10	23	Front Cap Stud	6	6/12	20
2	Upper Cap	3	3	5	24	Packing Spring	3	3	5
3	Upper Cap Gasket	3	3	5	25	Plunger Packing	vary	vary	vary
5	Discharge Valve Spring	3	3	5	26	Plunger Ring	3	3	5
7	Discharge Valve Guide	3	3	5	27	Packing Adjusting Ring	3	3	5
8	Discharge Ball Valve	3	3	5	28	Front Cap Gasket	3	3	5
9	Tapered Discharge Valve Seat	3	3	5	29	Front Cap	3	3	5
10	Cylinderblock	1	1	1	30	Front Cap Stud Nut	6	6/12	20
11	Plunger	3	3	5	31	Inlet Cap Gauge	—	1	1
14	Upper Cap Stud	6	6	10	37	Gauge Block	—	1	—
15	Inlet Connection Stud	2	4	4	38	Gauge Stud	2	2	2
16	Inlet Connection Gasket	1	2	2	39	Gauge Block Gasket	—	1	—
17	Inlet Connection	1	1	1	40	Gauge Block Stud Nut	—	2	—
18	Inlet Connection Stud Nut	2	4	4	41	Gauge with Flange	1	1	1
19	Tapered Suction Valve Seat	3	3	5	42	Gauge Gasket	1	1	1
20	Suction Ball Valve	3	3	5	43	Gauge Stud Nut	2	2	2
21	Suction Valve Guide	3	3	5	46	Gauge Block Stud	—	2	—
22	Suction Valve Stop	3	3	5					

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

TAPERED BALL VALVE SEAT CYLINDER (SPRING-LOADED PACKING) (TBS)

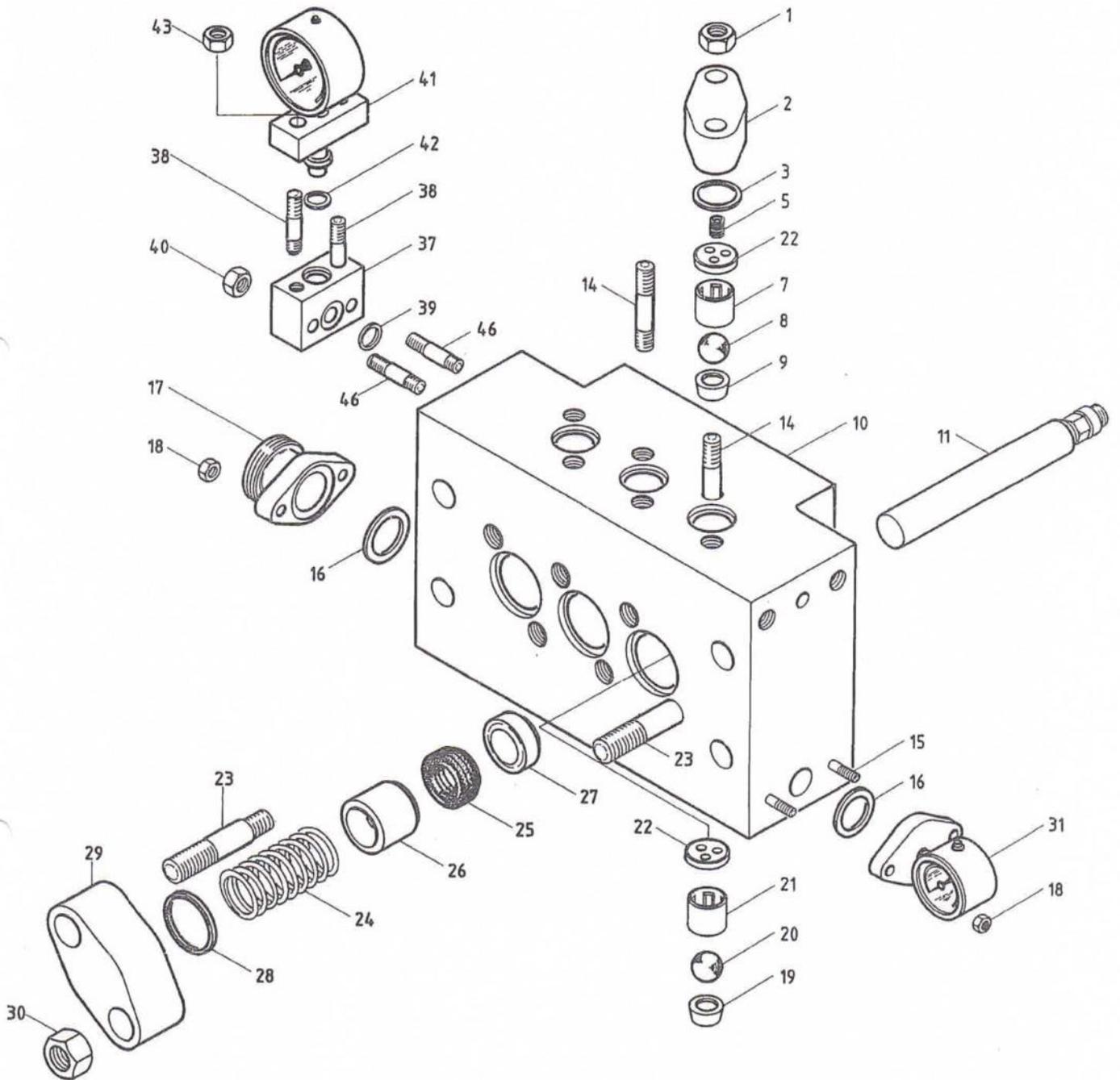


Illustration is for Triplex Units, applicable to Quintuplex Models.

Figure 35

PLATE V216 (C)

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

VALVE DISASSEMBLY

1. Remove single-stage Valve Body Stud Nuts (#5), single-stage Handwheel (#9) and Handwheel Support assembly (#4).
2. Remove single-stage Valve Body (#2) assembly, being careful not to drop valve components.
3. Remove Valve Seat Gasket (#14), Valve Seat (#13), Impact Ring (#12), Valve Guide (#15) with Gasket (#16), and Valve (#11) with Valve Gaskets (#17), if used.

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

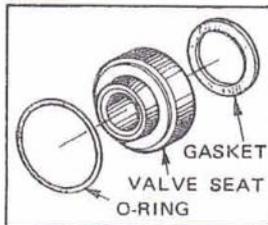
Be careful to prevent metal parts from striking each other or other metal objects.

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.

Note: If your machine is furnished with a Hydraulically Actuated Homogenizing Valve Assembly (HVA) also see Plate V220 for complete reassembly instructions

VALVE REASSEMBLY

1. Lubricate Valve (#11) with an acceptable lubricant and insert into Valve Guide (#15), if used, making sure that the valve moves freely.
2. Reinstall Valve Guide Gasket (#16), if used.
3. Insert this assembly into Valve Body (#2).
4. Reinstall Impact Ring (#12), Valve Seat (#13), and Valve Seat Gasket (#14).
5. Slide valve body assembly over Studs (#1).
6. Reassemble Handwheel (#9) and Handwheel Support (#4) assembly on studs.
7. Replace Stud Nuts (#5) and tighten evenly and securely.



Valve Seat Used On Some Assemblies

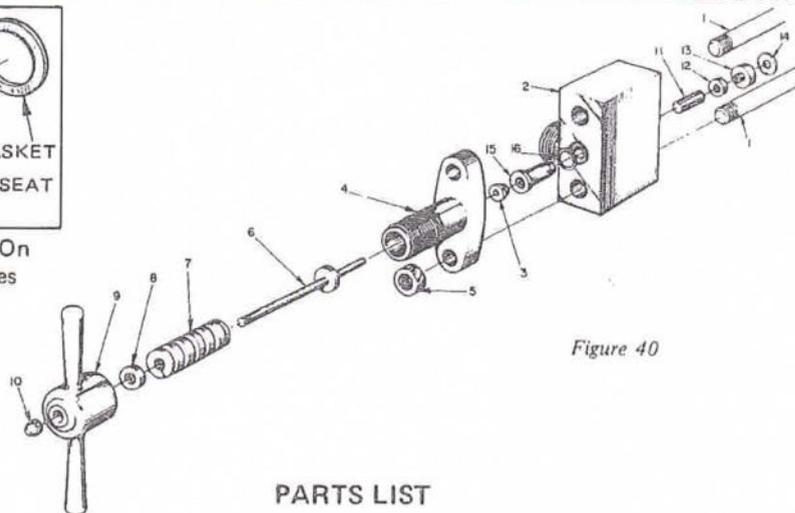


Figure 40

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.

PLATE V216 (D)

SINGLE-STAGE SUB-MICRON DISPERSER(SMD) VALVE ASSEMBLY INSTRUCTIONS AND PARTS LIST

VALVE DISASSEMBLY

1. Remove single-stage Valve Body Stud Nuts (#5), single-stage Handwheel (#9), and Handwheel Support assembly (#4).
2. Remove single-stage Valve Body (#2) assembly, being careful not to drop valve components.
3. Remove Valve Seat Gasket (#14), Valve Seat Assembly (#19), Impact Ring (#12), Valve Insert (#11), Valve Guide (#15) with Gasket (#16), Valve Holder (#18) and Valve Gaskets (#17).

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

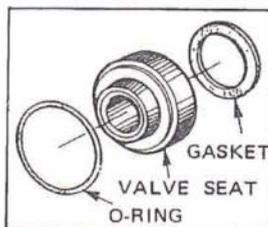
Be careful to prevent metal parts from striking each other or other metal objects.

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.

Note: If your machine is furnished with a Hydraulically Actuated Homogenizing Valve Assembly (HVA) also see Plate V220 for complete reassembly instructions

VALVE REASSEMBLY

1. Lubricate Valve (#11) and Gaskets (#17) with an acceptable lubricant and insert into Valve Guide (#15), if used, making sure that valve moves freely.
2. Reinstall Valve Guide Gasket (#16), if used.
3. Replace Valve Insert (#11) into Valve Holder (#18).
4. Reinstall Gaskets (#17).
5. Lubricate Valve Holder (#18) and Valve Holder Gaskets (#17) with an acceptable lubricant, making sure that Valve Holder (#18) moves freely.
6. Insert assembly into Valve Body (#2) or Valve Guide (#15), if used.
7. Install Impact Ring (#12), Valve Seat Assembly (#19), and Valve Seat Gasket (#14).
8. Slide valve body assembly over Studs (#1).
9. Reassemble Handwheel (#9) and Handwheel Support (#4) assembly on studs.
10. Replace Stud Nuts (#5) and tighten evenly and securely.



Valve Seat Used On Some Assemblies

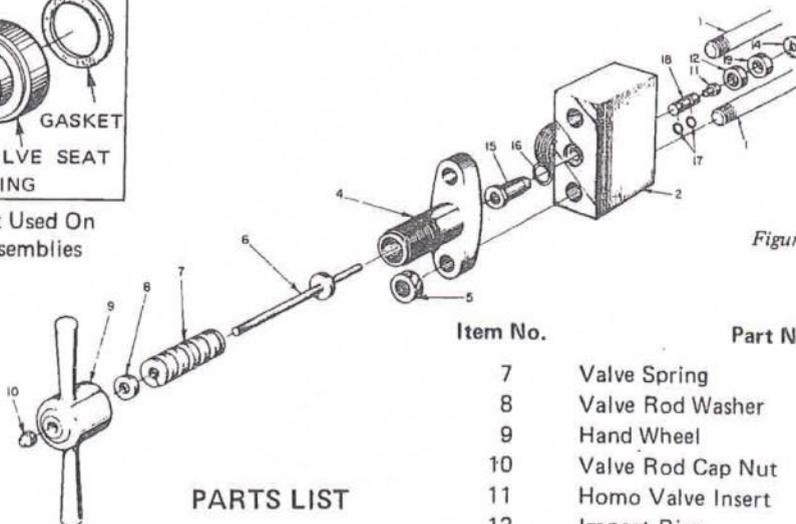


Figure 41

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
4	Hand Wheel Support	1	9	Hand Wheel	1
5	Valve Body Stud Nut	2	10	Valve Rod Cap Nut	1
6	Valve Rod	1	11	Homo Valve Insert	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 Gasket	2
			18	Homo Valve Holder	1
			19	Homo Valve Seat Assembly	1

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

PLATE V216 (E)

SINGLE-STAGE HOMOGENIZING VALVE ASSEMBLY INSTRUCTIONS AND PARTS LIST

VALVE DISASSEMBLY

1. Remove single-stage Value Body Stud Nuts (#5), single-stage Handwheel (#9) and Handwheel Support assembly (#4).
2. Remove single-stage Valve Body (#2) assembly, being careful not to drop valve components.
3. Remove Valve Seat Gasket (#14), Valve Seat (#13) and 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 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.

Note: If your machine is furnished with a Hydraulically Actuated Homogenizing Valve Assembly (HVA) also see Plate V220 for complete reassembly instructions

VALVE REASSEMBLY

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 steam 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 Valve Body (# 2) over Studs (#1).
5. Reassemble Handwheel (#9), and Handwheel Support (#4) assembly on studs.
6. Replace Stud Nuts (#5) and tighten evenly and securely.

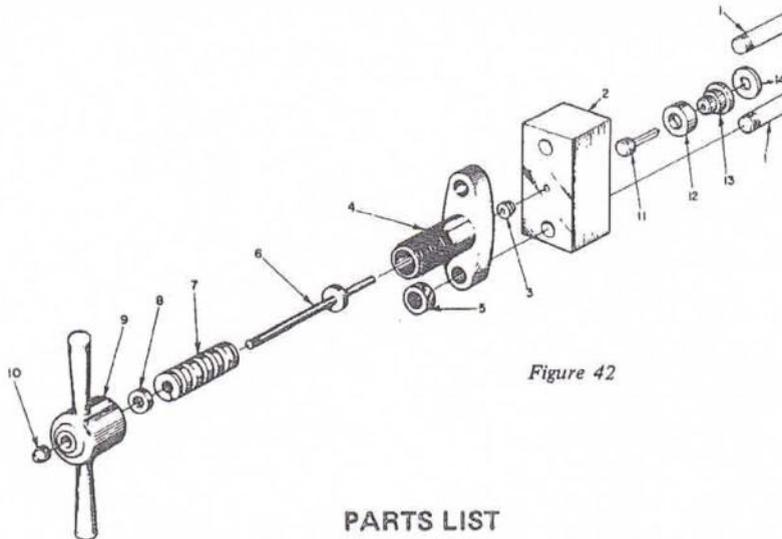


Figure 42

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.

PLATE V216 (F)

MANUALLY OPERATED RELIEF VALVE AND HIGH PRESSURE DISCHARGE BLOCK ASSEMBLY INSTRUCTIONS AND PARTS LIST

VALVE DISASSEMBLY

1. Remove Valve Body Stud Nuts (#5), Handwheel (#9), Handwheel Support assembly (#4).
2. Remove Valve Body (#2), being careful not to drop the valve, seat and impact ring.
3. Remove Valve (#11), Seat (#13), Impact Ring (#12) and Valve Seat Gasket (#14) 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.

Note: If your machine is furnished with a Hydraulically Actuated Homogenizing Valve Assembly (HVA) also see Plate V220 for complete reassembly instructions

VALVE REASSEMBLY

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. Reassembly Handwheel (#9) and Handwheel Support assembly (#4) onto Studs (#1).
6. Replace Valve Body Stud Nuts (#5) and tighten evenly and securely.

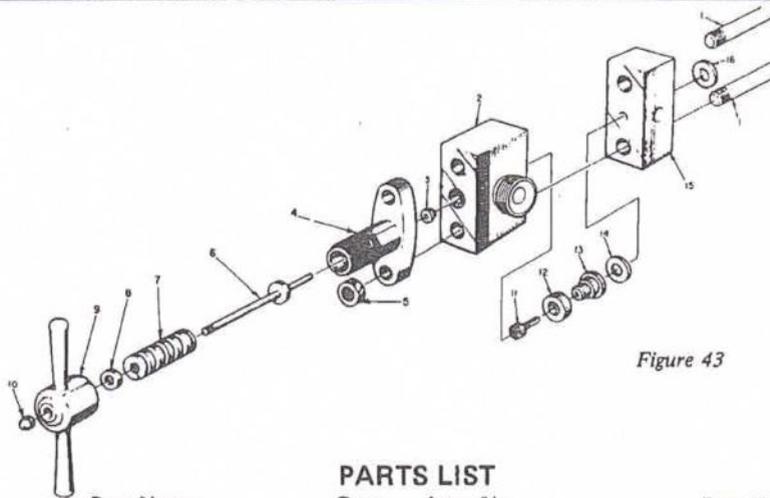


Figure 43

PARTS LIST		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.

PLATE V 217 (C)

HOMOGENIZING VALVE INSTRUCTIONS

VALVE DISASSEMBLY

1. Remove second-stage Valve Body Stud Nuts (#27), second-stage Handwheel (#31) and Handwheel Support assembly (#26).
2. Remove the second-stage Valve Body (#24) being careful not to drop the valve and seat.
3. Remove Valve (#23) and Seat (#22) from second-stage Body (#24).
4. Remove first-stage Valve Body Stud Nuts (#5), first-stage Handwheel (#9) and Handwheel Support (#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) Valve Guide (#15) with Gasket (#16), and Valve (#11) with Valve Gaskets (#17), if used.

Note: If your machine is furnished with a Hydraulically Actuated Homogenizing Valve Assembly (HVA) also see Plate V220 for complete reassembly instructions.

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

1. Lubricate Valve (#11) with an acceptable lubricant and insert into Valve Guide (#15), if used, making sure that the valve moves freely.

NOTE: When installing Valve (#11) the solid end of the valve must be located against the seat.

2. Reinstall Valve Guide Gasket (#16).
3. Insert this assembly into Valve Body (#2).
4. Reinstall Impact Ring (#12), Valve Seat (#13), and Valve Seat Gasket (#14).
5. Slide valve body assembly over Studs (#1).
6. Reassemble Handwheel (#9) and Handwheel Support (#4) assembly on studs.
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 (#11) remains inserted into Valve Seat (#13) 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. Assemble Handwheel Support (#26) and Handwheel (#31) as a unit onto Valve Body Studs (#20).
12. Replace Stud Nuts (#27) and tighten evenly and securely.

