VOLDA

C. P. PROPELLERS — REDUCTIONS GEARS

Instruction manual

TYPE: ACG 850
w/PF 700/1CC

INST.NO.: 892 & 893

YEAR: 1992

VOLDA

AS VOLDA MEK VERKSTED

P.O.Box 205
N-6101 Volda
Norway
Telephone: +4770 76114
Mobil phone: +4790 82134
Telefax: +4770 79903
Telex: 42334 vomek n

47700 79903

This instruction manual, issued with Volda gear and Controllable Pitch Propellers, is prepared for use by operating personnel.

Operators should familiarize themselves with working principles of the equipment and with the instructions and precautions contained herein.

Keep this book handy for reference at all times, so that proper and correct operating instructions can be observed and followed.

When using the book, note that all part numbers mentioned, unless otherwise stated, refer to the drawing number appearing in the upper right hand corner of each page. If reference is made to other drawings the part is designated with drawing number and part number.

No dismantling or adjusting work should be started, unless the appurtenant instructions have been carefully studied, so that the work sequence is clear and all necessary tools can be at hand.

It is of paramount importance that extreme cleanliness is observed during all work on the equipment. Sand, dust or other impurities are detrimental to hydraulic and pneumatic equipment, and are most likely to impair the functioning seriously. Keep therefore hands and tools clean. Use clean linen rags - never cotton waste - when cleaning parts.

Direct all correspondence to our adress:

A.S.Volda Mek.Verksted
Volda - Norway

Telephone:	Telex no:	Telegrams:
Volda no.	42334 (Vomek n)	"Verkstedet",Volda

(070) 76114
(090) 82134 (mobiletelephone)
Telefax:
(070) 79903

VOLDA
A/S Volda Mek. Verksted
P.O.box 205, N-6101 Volda, Norway

J-
Dato
Sign.

TABLE OF CONT. ACG 850 W/PF 700/1CC

Spare parts/Tool.

10 pcs.	Thrust blocks	200498
1 pc.	Thrust block w/hole for temp. alarm	300684
4 pcs.	Spare filter, Parker	502629
4 pcs.	Emergency bolts for clutch M24x2, L=60	
1 pc.	Hose	301264
1 pc.	Bearing	502775
1 pc.	"	502967

VOLDA

Data sheet

J-
Date
Sign.

Installation No: 892-893 Type ACG 850 w/PF 700/1CC

Propeller diameter:		mm
Number of blades:		
Propeller direction of rotation:	Anticlockwise (left hand)	
Sterntube gland, distance L:		mm
Reduction gear ratio:	4,61 : 1	G
Gear backlash:		mm
Friction clutch type main gear:	Ortlinghouse 0-002-333-84-002-000	
Friction clutch type PTO:	Ortlinghouse 0-002-833-75-001	
Friction clutch pressure main gear:	22	bar
Friction clutch pressure PTO:	22	bar
Servo oil pressure:	24	bar
Maximum oil pressure, safety valve:		bar
Control oil pressure:		bar
Lubrication oil pressure:	2-4	bar
Oil pump: Type:	Tyrone 25500 A3D	
RPM:		
Capacity:	l/min. at.....	RPM
Approx. oil contents in gear:	630	ltr.
Air pressure, supply remote control:		bar
Max. air pressure from transmitter valve (prop.):		bar
Min. air pressure from transmitter valve (prop.)		bar
Max. air pressure from transmitter valve (engine)		bar
Min. air pressure from transmitter valve (engine)		bar
Air pressure, supply pneudyne positioner:		bar
Air pressure, aut. pitch control:		bar
Bearing clearance, output shaft (new):	0.13-0.27	mm
Thrust bearing, axial clearance (new):	0.3 - 0.6	mm
Bearing clearance, pinion shaft (new):	0.22-0.33	mm
Pinion shaft, axial clearance (new):	0,3 - 0,6	mm
Clearance aft sterntube bearing (new):		mm
Clearance, aft sterntube bearing (wear limit):		mm
Clearance, forward sterntube bearing (new):		mm
Clearance, forward sterntube bearing (wear limit):		mm
Gearbox oil temperature:	50	oC

Pressure switch set points:

Alarm high servo oil temperature	60	°C
Alarm high temperature in sterntube		°C
Alarm high temperature in thrust bearing	60	°C
Automatic start and stand by pump	17	bar
Indication of clutch "Engaged-Disengaged"	10	"
Indication of "Bridge"-"Engine Room" control		"
Alarm low servo pressure	18	"
Alarm control pressure	4	"
Alarm low clutch pressure	18	"
" " " PTO	18	"
Alarm low lubrication oil pressure	1,5	"
Alarm failure lubrication oil pressure		"
Auto stop stand by pump		"
Request stop main engine by extra low lub.oil pressure		"
Alarm low air pressure		"
Signal overload air pressure		bar

Alarm low level in gravity tank. Oil level abt. 10 cm above bottom.

Pull up for propeller hub.

CP 42/3 - 47/3 - 52/3 distance a = mm.

Tension of bolts:

Blade bolts : Prestressing angle.....°, cord.....mm, at ø....mm
Guide bolts : " " .....°, cord.....mm, at ø....mm
Flange bolts : " " .....°, cord.....mm, at ø....mm
Servocyl.bolts : " " .....°, cord.....mm, at ø....mm

Servocyl.bolts : Tightening torque .....250.....kpm
Gearhousing bolts: M42: Tightening torque 170 kpm

Tightening torque for screws qual 12,9

M 10 =	7,6	kpm
M 12 =	13,3	"
M 16 =	33,0	"
M 20 =	64,3	"
M 24 =	111,0	kpm

Tightening torque for stainless screws qual 7,8 and 8,9

M 10 =	3,6	kpm
M 12 =	6,2	"
M 16 =	15,5	"
M 20 =	30,0	"
M 24 =	52,0	kpm

The reduction gear is a single-stage gear with helical toothed, case hardened and flank ground gear wheels, built into a gear-box of cast iron.(1).

The shafts are bedded in pressure oil lubricated bearings (12, lo and 11) lined with white metal. The output shaft is fitted with a thrust bearing (Michell - bearing) (31 and 32) to absorb the propeller thrust.

The hydraulic servomotor is built into the bull gear wheel and the slide valve (9 and 8) is placed in the servomotor piston.(3) Pitch variation is attained by moving the slide valve (9) via the guide ring (22).

The clutch is fitted on the forward end of the pinion shaft. It is hydraulically operated and its operating oil pressure should not drop below a pressure as indicated in "Data Sheet." This is the approximately required oil pressure in the hydraulic system.

The gearbox shall have a surface temperature as stated in "Data Sheet", by adjusting the water flow through the oil cooler.

The safety valve (J-17-22) is adjusted to open at the max oil pressure stated in "Data Sheet."

Lubrication pressure on bearings to be as stated in "Data Sheet."

Check the oil level in gearhousing freequently.

1. The push-pull rod in the propeller shaft should be moved as far astern (into the shaft) as possible.

2. Fit the shaft coupling preliminarily to the shaft as described under"Shaft-coupling Mounting". (J-99)

3. The lining up of the gearbox can now be carried out in the usual way with 10 mm clearance between the flanges.

4. Bolt the gearbox