PLATE V 217 (C)

TWO-STAGE HOMOGENIZING VALVE ASSEMBLY (First-Stage is Fluted Plug Valve, Second-Stage is Piloted Valve)

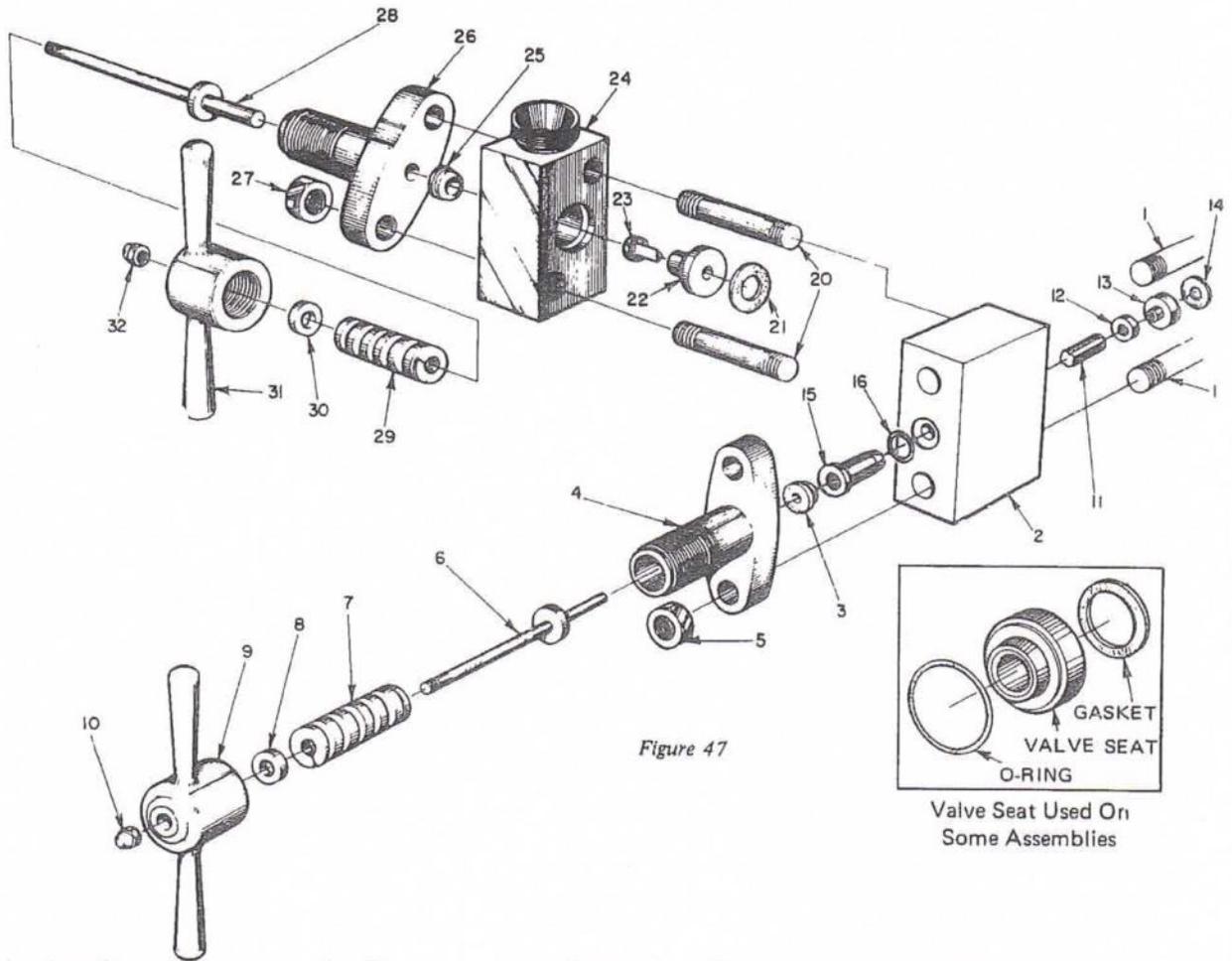


Figure 47

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
FIRST STAGE			SECOND STAGE		
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

PLATE V 217 (D)

SUB-MICRON DISPERSER VALVE INSTRUCTIONS

VALVE DISASSEMBLY

1. Remove second-stage Valve Body Stud Nuts (#27), second-stage Handwheel (#31) and Handwheel Support assembly (#26).
2. Remove second-stage Valve Body (#24) being careful not to drop the valve and seat.
3. Remove Valve (#23) and Seat (#22) from second-stage Body (#24).
4. Remove first-stage Valve Body Stud Nuts (#5), first-stage Handwheel (#9) and Handwheel Support (#4).
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), Impact Ring (#12), Valve Insert (#11), Valve Guide (#15) with Gasket (#16), Valve Holder (#18) and Valve Gaskets (#17).

Note: If your machine is furnished with a Hydraulically Actuated Homogenizing Valve Assembly (HVA) also see Plate V220 for complete reassembly instructions.

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

1. Lubricate Valve Holder (#18) and Gaskets (#17) with an acceptable lubricant and insert into Valve Guide (#15), making sure that valve holder moves freely.
2. Reinstall Valve Guide Gasket (#16).
3. Insert this assembly into Valve Body (#2).
4. Replace Valve Insert (#11) into Valve Holder (#18).
5. Install Impact Ring (#12), Valve Seat Assembly (#13), and Valve Seat Gasket (#14).
6. Slide valve body assembly over Studs (#1).
7. Reassemble Handwheel (#9) and Handwheel Support (#4) assembly on studs.
8. Replace Stud Nuts (#5) and tighten evenly and securely.
9. 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.

10. Install Valve Seat Gasket (#21).
11. Assemble second-stage valve body to first-stage valve assembly on Studs (#20).
12. Assemble Handwheel Support (#26) and Handwheel (#31) as a unit onto Valve Body Studs (#20).
13. Replace Stud Nuts (#27) and tighten evenly and securely.

PLATE V 217 (D)

TWO-STAGE SUB-MICRON DISPERSER (SMD) VALVE ASSEMBLY (First-Stage is O-Ring Plug Valve, Second-Stage is Piloted Valve)

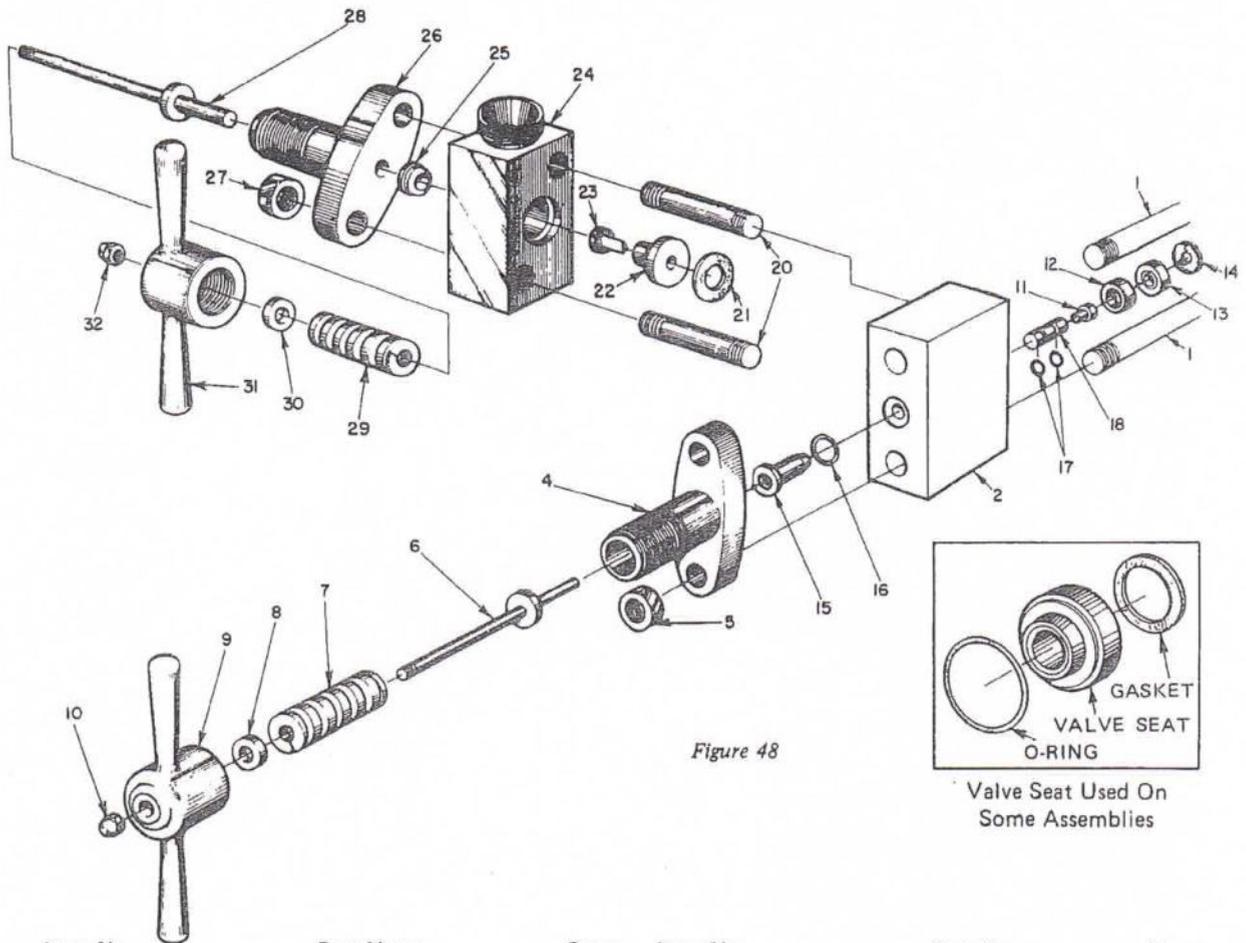


Figure 48

Valve Seat Used On
Some Assemblies

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

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

PLATE V 217 (E)

HOMOGENIZING VALVE INSTRUCTIONS

VALVE DISASSEMBLY

1. Remove second-stage Valve Body Stud Nuts (#27), second-stage Handwheel (#31) and Handwheel Support assembly (#26).
2. Remove second-stage Valve Body (#24) being careful not to drop the valve and seat.
3. Remove Valve (#23) and Seat (#22) from second-stage Body (#24).
4. Remove first-stage Valve Body Stud Nuts (#5), first-stage Handwheel (#9) and Handwheel Support (#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).

Note: If your machine is furnished with a Hydraulically Actuated Homogenizing Valve Assembly (HVA) also see Plate V220 for complete reassembly instructions

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

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 (#4) assembly on studs.
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 on studs (#20).
10. Assemble Handwheel Support (#26) and Handwheel (#31) as a unit onto valve Body Studs (#20).
11. Replace stud nuts (#27) and tighten evenly and securely.

PLATE V 217 (E)

TWO-STAGE HOMOGENIZING VALVE ASSEMBLY (Both Valve Stages are Piloted Type Valve)

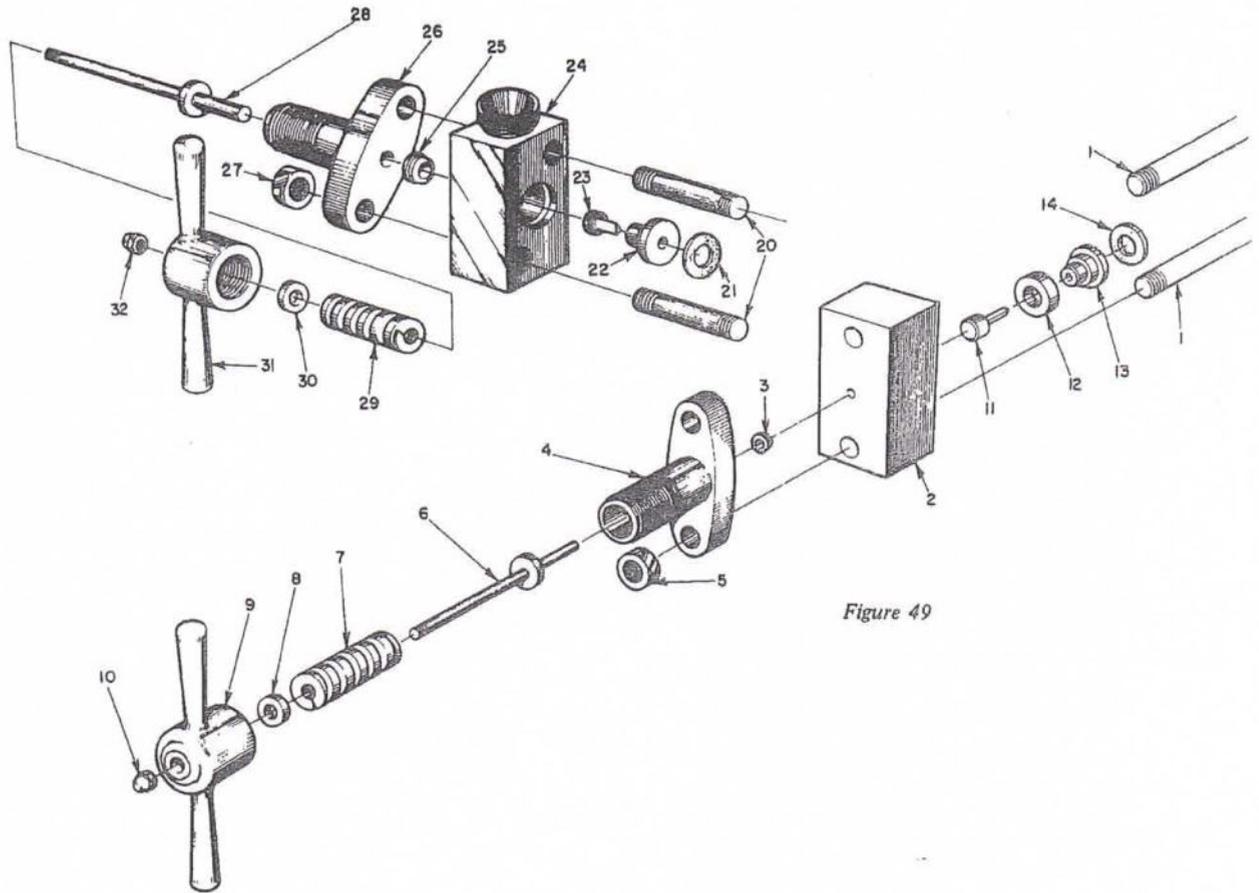


Figure 49

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
FIRST STAGE			SECOND STAGE		
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.

PARTS LIST FOR PLATES B168, B169 AND B170

Item No.	Part Name	Quan.	Item No.	Part Name	Quan.
1	Top Plate Screws	*	64	Crosshead Cover	1
2	Top Plate Sealing Washer	*	65	Crosshead Cover Dowels	2
3	Top Plate Gasket		66	Gear	1
4	Oil Pump Mounting Cap Screw	4	67	Eccentric Shaft Thrust Washer	2
5	Oil Pump	1	68	Eccentric Shaft Plug	2
6	Gear Case Cap Screw	*	69	Gear Key	1
7	Top Plate Assembly	1	70	Eccentric Shaft Assembly	1
8	Bearing Lock Ring (Pinion Side)	1	71	Connecting Rod Dowel	6*
9	Drive Shaft Bearing (Pinion Side)	1	72	Connecting Rod Cap	3*
10	Oil Filter Mounting Bracket	1	73	Connecting Rod Bolt	6*
11	Drive Shaft	1	74	Connecting Rod Bearing	6*
12	Pinion Key	1	75	Connecting Rod Bearing Dowel	6*
13	Air Inlet Nipple	2	76	Connecting Rod	3*
14	Base	1	77	Connecting Rod Nut	6*
15	Cylinder Dowel	2	78	Eccentric Bearing Cap	2
16	Cylinder Gasket	1	79	Eccentric Shaft Bearing	2
17	Base Mounting Cap Screw	4	80	Crosshead Bearing Ball Set Screw	6*
18	Base Mounting Lockwasher	4	81	Crosshead Bearing Retainer Nut	3*
19	Sub Base	1	82	Crosshead Bearing Retainer	3*
20	Motor Rail Shaft Set Screw	2	83	Crosshead Bearing Ball	3*
21	Motor Rail Collar	2	84	Crosshead Bearing	3*
22	Motor Rail	2	85	Crosshead Set Screw	3*
23	Motor Rail Shaft	1	86	Crosshead	3*
24	Motor Rail Adjusting Screw	4	87	Plunger Adapter Set Screw	6*
25	Motor Rail Shaft Support	2	88	Plunger Adapter	3*
26	Motor Rail Shaft Support Lockwasher	4	89	Packing Adjusting Screw	3*
27	Motor Rail Shaft Support Cap Screw	4	90	Baffle Seal Packing	6*
28	Driven Sheave Assembly (Includes 29, 30, 31)		90A	Baffle Wiper Ring	6*
29	Driven Sheave Lockwasher	3	91	Baffle Stuffing Box	3*
30	Driven Sheave Cap Screw	3	92	Eccentric Shaft Bearing Dowel	2
31	Driven Sheave Bushing	1	93	Eccentric Shaft Cover Plate Gasket	1
32	Driven Sheave Key	1	94	Eccentric Shaft Cover Plate	1
33	Driving Sheave Assembly (Includes 34, 35, 36)		95	Eccentric Shaft Cover Plate Cap Screw	6
34	Driving Sheave Lockwasher	3	96	Bearing Cap Screw	8
35	Driving Sheave Cap Screw	3	97	Top Cover	1
36	Driving Sheave Bushing	1	98	Handle	2
37	VEE Belt <i>1399</i>		99	Handle Screw	4
38	Motor Rail Shaft Set Screw	2	100	Oil Splash Guard	1
39	Motor Mounting Screw Lockwasher	4	101	Panel Screw	Varies
40	Motor Mounting Screw	4	102	Rear Panel	1
41	Driving Sheave Key	1	103	Oil Splash Guard Gasket	Varies
42	Motor	1	104	Panel Support Left	2
43	Drive Shaft Bearing (Drive Side)	1	105	Side Panel Left	1
44	Bearing Lock Ring (Drive Side)	1	106	Well Strip	1
45	Base Foot	4-6	107	Tinnerman Nut	Varies
46	Drive Shaft Seal <i>42800</i>	1	108	Oil Pressure Gauge Gasket	1
47	Seal Retainer Cap Screw	6	109	Front Side Panel Left	1
48	Seal Retainer	1	110	Contact Block	2
49	Seal Retainer Gasket	1	111	Front Panel Center	1
50	Oil Pump Driving Gear Key	1	112	Front Side Panel Right	1
51	Oil Pump Driven Gear Key	1	113	Panel Support Right	2
52	Oil Pump Driven Gear	1	114	Side Panel Right	1
53	Oil Pump Driving Gear	1	115	Oil Pressure Gauge	1
55	Gear Case Gasket	1	116	Start Switch	1
56	Gear Case	1	117	Stop Switch	1
57	Cylinder Stud	4*	122	Well Cover	1
58	Relief Valve	1	126	Well Lining	1
59	Oil Filter Mounting Brkt. Cap Screw	2	127	Name Plate - Serial Number	1
60	Oil Filter Mounting Brkt. Cap Screw Lockwasher	2	129	Fan Mounting Spacer	1
61	Pinion	1	130	Fan	1
62	Crosshead Cover Cap Screw		131	Fan Mounting Bolt Lockwasher	1
63	Crosshead Cover Cap Screw	4*	132	Fan Mounting Bolt	1
			133	Air Inlet Vent Nipple	2
			134	Oil Filter	1

PLATE B168

MC MODELS BASE, DRIVE COMPONENTS

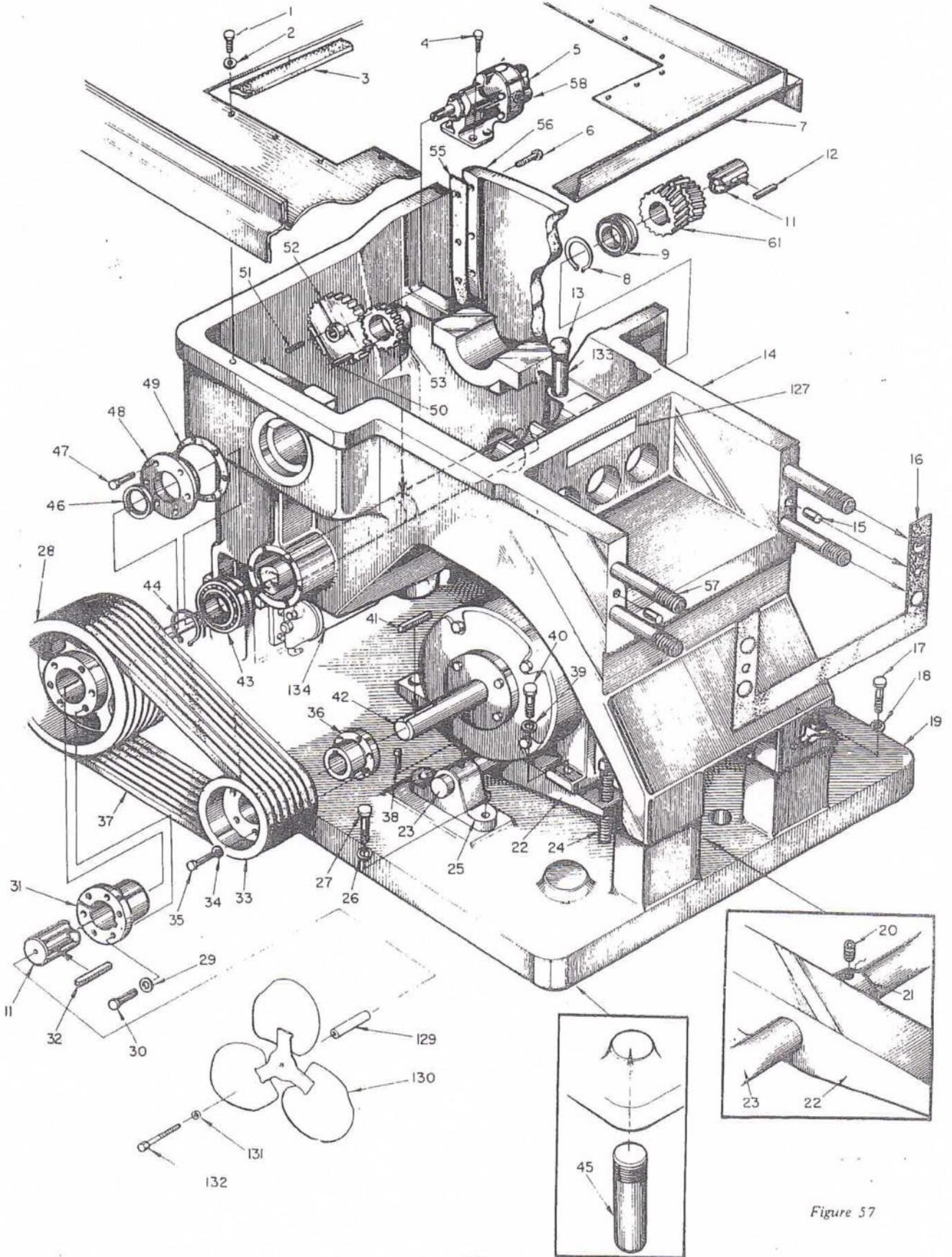


Figure 57

PLATE B169

MC MODELS .BASE, DRIVE COMPONENTS

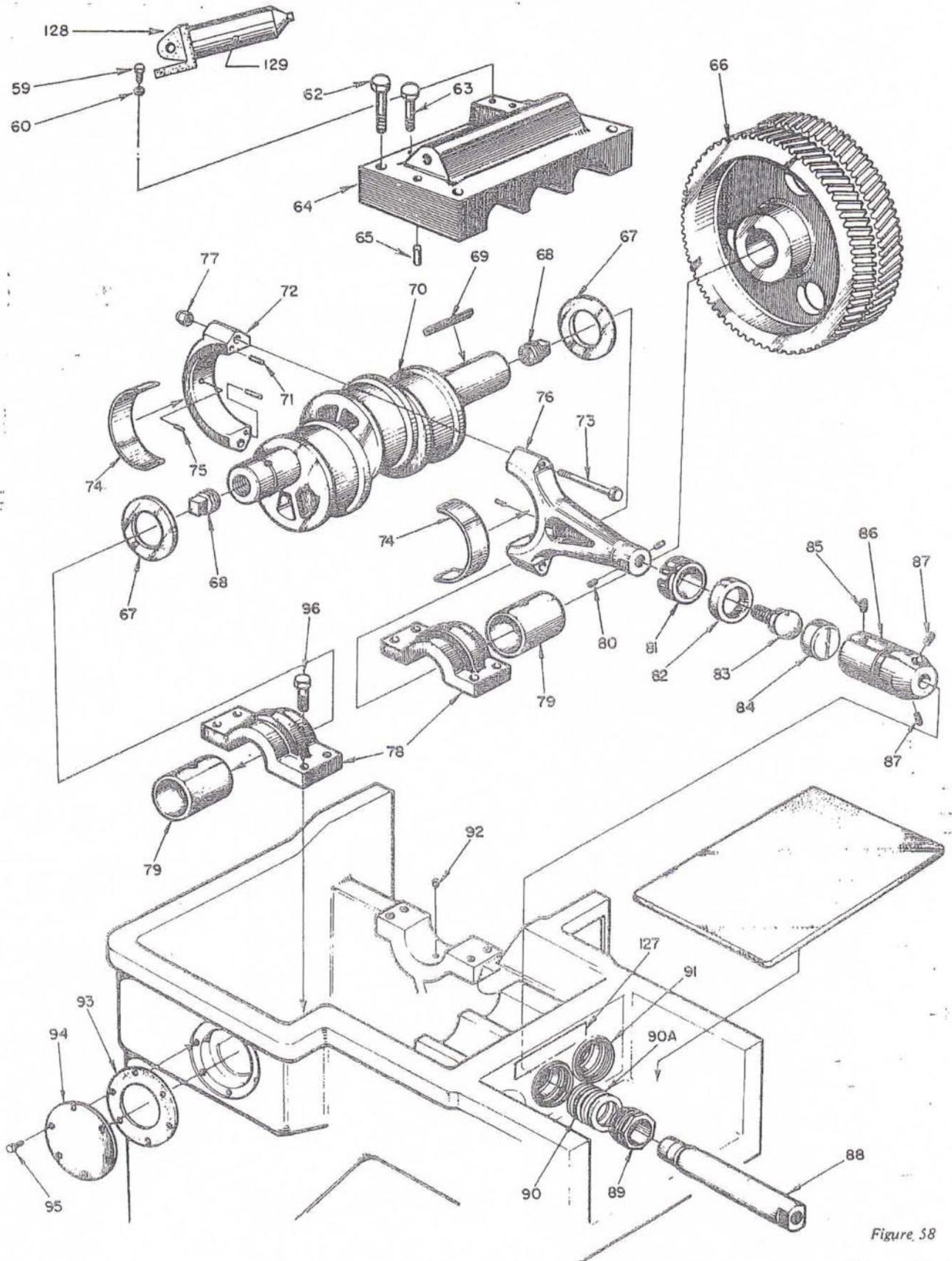


Figure 58

PLATE B170

MC MODELS STAINLESS STEEL SKIN

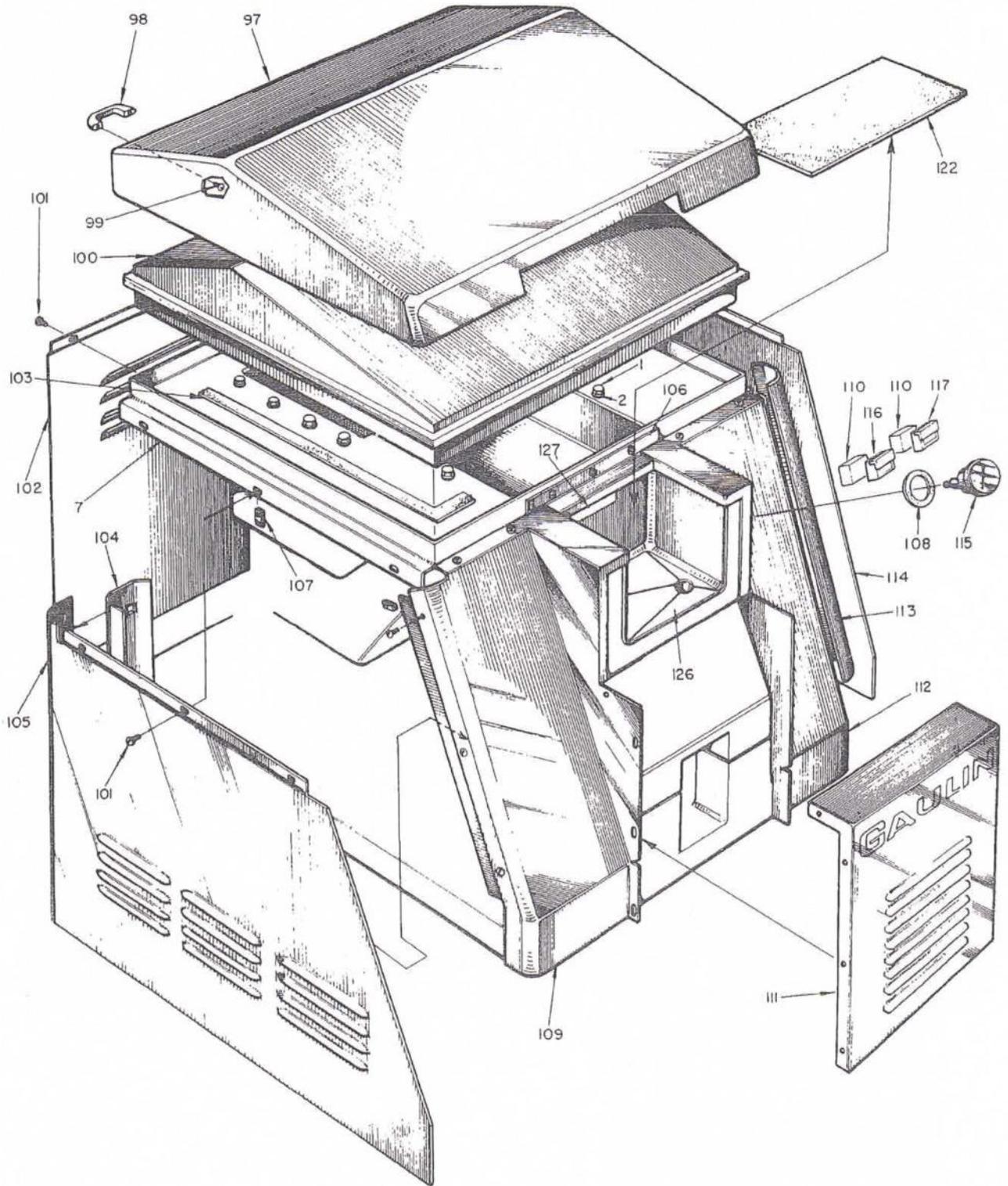
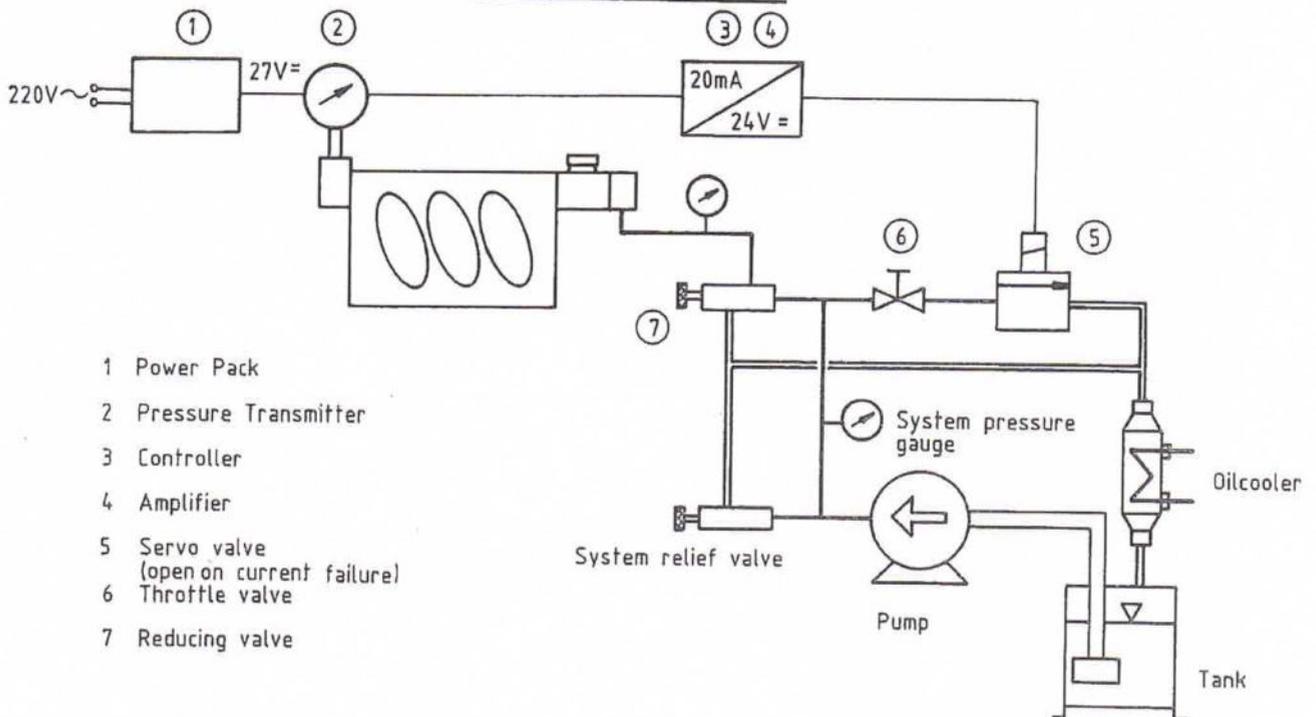


Figure 59

ELECTRONIC PRESSURE CONTROL



- 1 Power Pack
- 2 Pressure Transmitter
- 3 Controller
- 4 Amplifier
- 5 Servo valve
(open on current failure)
- 6 Throttle valve
- 7 Reducing valve

The Electronic Pressure Control system permits supervision free operation of the Homogeniser operating pressure.

Operation

Initial start-up

Before start-up ensure that the HVA pump and controller switches are set to OFF and that valves 6 and 7 are fully open.

1. Start the main motor
2. Start the HVA pump motor
3. Close valve 6
4. Using valve 7, set the maximum desired pressure
(lock in this position)
5. Switch on Controller and Amplifier
Adjust the set point to correspond with the indicated value.
6. Open valve 6
7. The control system is now operating and will maintain the desired pressure. Should another operating pressure be required it can be obtained by adjusting the set point.

Shutting down the Control System

1. Adjust the set point to minimum
2. Switch off Controller
3. Switch off the HVA pump

In no circumstances delete any step of the shut down procedure.

Normal start-up

Follow the initial start-up procedure with omission of steps 3, 4 and 6.

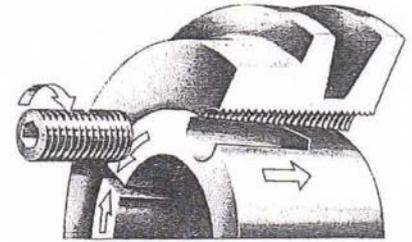
IMPORTANT

Whenever the system is to be shut down e. g. for cleaning, pauses in production etc. the complete shut-down and start-up procedures must always be followed. The controller set point must always be returned to minimum and the controller switched off.

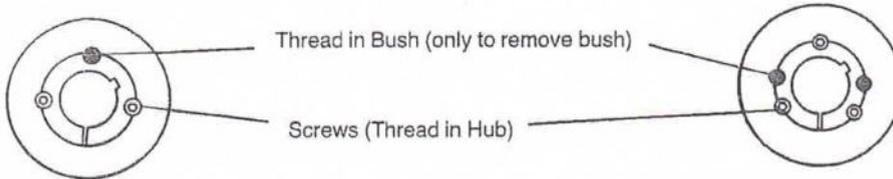
Installation Instructions for Taper-Lock

To install

- 1) Remove the protective coating from the bore and outside of bush, and bore of hub. After ensuring that the mating tapered surfaces are completely clean and free from oil and dirt, insert bush in hub so that holes line up.
- 2) Sparingly oil thread and point of grub screws or thread and under head of cap screws. Place screws loosely in holes threaded in hub.
- 3) Clean shaft and fit hub and bush to shaft as one unit and locate in position desired, remembering that bush will nip the shaft first and then hub will be slightly drawn on to the bush.



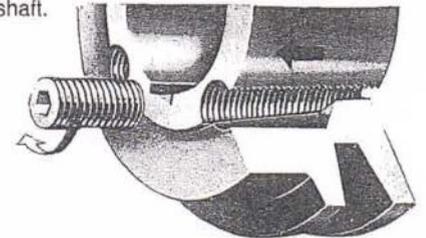
Installation of Bush



- 4) Using a hexagon wrench tighten screws gradually and alternately until all are pulled up very tightly.
- 5) Hammer against large end of bush, using a block or sleeve to prevent damage. (This will ensure that the bush is seated squarely in the bore). Screws will not turn a little more. Repeat this alternate hammering and screw tightening torque is obtained.
- 6) If a key to be fitted place it in the shaft keyway before fitting the bush. It is essential that it is a parallel key and side fitting only and has top clearance.
- 7) After drive has been running under load for a short time, stop and check tightness of screws.
- 8) Fill empty holes with grease to exclude dirt.

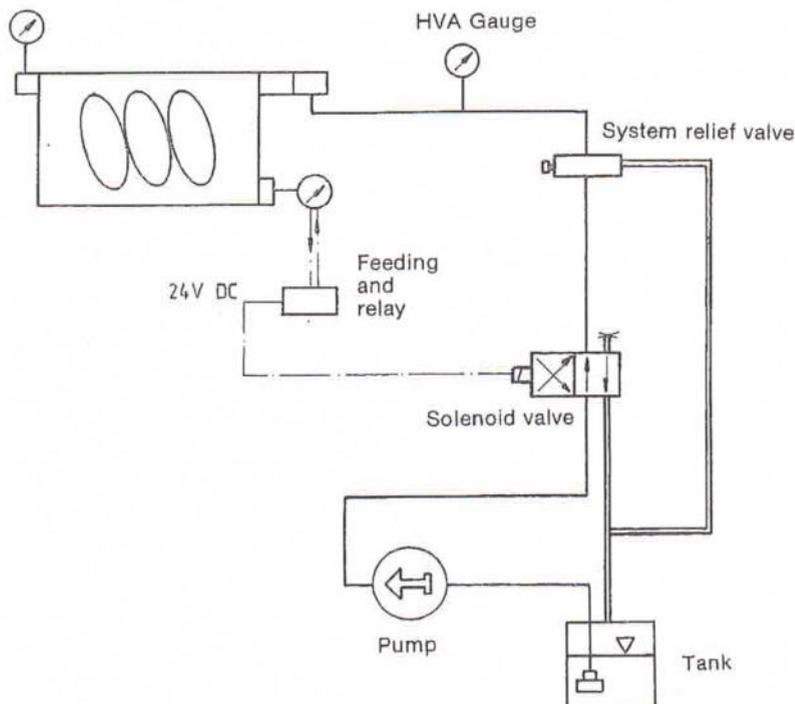
To remove

- 1) Slacken all screws by several turns, remove one or two according to number of jacking off holes shown as black point in diagram. Insert screws in jacking off holes after oiling thread and point of grub screws or thread and under head of cap screws.
- 2) Tighten screws alternately until bush is loosened in hub and assembly is free on the shaft.
- 3) Remove assembly from shaft.

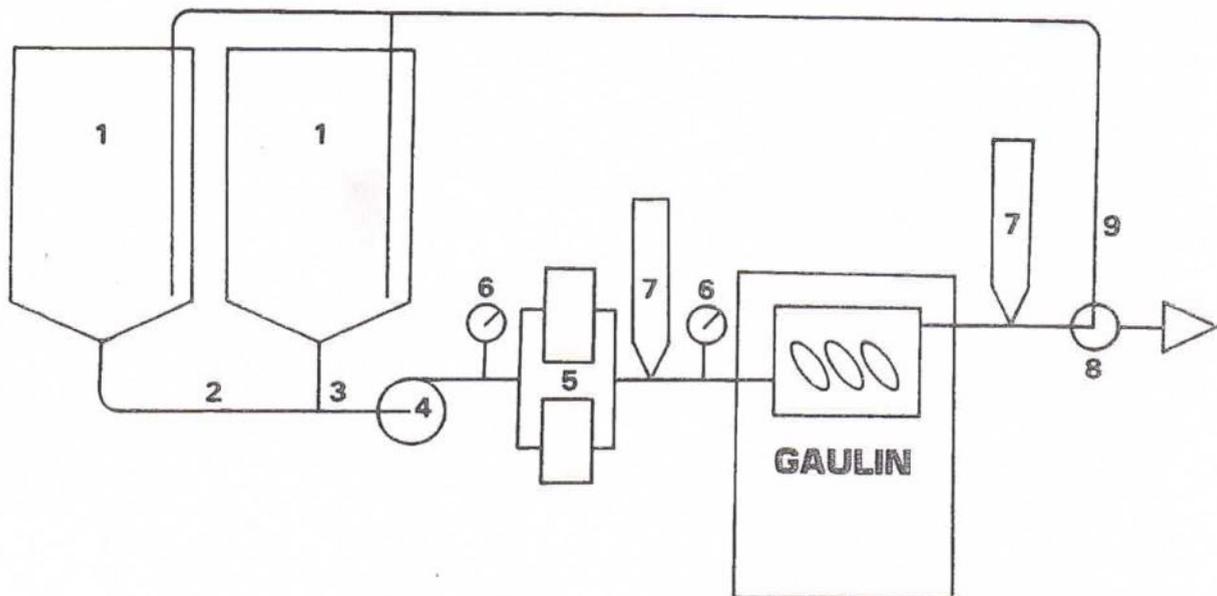


Removal of Bush

Feeding control



RECOMMENDED LAY-OUT OF GAULIN HOMOGENIZER/PUMP INSTALLATION



- 1 **Feed Tank.** Tank design with agitator (if used) to be such as to avoid early drawing of vortex, resulting in air entrapment. Low level detector may be installed to sound alarm or automatically stop homogenizer/pump and/or lower homogenizing pressure prior to the time that feed tank is completely emptied.
- 2 **Suction & Discharge Piping.** Avoid long lines and sharp elbows as far as practical and select pipe line diameters not less than those specified for the homogenizer/pump suction and discharge respectively.
- 3 **Change-over to another feed tank.** The valve arrangement in the suction piping should be such that the change-over from one feed tank to another will be gradual, allowing stagnant product in the line to accelerate to normal flow velocity before the feed from the first tank is cut completely.
- 4 **Feed Pump.** To be dimensioned such as to ensure positive feed pressure, preferably not less than 1 bar over the vapor pressure of the product, immediately at the homogenizer inlet. Heavy bodied products may require an even higher pressure.
- 5 **Suction Strainer.** Recommended for protection of homogenizer/pump cylinder parts. Preferably duplex arrangement for easy maintenance without interruption of product flow.
- 6 **Suction Pressure Gauges.** One to be installed upstream of filter and one immediately at homogenizer inlet to register the inlet pressure and the pressure drop across the suction strainer to indicate strainer fouling.
- 7 **Hydraulic Accumulators or Vibration Dampeners.** Recommended to be mounted in homogenizer in and outlet line, if pipe line vibration excessive which often due to excessively long tubing, high pipe line velocities etc.
- 8 **Valve in Homogenizer/Pump Discharge Line.** Under no circumstances do install shut-off valves in discharge line. To divert product flow, use three-way valve or similar which keeps discharge open in at least one of several directions.
- 9 **Return Line.** If installed, returnflow to discharge preferably under level of product in feed tank to prevent incorporation of air.

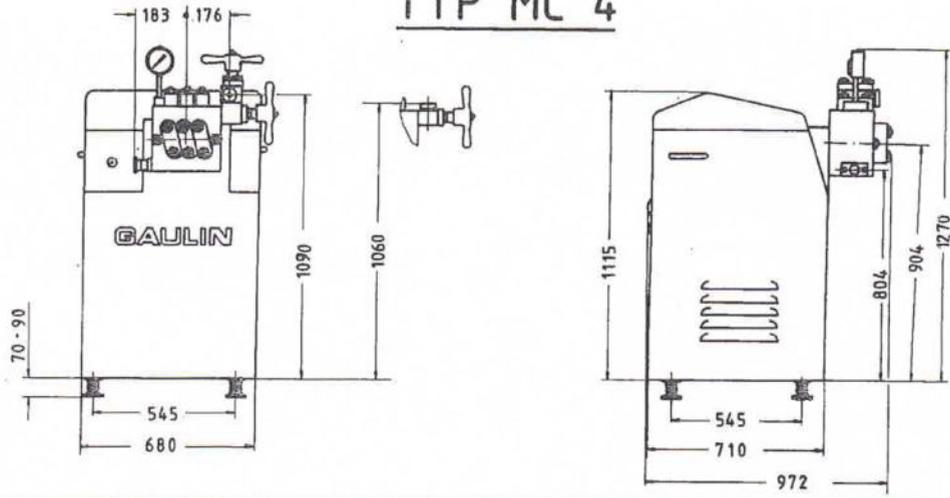
Attention. Perfect feed conditions are of paramount importance. Also it should be borne in mind that the homogenizer/pump uses a positive volume pumping system which is capable of an unlimited pressure build-up in case of flow restrictions in the discharge line. Any possible restrictions in the discharge system therefore warrant the installation of protective devices.



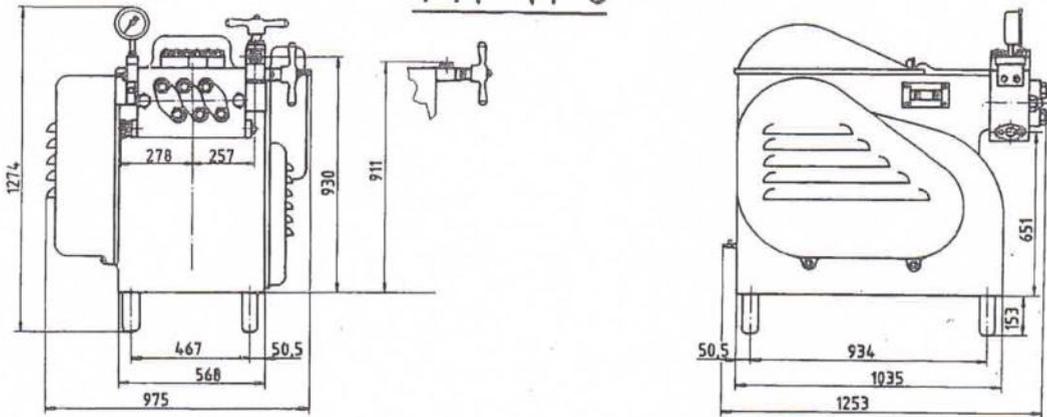
APV SCHRÖDER GMBH

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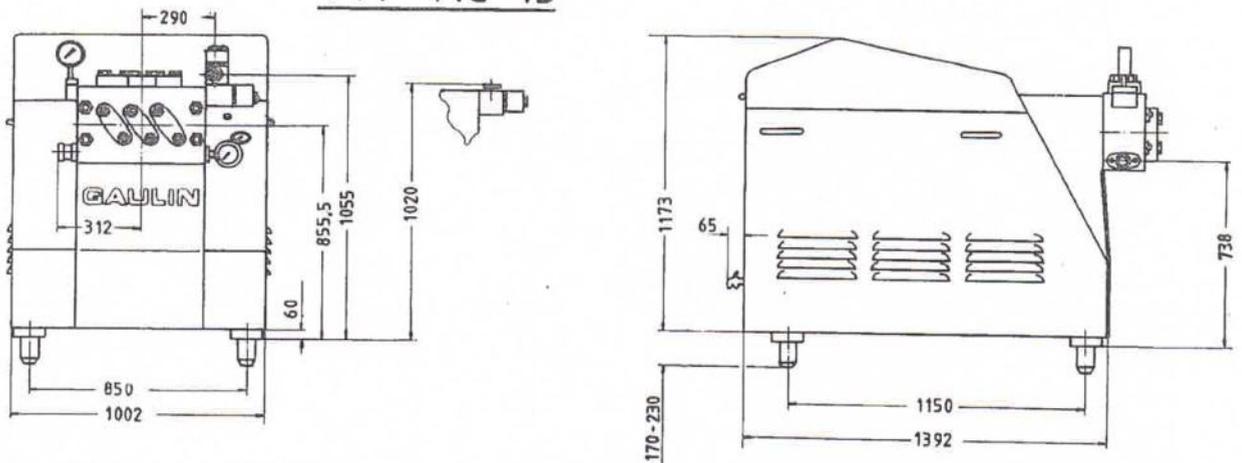
TYP MC 4



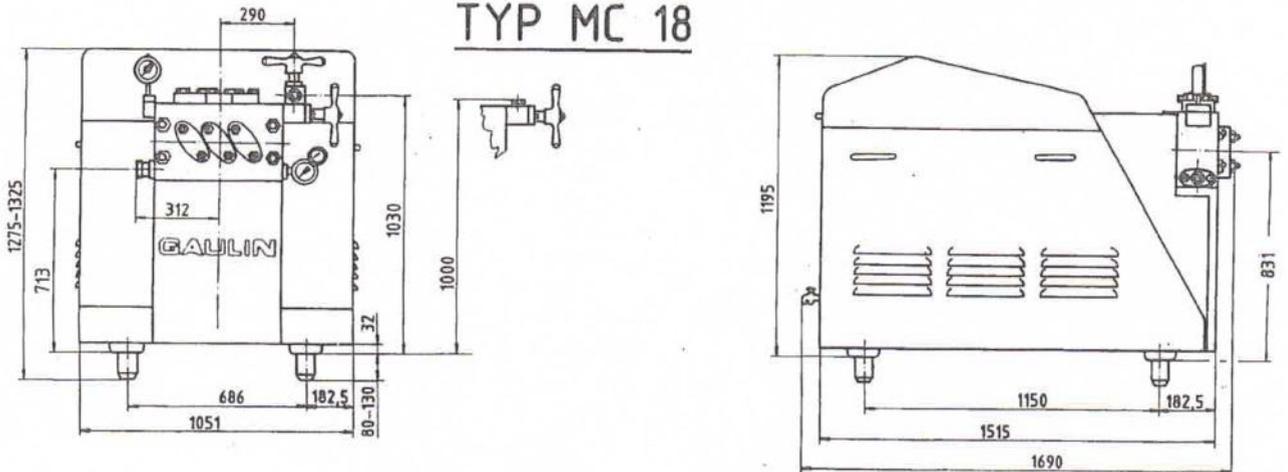
TYP M 6



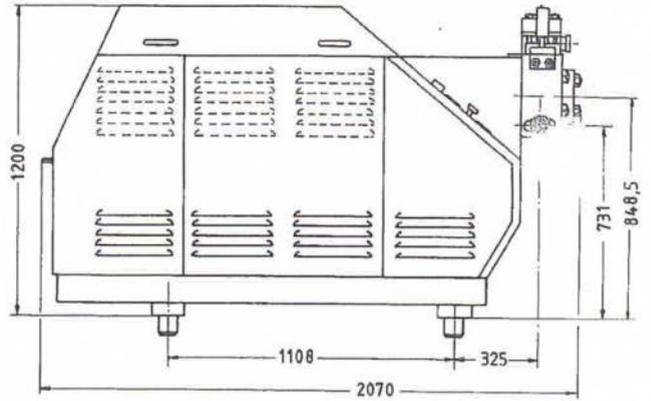
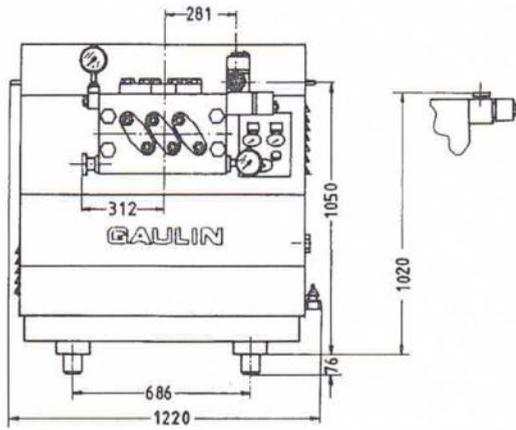
TYP MC 15



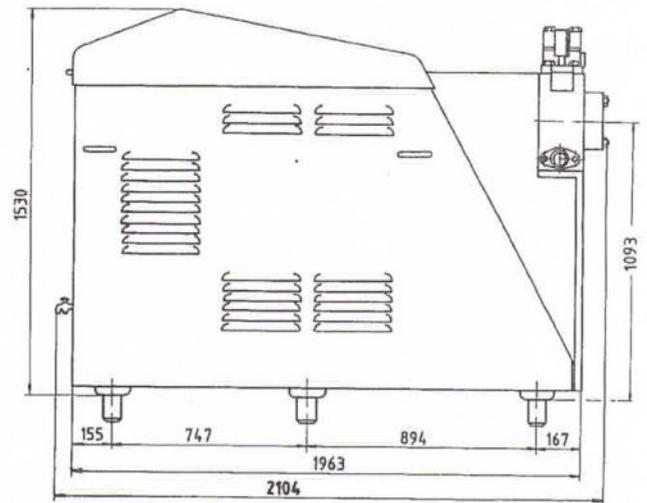
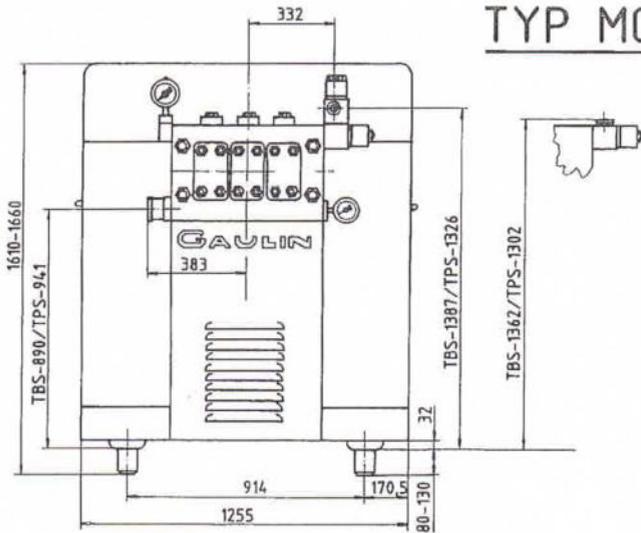
TYP MC 18



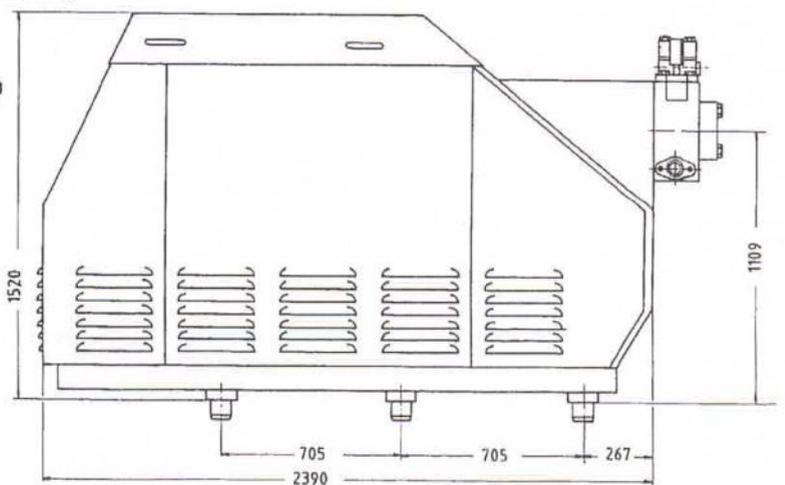
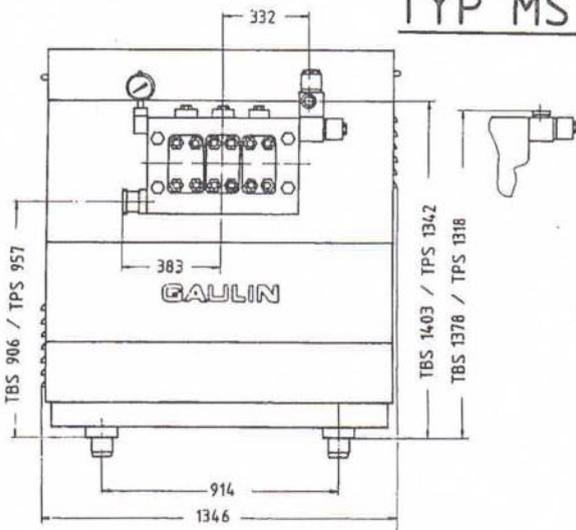
TYP MS 18



TYP MC 45



TYP MS 45

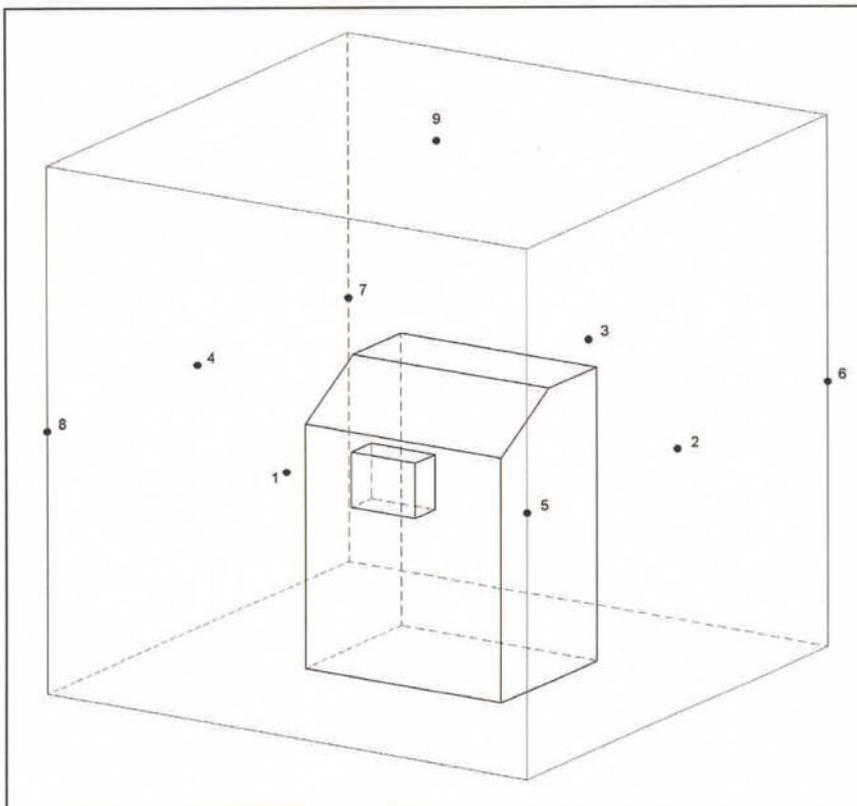


3. APPENDIX

Sound level report

Order No. : 201510987
 Customer : Image S.L.
 Machine type : MC45-150P-01
 Serial No : 15H3014

Measure date : 12-08-2015
 Measure equipment : Centre 320
 Measure distance : 1m from machine
 Measure conditions : under full load



POSITION		dB(A)
1	Front centre	81,4
2	Right centre	84,6
3	Rear centre	82,3
4	Left centre	81,8
5	Right front	82,8
6	Right rear	83,8
7	Left rear	81,9
8	Left front	80,7
9	Top center	79,1
$\Sigma/9$	Average	82,0
dB(A)	Correction	2,0
dB(A)		80,0

EC-declaration of conformity for machinery

DECLARATION OF INCORPORATION OF PARTLY COMPLETED MACHINERY

(According to II.1.B of the Machine directive 2006/42/EG)

BOS HOMOGENISERS b.v.
Oscar Romerolaan 18
1216TK Hilversum
Nederland

herewith declares that the below partly completed machine:

Machine type: Homogeniser
Manufacturer: BOS Homogenisers b.v.
Type: MC45-150P
Serial number: 15H3014

- The relevant technical documents are according to annex VII under B of the machine directives 2006/42/EG;
- On request of the national authorities the relevant information of the partly completed machine will be made available.

The partly completed machine is in accordance with the EG- directives:

- Low voltage directives 2006/95/EC
- EMC directives 2004/108/EG

The machine must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the Directive 2006/42/EC.

Hilversum, Thursday 13 of August 2015

K. Nendels

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

General terms and conditions of BOS homogenisers b.v.

Bos Homogenisers B.V.
18 Oscar Romerolaan
1216 TK Hilversum

Applicability, definitions

These terms and conditions apply to all offers and all agreements of sale/purchase as well as to all contracts for carrying out work for Bos Homogenisers B.V., established in Hilversum, hereinafter referred to as "Bos".

The Buyer and/or the Principal shall hereinafter be referred to as, the "other party".

"In writing" in these terms and conditions shall mean: by letter, by email, by fax or by any other comparable means of communication in terms of the current state of technological progress and according to what is generally accepted.

"Goods" in these terms and conditions shall mean: both goods delivered from stock by Bos and goods manufactured to order, unless a provision expressly states that this provision only applies to the latter goods.

Expert opinions, calculations, drawings, reports, designs, and suchlike, to be produced by Bos and/or provided by the other party shall hereinafter be referred to as, "the documents". These documents can be both written, and recorded on other data carriers, such as CD-ROMs, DVDs, USB sticks, etc.

The possible inapplicability of (part of) a provision of these General Terms and Conditions does not affect the applicability of the remaining provisions.

These General Terms and Conditions shall also apply to repeat orders or partial orders and/or future assignments or partial assignments arising from the Agreement.

If Bos has already handed over these General Terms and Conditions to the other party several times, this may be regarded as constituting a permanent business relationship. In this way, Bos does not have to hand over the General Terms and Conditions each time again in order for them to apply to subsequent agreements.

Conclusion of agreements

The agreement is concluded once the other party has accepted the offer made by Bos, even if this acceptance deviates on minor points from the offer. If, however, the acceptance of the other party substantially differs from the offer, the agreement will only become effective if Bos has expressly agreed in writing with these deviations.

If the other party offers an assignment or places an order without first submitting an offer to Bos, Bos shall only be bound by this assignment or order after it has confirmed it in writing to the other party. Changes to an already provided assignment or order must be made in writing and be accompanied by a clear description of the changes. Bos shall only be bound by the above amendments and additions or changes to the General Terms and Conditions and/or the agreement, after it has confirmed these in writing to the other party.

Bos shall only be bound by oral agreements after it has confirmed these to the other party in writing or once Bos – without objection by the other party – has commenced performance of the agreements.

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Offers and quotations

All offers and quotations of Bos are without obligation, unless they have a deadline for acceptance. If an offer or quotation contains a non-binding offer and this offer is accepted by the other party, then Bos is entitled to revoke the acceptance no later than two business days after receipt of the acceptance.

In the case of a composite quotation, Bos is not obliged to deliver a part of the goods offered in the quotation for a proportionate part of the offer price.

If the offer is based on information provided by the other party and such information turns out to be inaccurate or incomplete, or subsequently changes, Bos is entitled to modify the prices, rates and/or lead times listed in the offer.

Offers, quotations, prices and rates shall not apply automatically to repeat orders or new orders.

Displayed and/or provided models, estimates of dimensions, weights, features and other descriptions in brochures, promotional materials and/or on the website of Bos are as accurate as possible, but are given by way of an indication only. The other party may derive no rights whatsoever here from.

The models mentioned in the preceding paragraph shall remain the property of Bos and returned to Bos at their first request at the expense of the other party.

Forest has the right to charge the other party for the costs associated with the offer or quotation, if they have notified the other party of these costs in advance in writing.

If the other party does not accept an offer or quotation, they must return all of the documents provided with this offer or quotation to Bos at the first request of Bos. By failing to return the documents in a timely manner, the other party forfeits a fine of € 500.00 per day that he is too late with returning.

Fees, prices, rates

Unless the parties have agreed on a fixed price or a fixed fee for the work, Bos shall calculate its fee based on the number of hours spent using the agreed hourly rate or the usual hourly rate of Bos.

The hourly rates shall apply for normal working days, i.e.: Monday to Friday (with the exception of recognised public holidays) between 08.00 and 18.00 hours.

If at the request of the other party, for rush orders, the work must be accelerated or if the work should take place outside normal working days, Bos is entitled to charge a surcharge over the agreed hourly rate.

Should a dispute arise between the parties on the number of ordered and/or invoiced hours, the time registration of Bos is binding.

Bos is entitled to increase an agreed fixed fee if, during the performance of the agreement it turns out that the agreed or expected workload was not correctly estimated by the parties at the conclusion of the agreement, this incorrect estimate is not due to an attributable shortcoming of Bos and it cannot reasonably be expected to perform the work at the agreed fee.

The prices specified in the price lists are excluding VAT and any other possible taxes and costs, such as transportation costs, shipping costs, travel and accommodation expenses, costs associated with international payments, import duties and other local government levies and declarations of hired third parties.

If, between the date of the conclusion of the agreement and its implementation for Bos, (cost) price increasing circumstances occur as a result of laws and regulations, currency fluctuations, price changes with the third parties or suppliers hired by Bos, or changes in the prices of the necessary materials, parts, etc., Bos is entitled to increase the agreed price accordingly and to charge this to the other party.

Third party engagement

If a proper performance of the agreement requires this, Bos is entitled to have certain supplies and/or work performed by third parties. The foregoing is at the discretion of Bos.

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Obligations of the other party

The other party shall ensure that:

it provides Bos with all of the information necessary for the performance of the agreement in a timely manner, in the manner desired by Bos;
any data carriers, electronic files, etc., provided by the other party to Bos are free of viruses and/or defects;

if (part of) the assignment must be performed on the premises of the other party, Bos must be able to access this location on the agreed dates and times and this site meets the applicable (safety) requirements;

Bos should have access to connections for electricity, gas and water at the aforementioned site. Any costs associated with this shall be borne by the other party. Lost working hours due to water, gas or power outages shall also be borne by the other party;

at the location where (part of) the assignment should be performed, any other provisions that Bos may reasonably expect – such as, in particular, internal transport and lifting equipment required for carrying out the work – are present, at no additional expense to Bos.

The other party shall ensure that the information they have provided is correct and complete and shall indemnify Bos for third party claims arising from any incorrect and/or incomplete data.

If the requirements of this article are not met in a timely manner, Bos is entitled to suspend the performance of the agreement until the other party has met their obligations. Costs associated with the delays incurred and/or costs of undertaking additional work and/or other consequences arising there from are at the expense and risk the other party.

If the other party fails to fulfil its obligations and Bos fails to require fulfilment of the other party, this does not affect the right of Bos to require fulfilment at a later date.

Confidential information

The parties undertake to keep confidential all information obtained in the context of the conclusion and implementation of the agreement from and/or about the other party and which the other party has indicated as being confidential information and/or which they know or may reasonably expect must be handled confidentially. Parties shall only supply this information to third parties insofar as this is necessary for the implementation of the agreement.

Each party shall take all reasonable precautions to keep the confidential information confidential and shall guarantee that its employees or other persons under its responsibility in the implementation of the agreement shall also honour this obligation.

The confidentiality obligation shall not apply if a party is obliged to make the confidential information public as a result of legislation and/ or regulation or a court ruling and is unable to invoke a privilege of non-disclosure permitted by a law or a court. This exception also applies to employees or other persons as referred to in section 2 of this article.

Bos is at any time allowed to publish about the agreed work and/or supplied goods and the methods and procedures used and/or developed, provided the privacy of the other party and/or the final customer is guaranteed or Bos has obtained permission to do so from the other party.

Supply and delivery deadlines

Agreed delivery periods can never be regarded as strict deadlines. If Bos fails to fulfil its delivery obligations under the agreement or fails to fulfil them in a timely manner, the other party shall give Bos notice of default in writing, where said party shall be granted a reasonable amount of time to still meet its delivery obligations.

Bos is entitled to partial deliveries, where each partial delivery can be invoiced separately by Bos.

The risk relating to the delivered goods shall pass to the other party at the time of delivery. "Time of delivery" in these General Terms and Conditions shall mean: the moment when the goods leave the property, the warehouse, or the factory of Bos or the moment when Bos informs the other party that the goods can be picked up by said party.

Unless otherwise agreed, shipping or transport of the ordered goods shall take place in a manner determined by Bos and at the expense and risk of the other party. Bos is not liable for any damage of any kind – whether or not to the goods themselves – related to the shipping or transportation. For transport

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

and shipments arranged by Bos itself, Bos has taken out transport insurance for own account.

If, due to a reason that lies in the control of the other party, it is not possible to deliver the ordered goods (in the agreed manner) to the other party or if the goods are not picked up, Bos is entitled to store the goods for the account and risk of the other party. Unless Bos has explicitly stated in writing a different period, the other party must enable Bos to deliver the goods after all within 1 month of notice and/or the other party must pick up the goods within this period.

If the other party remains in default with respect to its obligation to collect after the period specified in section 5 of this article, said party is immediately in default. Bos shall then have the right to dissolve the agreement in whole or in part, with immediate effect, without judicial intervention, by means of a written statement and sell the goods to other persons. This without resulting in Bos being liable for compensation for damages, costs and interest.

The above will not affect the obligation of the other party to pay compensation for any (storage) costs, damages due to delays, loss of profit or other damages.

Performance and development of the agreement

If the commencement, development or completion of the work and/or the agreed delivery of goods is delayed because:

Bos fails to receive all necessary information and/or documents from the other party on time;

Bos fails to receive any agreed (advance) payments from the other party on time;

there are other circumstances, at the expense and risk of the other party; Bos is entitled to such extension of the delivery and/or completion deadline as reasonably results from these circumstances and is entitled to charge any associated costs and damages, such as for example any waiting time, to the other party.

If the agreement is performed in stages, Bos is entitled to have the parts belonging to the next stage suspended until the other party has approved the results of the previous stage. The resulting costs are at the expense of the other party.

Bos shall endeavour to achieve the agreed work and supplies within the agreed and planned time, insofar as this can reasonably be expected from them. If the performance of the agreement must be accelerated at the request of the other party, Bos is entitled to charge the associated extra hours and other costs to the other party.

Bos is required to perform the work properly, adequately and in accordance with the provisions of the agreement. Bos must perform the work in such a way that damage to persons, property or the environment is minimised as much as possible, and in this context follow any orders and instructions given by or on behalf of the other party as much as possible.

If during the performance of the agreement it becomes clear that as a result of unforeseen circumstances the work and/or supplies cannot be performed in the manner agreed, Bos shall consult with the other party on amending the agreement. In connection with this, Bos shall inform the other party about the consequences of the amendment on the agreed prices, rates and the agreed delivery and/or completion deadlines. If as a result of this, the performance of the agreement should become impossible, Bos is in any case entitled to full compensation for all work and deliveries already carried out.

Contract variations

Contract extras shall mean: all extra work and supplies at the request of the other party or work and supplies, which are a necessary by-product thereof, which are not included in the offer, quotation or order. Contract variations must be agreed between Bos and the other party in writing. Bos shall only be bound oral agreements after it has confirmed these to the other party in writing or once Bos – without objection by the other party – has commenced performance of the agreements.

Settlement of contract variations takes place:

when changes are made to the original assignment;

in the event of unforeseen cost increases or reductions and deviations from deductible and/or estimated quantities.

Settlement of contract variations takes place in full in the final settlement, unless the parties expressly agree otherwise in writing.

Customer: Image S.L.

Customer reference: Q-Iberica

Bos reference: 201510987

Machine type: MC45-150P-01

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Year of manufacture: 2015

Delivery, acceptance and maintenance period

If the contract (also) concerns the performance of work, Bos is obliged to notify the other party that the agreed work has been completed and the results of the work has become ready for use.

The result of the work is deemed to have been delivered under the agreement if the other party has verified this result and the delivery note or work sheet has been signed as accepted by the other party. The outcome of the work shall also be deemed to have been delivered in accordance with the agreement, if the other party has not filed a complaint with Bos within a period of 2 weeks after the announcement that the work was completed or, where possible, as much earlier as the other party has already been using this result before this date.

Work that has not yet been performed and/or finished of, by, or on behalf of third parties hired by the other party, which affects a proper use of the outcome of the work, shall not affect the delivery of the results of the work.

Small defects that can be easily remedied in a maintenance period agreed between the parties shall not be a reason for abstention of acceptance, provided said deficiencies do not interfere with any possible putting into operation. If parties have not agreed on a specific maintenance period, a term of maintenance of 31 days after delivery shall apply. Bos is required to remedy, or have remedied, defects or faults, which are established within the maintenance period and are for its own account, as soon as possible.

If after the delivery or maintenance period specified in this article, the other party should still establish defects, faults, etc., with regard to the outcome of the work, then the provisions of the article dealing with complaints included in these General Terms and Conditions shall apply.

Maintenance and malfunctions

The parties may conclude a separate agreement regarding the performance of regular maintenance or fault-clearance, including defects, faults, etc.

The other party shall notify Bos of any identified faults, defects, malfunctions etc. - in accordance with the usual procedures of Bos. After receiving the notice, Bos shall to the best of its abilities seek to remedy any faults, defects, malfunctions, etc.

Unless the parties have expressly agreed otherwise, materials used and/or replaced during the maintenance work are not included in the regular maintenance fee. These materials will be charged to the other party by Bos based on the prices applicable at the time of the work.

The agreement concluded between the parties shall include at least the following:

the regular maintenance fee and the time limit for payment;

an arrangement relating to any call-out charges;

the applicable rates and prices;

the currency of the agreement and the rules regarding its termination;

if applicable, a breakdown of the maintenance activities;

if applicable, the frequency of maintenance possibly including a schedule of the maintenance work.

Bos is entitled to implement an annual regular increase in respect of the regular maintenance fee and to pass this charge on to the other party. Should Bos wish to modify the regular maintenance fee outside the regular annual increase, it must notify the other party in writing no later than one month before the effective date of the interim increase. If the other party does not agree with the announced increase of the maintenance fee, it is entitled to terminate the agreement within 10 (ten) working days after the date of this notice by the date specified in the notice. Notice of termination must be given in writing.

Complaints and returns

The other party is obliged to inspect the delivered goods immediately upon receipt and mention any visible flaws, defects, damages and/or nonconformities on the delivery note or accompanying consignment note.

In the absence of delivery note or accompanying consignment note, the other party must notify Bos in writing of any defects, faults, etc., within 24 hours of receipt of the goods.

Other complaints regarding the delivered goods must be reported to Bos in writing immediately upon discovery - and at most within the agreed warranty period. Any consequences of not directly reporting shall be at the risk of the other party. If no explicit warranty period is agreed, a period of 1 year after delivery shall apply.

If a complaint is not reported to Bos within the periods specified in the preceding paragraphs, the goods

Customer: Image S.L.

Customer reference: Q-Iberica

Bos reference: 201510987

Machine type: MC45-150P-01

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are deemed to have been received in good condition and to satisfy the agreement. In that case, it is no longer possible to invoke the applicable storage life or agreed warranty.

Any complaints shall not suspend the obligation of payment of the other party.

The other party must enable Bos to investigate the complaint and provide Bos with all information relevant to the complaint. If for investigation of the complaint, return shipment is necessary, or if it is necessary that Bos investigate the complaint on the spot, this shall take place at the expense and risk of the other party, unless the complaint is later found to be legitimate.

In all cases, return shipment shall take place in a manner determined by Bos and in the original packaging and/or wrapping.

No complaints are possible in respect of goods which, following receipt by the other party, have changed in nature and/or composition and/or have been partly or fully modified or processed or are no longer in their original packaging.

Warranties

Bos will ensure that the agreed deliveries and/or orders are performed properly and in accordance with industry standards, but shall never be obliged to provide any further warranty than as expressly agreed between the parties.

Bos is responsible for the customary standard quality and soundness of the delivered goods during the warranty period.

Warranties can only be claimed if the other party has fulfilled all its obligations towards Bos, the prescribed maintenance has been done correct and in time and only genuine parts from Bos have been used.

When using the materials and/or components required for the performance of the agreement, Bos bases itself on the information provided by the manufacturer or supplier thereof on the properties of these materials and/or components. If the manufacturer or supplier of the delivered materials and/or components has issued a warranty, this warranty shall apply equally to both parties.

Bos does not warrant and shall never be deemed to have warranted that the delivered goods are suitable for the purpose for which the other party wishes to adapt, process, use or have them used, unless it has explicitly confirmed this in writing to the other party.

Should the other party legitimately invoke the warranty provisions, Bos shall assure repair or replacement of the delivered goods or provide a refund or discount on the agreed price for said goods. The foregoing is at the discretion of Bos. Any additional damage is subject to the provisions of the article that deals with liability included in these General Terms and Conditions.

Faults and defects caused by normal wear and tear, erosion, corrosion, by injudicious and/or improper use or maintenance or those occurring after repairs or alterations performed or introduced by or on behalf of the other party, are not covered by the warranty. Faults and defects due to, among other things, aging and damage by external influences, and those incurred during storage of the goods by the other party before its entry into operation, are not covered by the warranty.

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Liability

Bos accepts no liability whatsoever outside the explicitly agreed warranties and/or those provided by Bos. Without prejudice to the provisions in paragraph 1 of this article, Bos shall only be liable for direct damages. Any liability of Bos for consequential damages, such as trading loss, lost profits and/or incurred losses, damages due to delays and/or damages due to personal or bodily injury, is expressly excluded.

The other party is obliged to take all the measures necessary to prevent or limit any damage.

If Bos is liable for damage incurred by the other party, the obligation to pay compensation of Bos shall always be limited to the amount paid by its insurer in the occurring event. In the event that the insurer of Bos fails to pay or the losses are not covered by insurance taken out by Bos, the duty of compensation of Bos is limited to the invoiced amount for the goods delivered.

The other party must notify Bos of the damage it has suffered at the latest within 6 months after it has become known to them and/or could have become known to them.

If Bos must perform the assignment and/or the deliveries on the basis of documents provided by or on behalf of the other party records, Bos shall only be responsible for the proper performance of the assignment and/or the soundness of the delivered goods.

If the other party provides Bos with materials and/or components for processing, then Bos is responsible their correct use, but in no case for the soundness of these materials and/or components and the impact of these materials and/or components on the final result.

The other party may not invoke the applicable warranty, nor hold Bos liable on other grounds, if the loss occurred:

by incorrect usage or usage contrary to the intended use of the delivered goods or contrary to the instructions, expert opinions, instructions, etc., provided by or on behalf of Bos;

by improper storage and/or maintenance of the delivered goods;

by errors, omissions, defects, etc., in the information, documents, materials or components supplied by or on behalf of the other party to Bos;

caused by directions or instructions from or on behalf of the other party;

because repairs and/or other work has been performed on or to the supplied goods by or on behalf of the other party, without the express prior written permission from Bos.

The other party, in the cases listed in paragraph 8 of this article, shall be fully responsible for any damage caused and shall indemnify Bos expressly for all third party claims for compensation for said damage.

The limitations of liability under this article shall not apply if the damage was caused by an intentional act and/or wilful recklessness by Bos or its managing executives at director level or when mandatory provisions of law are opposed to this. Only in these cases will Bos indemnify the other party for any claims by third parties against the other party.

Payment

Bos is at all times entitled to demand (partial) prepayment or any other security for payment of the other party.

Payment shall be made within a period of 30 days after the invoice date, unless the parties have expressly agreed otherwise in writing. The accuracy of an invoice shall apply if the other party fails to object within this payment term.

If an invoice, after expiry of the period referred to in paragraph 2, is not fully paid, the other party shall pay Bos a default interest at a rate of 2% per month, to be calculated cumulatively on the principal. Parts of one month are here counted as full months.

If after a reminder by Bos, payment is still not made, Bos is also entitled to charge the other party extrajudicial collection costs.

The extrajudicial collection costs referred to in paragraph 4 for claims with a principal of up to € 25,000.00 are 15% of the principal amount (with a minimum of € 40.00). All this unless mandatory provisions of law are opposed to this.

If the principal exceeds € 25,000.00, Bos is entitled to charge the other party extrajudicial collection costs on the first € 25,000.00 in accordance with paragraph 5 of this article, and to charge the other party extrajudicial collection costs of 10% over that difference.

For the calculation of the extrajudicial collection costs, Bos is entitled to increase the principal of the claim after the expiration of 1 year with the default interest cumulatively accrued in that year, in accordance with paragraph 3 of this article.

In the absence of full payment by the other party, Bos shall be entitled, without further notice or judicial

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

intervention, to dissolve the agreement or to suspend its obligations under the agreement by means of a written statement, until the payment is nonetheless successfully made or the other party has provided an adequate guarantee in this regard. Bos shall also have the aforementioned right of suspension if it already has reasonable grounds to doubt the creditworthiness of the other party before the other party is in default with the payment.

Payments made by the other party, shall firstly be deducted by Bos from all interest and costs owed, and then from the longest outstanding invoices, unless at payment the other party expressly indicates in writing that the payment is for a later invoice.

The other party is not entitled to offset claims of Bos with any counterclaims it has against Bos. This also applies if the other party applies for a (temporary) moratorium on payments or is declared bankrupt.

Retention of title

Bos retains ownership of all goods delivered, and yet to be delivered under the agreement, until such time as the other party has fulfilled all of its payment obligations to Bos.

The payment commitments specified in paragraph 1 shall consist of the payment of the purchase price and/or the agreed fee for the supplied and yet to be supplied goods, plus receivables for work performed related to the delivery and claims for imputable failure of the other party in fulfilling its obligations, including the payment of indemnification, extrajudicial collection costs, interest and possible penalties. Goods subject to retention of title are allowed to be resold by the other party as part of normal business activities, provided it has likewise agreed with its customers on a retention of title with respect to the delivered goods.

As long as the delivered goods are subject to a retention of title, the other party is not entitled to pledge the goods or to allow financiers to take actual possession of the goods.

The other party is obliged to inform Bos immediately in writing if third parties claim to have ownership or other rights with respect to the goods subject to a retention of title.

The other party is obliged to store the goods subject to retention of title carefully and to ensure that they are identifiable as being the property of Bos, until such time as it has fulfilled all of its payment obligations to Bos.

The other party shall be responsible for obtaining the proper business insurance and/or contents insurance, such that the goods delivered subject to retention of title are at all times co-insured, and shall grant Bos access at its first request to the insurance policy and any accompanying proofs of premium payment.

If the other party acts in contravention of the provisions of this article, or Bos makes an appeal to the retention of title, Bos and its staff are given the irrevocable right to enter the grounds of the other party and take back the goods subject to a retention of title. The foregoing is without prejudice to the right of Bos to claim indemnification for damages, lost profits and interest and the right to dissolve the agreement without any further notice, by a written statement.

Intellectual Property Rights

Bos is and remains the holder of all intellectual property rights pertaining to, arising out of, related to and/or belonging to the goods, documents, etc., supplied or manufactured by Bos under the agreement, unless parties have expressly agreed otherwise in writing.

The exercise of the rights specified in paragraph 1 of this article, both during and after the performance of the agreement, is expressly and exclusively reserved to Bos.

The other party is not entitled to use the documents supplied or manufactured by Bos outside the context of the agreement. The other party is prohibited from providing these documents to third parties, allowing third parties to access these documents or multiplying them without the prior written permission of Bos. The other party warrants that all information and/or documents it is to provide to Bos shall not infringe the copyright or other intellectual property rights of third parties. The other party is liable for any damage caused by such breaches to Bos and indemnifies Bos against claims of any such third parties.

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Right of retention

Bos is authorised to suspend the return of the goods of the other party, which Bos has in its possession for the purposes of maintenance or repair, if and during the period that:
the other party has not or not fully met the costs of the work on the goods;
the other party has not or not fully met the costs of work performed by Bos earlier on the goods;
the other party has not or has not fully met other direct claims arising from the contractual relationship with Bos.
Bos is not liable for any damages – of any kind whatsoever – resulting from its exercised right of retention.

Bankruptcy, incapacity of disposing of property, and suchlike.

Without prejudice to the provisions set out in the other articles of these General Terms and Conditions, Bos is entitled to dissolve the agreement through a written statement to the other party, without recourse to the courts and without notice of default being required, the moment the other party:
is declared bankrupt or an application for bankruptcy has been made;
applies for a (temporary) suspension of payment;
is affected by executory seizure;
is placed under tutelage or administration;
otherwise loses the power to dispose of, or manage, its assets or some of its assets.
The provisions of paragraph 1 of this article shall apply, unless the trustee or receiver acknowledges the obligations arising from the agreement as estate debt.
The other party shall always be obliged to inform the trustee and/or receiver of the (contents of) the agreement and these General Terms and Conditions.

Force majeure

Where there are circumstances beyond the control of the other party or Bos, Bos is entitled to dissolve the agreement through a written statement to the other party, without judicial intervention, or to suspend the fulfilment of its obligations to the other party for a reasonable period, without any compensation being due.
Force majeure or circumstances beyond the control of Bos in the context of these General Terms and Conditions are understood to mean: a non-attributable shortcoming of the suppliers or third parties appointed by Bos, or other compelling reasons in support of Bos.
Circumstances that constitute force majeure shall include, among other things: war, riots, mobilisation, foreign and domestic unrest, government measures, strikes within the organisation of Bos and/or the other party or the threat of these and similar conditions, a significant change in the exchange rates that existed when the agreement was entered into, interruption of operations as a result of fire, theft, sabotage, natural phenomena and the like, as well as by weather conditions, road blocks, accidents, lack of materials or parts, etc., and problems with transport and delivery.
If the force majeure situation arises when the agreement has already been partially performed, the other party is obliged to meet its obligations towards Bos up to that time.

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Cancellation, suspension

If the other party wishes to cancel the agreement prior to or during its performance, it is obliged to pay Bos damages to be determined by Bos. These damages shall include all costs already incurred by Bos and any losses and loss of profit it has suffered, caused by the cancellation. Bos is entitled, at its own discretion, to set the related costs, losses and loss of profits at 20 to 100% of the agreed price that Bos would otherwise have charged the other party in light of the work that has already been carried out and the deliveries that have already been made.

The other party is liable for the consequences of the cancellation or termination of the agreement in relation to third parties and indemnifies Bos against any claims in this respect.

Bos is entitled to deduct all sums already paid by the other party from the damages owed by the other party.

In the event of suspension of the performance of the agreement at the request of the other party, the costs related to all the work currently already completed and/or costs incurred shall be immediately payable and Bos is entitled to charge the other party for them. Bos is also entitled charge the other party for all costs made or to be made during the suspension period as well as for the hours already allocated before the suspension period.

If performance of the agreement cannot be resumed after the agreed suspension period, Bos is entitled to dissolve the agreement, without recourse to the courts, through a written statement to the other party. If performance of the agreement is resumed after the agreed suspension period, the other party shall compensate Bos for any costs resulting from the resumption.

Governing Law and Jurisdiction

This agreement concluded between Bos and the other party is exclusively governed by Dutch law. Any disputes will be settled before the competent court of law in the place where Bos is established, although Bos always reserves the right to submit the dispute to the competent court in the country or State where the other party is established.

If the other party is established outside the Netherlands, Bos is entitled to act in accordance with paragraph 2 of this article or - at its option - to bring the disputes before the competent court in the country or state where the other party is established.

Date: 13 October, 2011

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Recommended wiring diagram

Hydraulic oil lines

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

BOS HOMOGENISERS

HOMOGENISER

CONTROL VOLTAGE: 24VDC

COLOR CODE	
MAIN CURRENT	400VAC
MAIN CURRENT	0VAC
CONTROL VOLTAGE	230VAC
CONTROL VOLTAGE	24VDC
ANALOG (VOLTAGE, CURRENT)	
EXTRINSIC VOLTAGE	
GROUND	

- BLACK
- LIGHT BLUE
- RED
- DARK BLUE
- GREY
- ORANGE
- GREEN/YELLOW

TERMINALS: WAGO

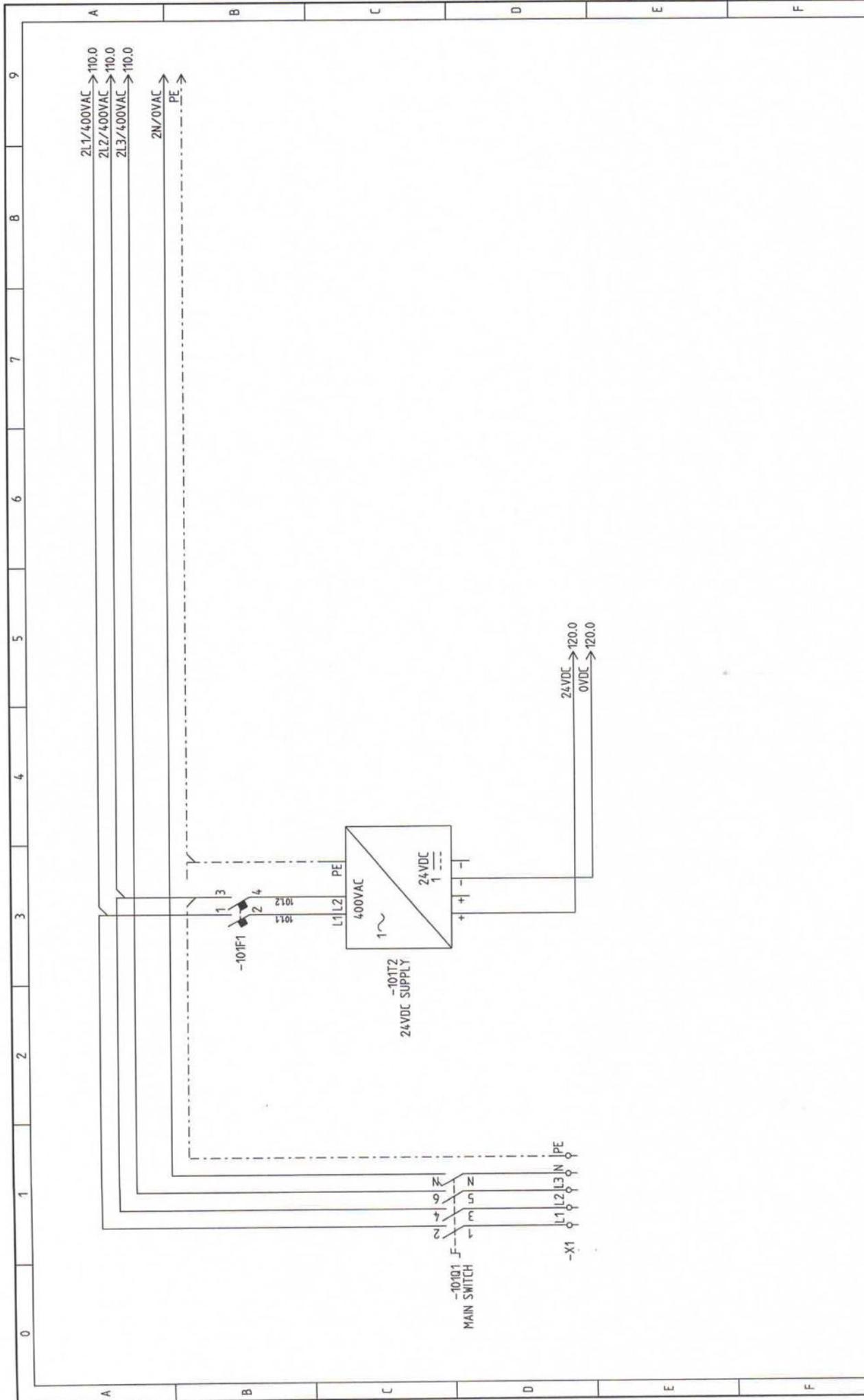
- X1: SUPPLY
- X2: MOTORS
- X4: SAFETY CONTACTS
- X10: CONTROL

COLOR ABBREVIATION

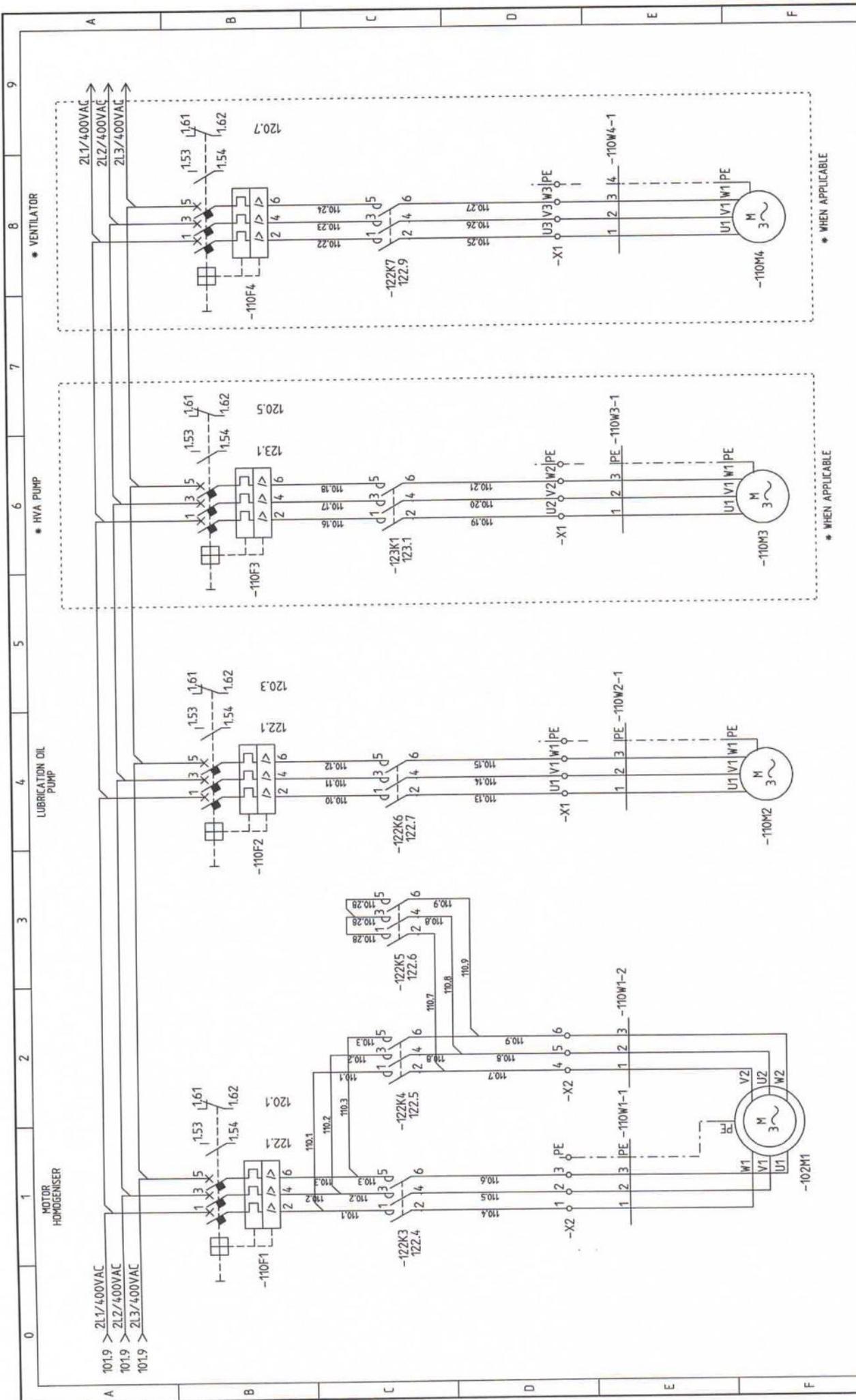
- | | |
|--------|----|
| BLACK | BK |
| BROWN | BN |
| RED | RD |
| ORANGE | OG |
| YELLOW | YE |
| GREEN | GN |
| BLUE | BU |
| VIOLET | VT |
| GRAY | GY |
| WHITE | WH |
| PINK | PK |

RECOMMENDED WIRING DIAGRAM

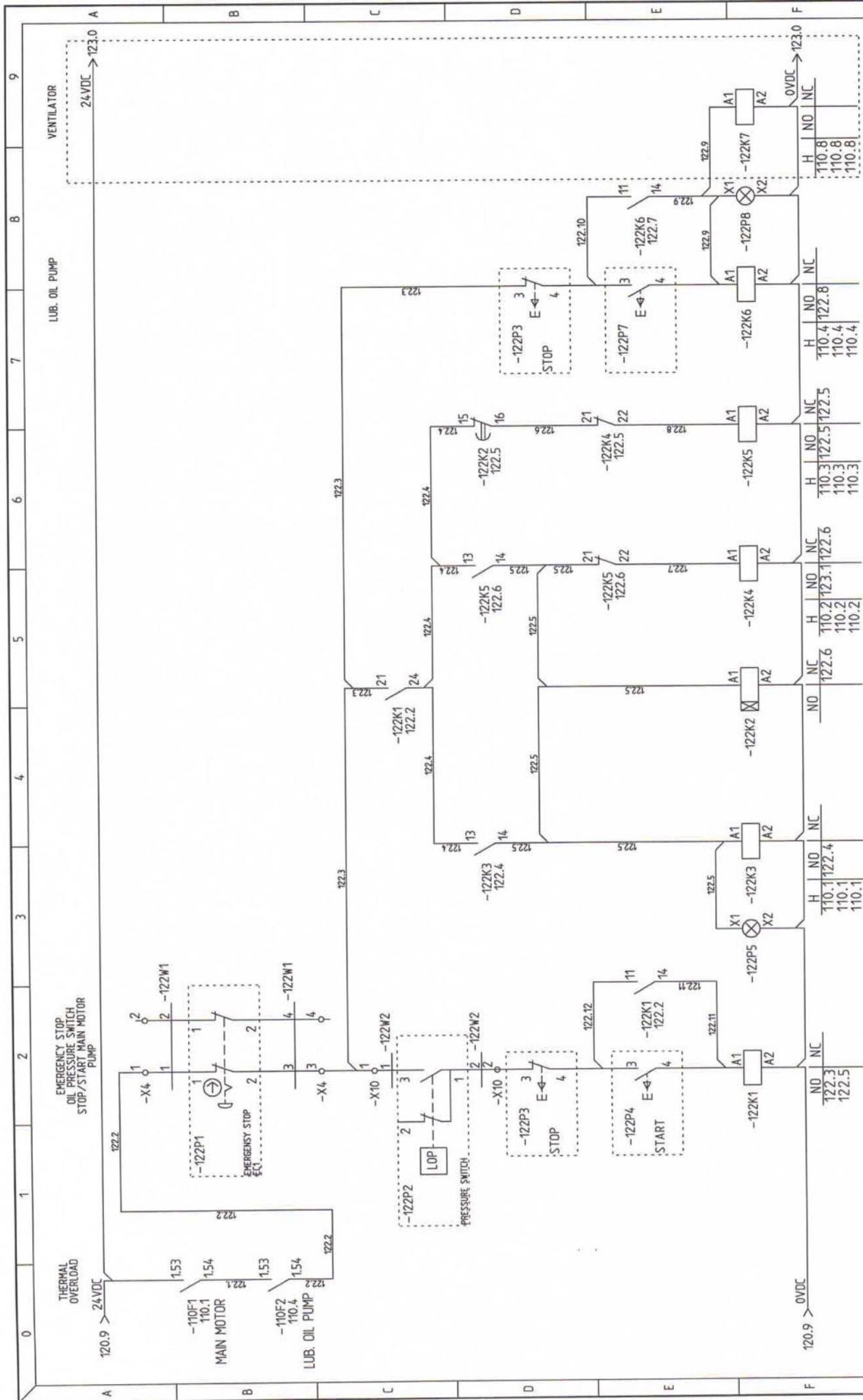
BOS HOMOGENISERS <small>hmk</small> FRONTPAGE BOS HOMOGENISERS	Projectname : 08-588 Projectname E&B 08-588	Drawing nr.: EL0040 Function: =EC1	Made: 27-6-2008 Revision.: 27-8-2008	Status: Last: 27-8-2008 Next: =EC1/101	Made by: G.Pelleboer Sheet: 100 From: 6
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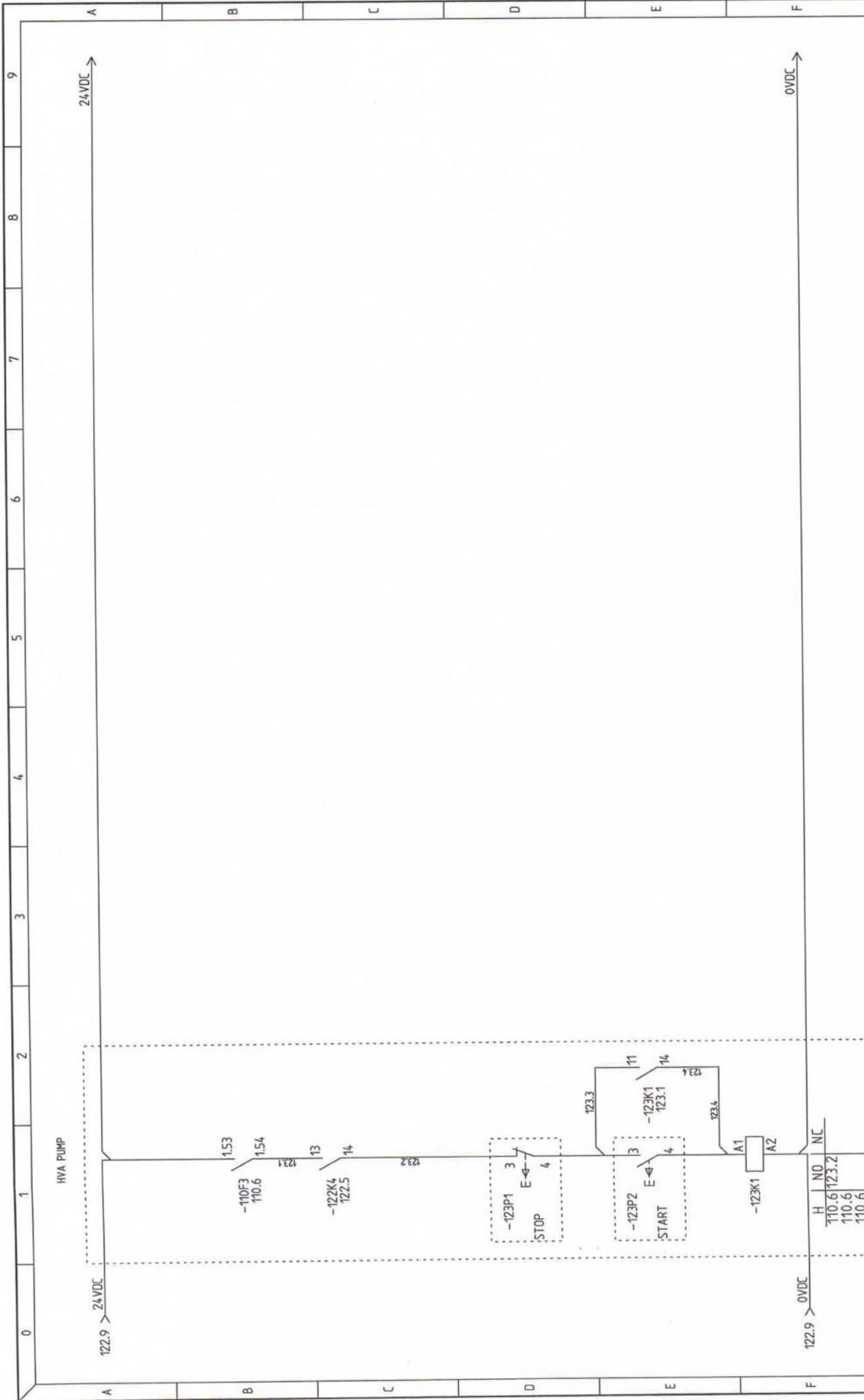
BOS <small>HOMOGENISERS</small> <small>bv</small> MAINPOWER BOS HOMOGENISERS	Projectname : 08-588 Projectname E&B 08-588	Drawing nr : EL0040 Function: =EC1	Made: 27-6-2008 Revision.: 27-8-2008	Status: Last: =EC1/100 Next: =EC1/110	Made by: G.Pelleboer Sheet: 101 From: 6



BOS HOMOGENISERS BOS HOMOGENISERS	MOTOR BOS HOMOGENISERS		Projectname : 08-588	Drawing nr : EL0040	Made: 27-6-2008	Status: 27-6-2008	Made by: G.Pelleboer
	Projectname E8B 08-588		Function: =EC1	Revision: =EC1	Revision: 27-8-2008	Last: =EC1/101	Sheet: 110
			Projectname : 08-588	Drawing nr : EL0040	Made: 27-6-2008	Status: 27-6-2008	Made by: G.Pelleboer
			Projectname E8B 08-588	Function: =EC1	Revision: 27-8-2008	Last: =EC1/101	Sheet: 110
							From: 6



CONTROL		Projectname : 08-588		Drawing nr. : EL0040		Made: 27-8-2008		Status:		Made by: G.Pelleboer	
BOS HOMOGENISERS <small>TM</small>		Projectname E8B		Function: =EC1		Revision.: 27-8-2008		Last: =EC1/120		Sheet: 122	
								Next: =EC1/123		From: 6	

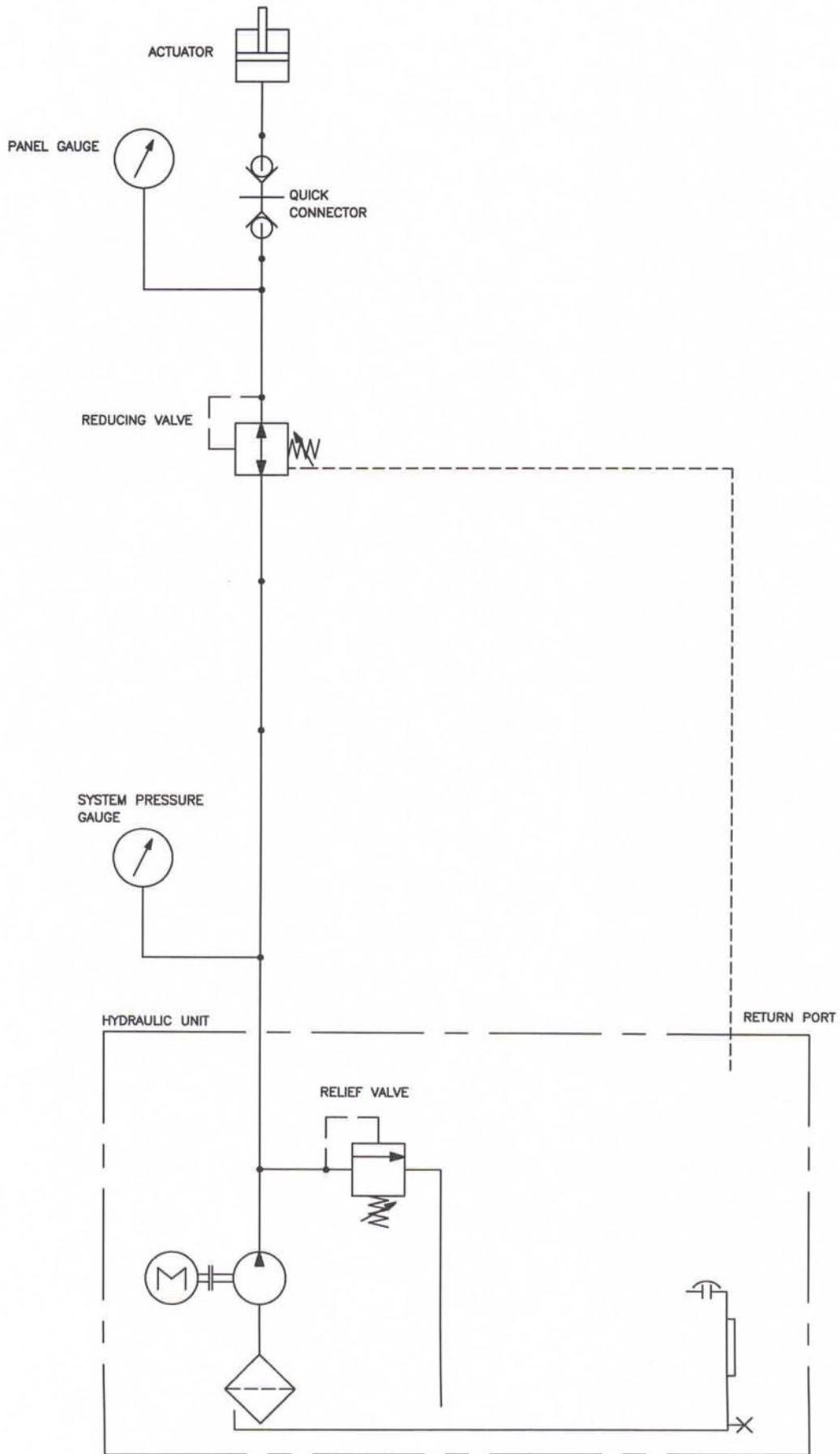


Projectname : 08-588		Drawing nr.: EL0040		Made: 27-8-2008		Status:		Made By: G.Pelleboer	
Projectname E&B 08-588		Function: =EC1		Revision.: 27-8-2008		Last: =EC1/122		Sheet: 123	
CONTROL BOS HOMOGENISERS								From: 6	

Hydraulic oil lines

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015



04				
03				
02				
01				
RevNo	Revision note	Date	Signature	Checked

HYDRAULIC SYSTEM



Designed by P.N.	Approved by P.N.	Filename HY0010	Date 08-07-99
HYDRAULIC SYSTEM			
Drawing number HY0010		Edition 01	Sheet 1/1

Taperlock pulley wheels

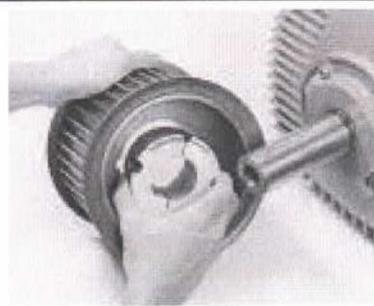
Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

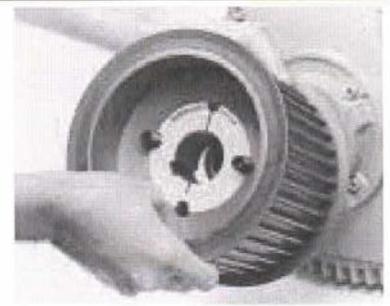
Taper Lock® Installation Instructions

TO INSTALL

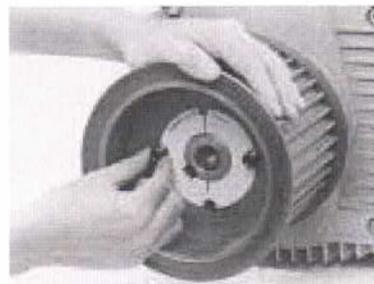
1. After ensuring that the mating tapered surfaces, bore and shaft are completely clean and free from oil or dirt, insert bush in hub so that holes line up.
2. Sparingly oil thread and point of grub screws, or thread and under head of cap screws. Place screws loosely in holes threaded in hub, shown thus ● in diagram.
3. If a key is to be fitted place it in the shaft keyway before fitting the bush. It is essential that it is a parallel key and side fitting only and has TOP CLEARANCE.
4. Clean shaft and fit hub to shaft as one unit and locate in position desired, remembering that bush will nip the shaft first and then hub will be slightly drawn on to the brush.
5. Using a hexagon wrench tighten screws gradually and alternately to torque shown in table below.
6. Hammer against large-end of bush, using a block or sleeve to prevent damage. (This will ensure that the bush is seated squarely in the bore.) Screws will now turn a little more. Repeat this alternate hammering and screw tightening once or twice to achieve maximum grip on the shaft.
7. After drive has been running under load for a short time stop and check tightness of screws.
8. Fill empty holes with grease to exclude dirt.



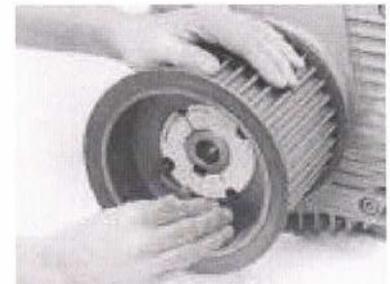
INSERT BUSH



INSERT SCREWS and LOCATE ON SHAFT



TIGHTEN SCREWS FINGER TIGHT



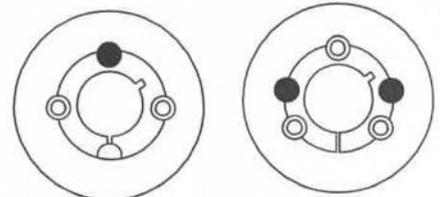
TIGHTEN SCREWS ALTERNATELY



REMOVING A TAPER LOCK BUSH

TO REMOVE

1. Slacken all screws by several turns, remove one or two according to number of removal holes shown thus ● in diagram. Insert screws into removal holes after oiling thread and under head of cap screws.
2. Tighten screws alternately until bush is loosened in hub and assembly is free on the shaft.
3. Remove assembly from shaft.



REMOVAL HOLES ●

Bush size	1008	1108	1210	1610	1615	2012	2517	3020	3030	3525	3535	4030	4040	4535	4545	5040	5050
Screw tightening torque (Nm)	5,6	5,6	20	20	20	30	50	90	90	115	115	170	170	190	190	270	270
qty	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
Screw details	size (BSW)	1/4"	1/4"	3/8"	3/8"	3/8"	7/16"	1/2"	5/8"	5/8"	1/2"	5/8"	5/8"	3/4"	3/4"	7/8"	7/8"
	Hex, socket size (mm)	3	3	5	5	5	6	6	8	8	10	10	12	12	14	14	14
Large end dia. (mm)	35,0	38,0	47,5	57,0	57,0	70,0	85,5	108	108	127	127	146	146	162	162	178	178
Bush length (mm)	22,3	22,3	25,4	25,4	38,1	31,8	44,5	50,8	76,2	63,5	89,0	76,2	102	89,0	114	102	127
Approx mass (kg)	0,1	0,1	0,2	0,3	0,5	0,7	1,5	2,7	3,6	3,8	5,0	5,6	7,7	7,5	10,0	11,1	14,0

Taper Lock® Engineering Data

Minimum Diameters of Taper Bored Hubs

The following table shows the recommended minimum diameter in mm for bespoke component hubs that are to be drilled, tapped and taper bored for use with Taper Lock bushes. The table differentiates between grey iron and ductile materials of various minimum tensile strength grades (in N/mm² or MN/m² units, which are numerically equal).

All standard Fenner Taper Lock products are tested to ensure that they are capable of safely containing the radial and circumferential hub stresses generated by the wedging mechanism which makes Taper Lock the equivalent of a shrink-on fit. For Taper Lock hub machining details, consult FPT.

Taper Lock® Bush	Minimum Hub Diameters (mm) for Various Materials			
	Tensile Strength N/mm ²			
	Cast Iron 180	Cast Iron 250	Steel 420	Steel 600
1008	62	54	51	47
1108	64	57	54	50
1210	104	86	78	69
1610	109	92	85	78
1615	90	81	77	73
2012	121	106	99	92
2517	130	119	113	108
3020	160	146	140	132
3030	144	136	132	127
3525	211	191	178	167
3535	191	176	168	160
4030	224	207	197	186
4040	209	195	188	180
4535	223	212	205	198
4545	215	205	200	194
5040	240	229	223	216
5050	233	223	219	213

Average Slip Torques for Taper Lock Fixing (Without key)

The following table shows empirically derived average slip torque values in Nm for each basic Taper Lock bush size with a variety of common metric bore diameters. The values assume that the assembly uses a Fenner Taper Lock bush fitted, in accordance with the instructions supplied with every bush, to a hub prepared to the Fenner specification. Slip will tend to occur at the bush/shaft interface, at the prescribed torque, unless a key is fitted. With a key, the slip tendency transfers to the bush/hub interface at a greater torque value related to the ratio of bush outer dia. to bore dia.. Consult FPT for specific values.

Formula to calculate the slip torque if a key is used: $\frac{\text{Large OD of Bush}}{\text{Shaft Size}} \times \text{average slip torque value.}$

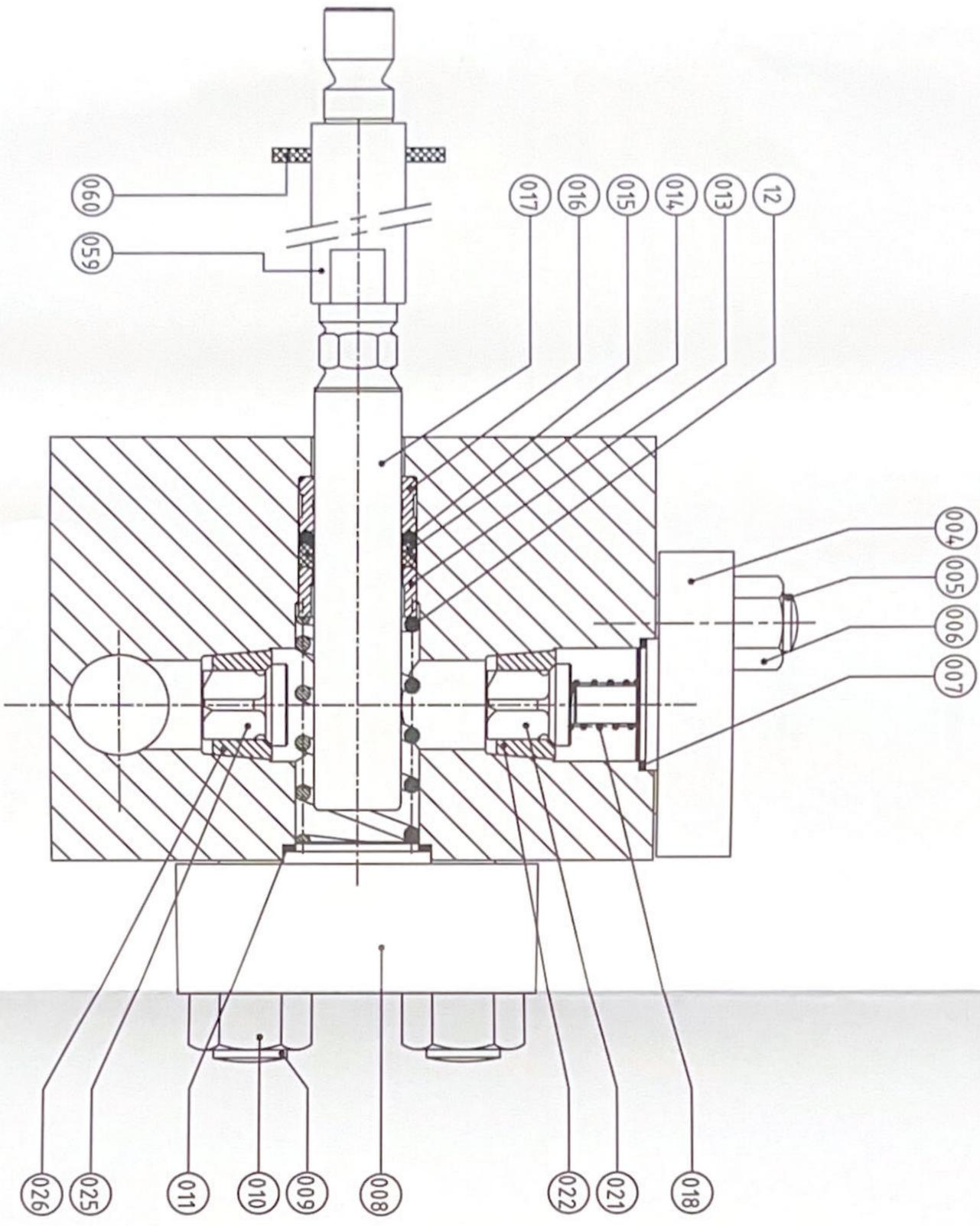
Bush	Bore (mm)	Average Slip Torque (Nm)	Bush	Bore (mm)	Average Slip Torque (Nm)
1008	12	29	3020 3030	38	520
	19	51		48	730
	24	66		55	890
1108	12	28	3525* 3535	60	970
	19	49		75	1300
	24	64		42	1000
	28	79		60	1580
1210	16	82	4030* 4040	75	2150
	19	105		90	2600
	24	142		100*	3075
	32	210		48	1700
	1610	19		98	60
1615	24	135	4535* 4545	75	3150
	38	240		100	4400
	42	265		115*	5150
	2012	24		165	55
2012	38	320	5040 5050	75	3900
	42	340		100	5500
	48	400		110	6300
	50	420		125*	6625
	2517	24		220	75
2517	38	380	5040 5050	100	5650
	42	430		125	7370
	48	510			
	55	600			
	60	670			

Large bores marked* are only available in bush sizes marked*

Drawing cylinder block

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015



Item#	Quantity	Title/Name, designation, material, dimension etc	Article No./Reference
060	3	WATER DRIP RING	T19275
059	3	PLUNGER ADAPTER	351801
038	2	INLET FLANGE GASKET	802644
037	2	INLET FLANGE NUT	570010
036	2	INLET FLANGE STUD	569200
035	1	INLET FLANGE	
030	1	PRESSURE GAUGE GASKET	802644
029	2	PRESSURE GAUGE NUT	570010
028	2	PRESSURE GAUGE STUD	569202
027	1	PRESSURE GAUGE	T18031
026	3	SUCTION VALVE SEAT	036722
025	3	SUCTION VALVE	H035916
024			
023			
022	3	DISCHARGE VALVE SEAT	036719
021	3	DISCHARGE VALVE	H035954
020			
019			
018	3	DISCHARGE VALVE SPRING	T39085
017	3	PLUNGER	T22480
016	3	PACKING ADJUSTING RING	H27325
015	9	BACK-UP RING	
014	9	PLUNGER PACKING	050325
013	3	PLUNGER RING	026325
012	3	PACKING SPRING	689325
011	3	FRONT CAP GASKET	802722
010	12	FRONT CAP NUT	570022
009	12	FRONT CAP STUD	410439
008	3	FRONT CAP	
007	3	UPPER CAP GASKET	802614
006	6	UPPER CAP NUT	570022
005	6	UPPER CAP STUD	
004	3	UPPER CAP	
003	2	CYLINDER BLOCK NUT	T106401
002	4	CYLINDER BLOCK STUD	807800
001	1	CYLINDER BLOCK	

Designed by: KN
 Checked by: **BIGS**
 Approved by - date: _____
 Filename: _____
 Date: 25-08-2015
 Article No./Reference: _____
 Scale: _____

BIGS MCL45-150P CYLINDER ASSY
 Edition: 0
 Sheet: 1/1

SECTION A-A

Drawing homogenising valve

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

Recommended spare parts list

Customer: Image S.L.
Customer reference: Q-Iberica
Bos reference: 201510987

Machine type: MC45-150P-01
Serial No.: 15H3014
Year of manufacture: 2015

RECOMMENDED SPARE PARTS

SET45012

DATE : 22-06-2015

TEL. :

FAX

CUSTOMER : Image

ADRESS :

BOS REF. :

CYLINDER No. :

LOCATION :

MACHINE TYPE : MC45-150P

CONTACT MAN :

SERIAL No. : 15H3014

ITEM	DESCRIPTION	RECOMMENDED QTY.		UNIT	PART NO.	UNIT PRICE	TOTAL PRICE
		MAINTENANCE	EMERGENCIES				
CYLINDER							
004	UPPER CAP						
005	UPPER CAP STUD						
006	UPPER CAP NUT						
007	UPPER CAP GASKET	1		BOX	802614		
008	FRONT CAP						
	FRONT CAP SPIGET						
009	FRONT CAP STUD						
010	FRONT CAP NUT						
011	FRONT CAP GASKET	1		BOX	802722		
012	PACKING SPRING		1	PCE	689325		
013	PLUNGER RING		1	PCE	026325		
014	PLUNGER PACKING	6		BOX	050325		
015	BACK UP RING						
016	PACKING ADJUSTING RING	3		PCE	H27325		
017	PLUNGER		1		122325		
018	DISCHARGE VALVE SPRING	3		PCE	T39085		
021	DISCHARGE VALVE	3		PCE	H035854		
022	DISCHARGE VALVE SEAT		3	PCE	036719		
025	SUCTION VALVE	3		PCE	H035816		
026	SUCTION VALVE SEAT		3	PCE	036722		
027	PRESSURE GAUGE	1		PCE	T18031		
028	PRESSURE GAUGE STUD						
029	PRESSURE GAUGE NUT						
030	PRESSURE GAUGE GASKET	1		BOX	802646		
035	INLET FLANGE						
036	INLET FLANGE STUD						
037	INLET FLANGE NUT						
038	INLET FLANGE GASKET	1		BOX	802664		
			1				
		1					
	PLUNGER ADAPTER		1	PCE	351801		
	WATER DRIP RING	3		PCE	T19215		
						TOTAL	

ITEM		RECOMMENDED QTY.		PART NO.		TOTAL PRICE
		MAINTENANCE	EMERGENCIES			
HOMOGENISING VALVE 1st. STAGE						
101	HOMO VALVE BODY					
102	HOMO VALVE BODY STUD					
103	HOMO VALVE BODY NUT					
104	HOMO VALVE SEAT	1		PCE	T22519	
105	HOMO VALVE SEAT GASKET	1		BOX	802683	
109	IMPACT RING	1		PCE	T22419	
110	HOMO VALVE	1		PCE	T22619	
113	HOMO VALVE GUIDE		1			
115	VALVE (ROD) GASKET	1		BOX	801576	
161	ACTUATOR VALVE ROD			PCE	905102	
162	ACTUATOR PACKING	2		PCE	905103	
190	OUTLET CONNECTION GASKET	1				
HOMOGENISING VALVE 2nd. STAGE						
201	HOMO VALVE BODY					
202	HOMO VALVE BODY STUD					
203	HOMO VALVE BODY NUT					
204	HOMO VALVE SEAT					
205	HOMO VALVE SEAT GASKET					
209	IMPACT RING					
210	HOMO VALVE					
215	VALVE (ROD) GASKET					
262	ACTUATOR PACKING					
HYDRAULIC SYSTEM						
	SYSTEM GAUGE		1	PCE	T18070	
	HVA GAUGE 1st.		1	PCE	T18061	
	REDUCING VALVE		1	PCE	905429	
	HYDRAULIC UNIT		1	PCE	HT98902	
DRIVE						
	OIL PRESSURE GAUGE		1	PCE	T18053	
	OIL FILTER	2		PCE	T52404	
	BAFFLE SEAL PACKING	1		PCE	811237	
	BAFFLE SEAL WASHER		1	PCE	415803	
	LUBRICATION OIL SWITCH		1	PCE	71320125	
	LUBRICATION OIL PUMP		1	PCE	T46618	
	MOTOR 75KW					
	V-BELT		8	PCE	B002346	
	MOTOR PULLY				8SPB212	
	MACHINE PULLY				8SPB560	
						TOTAL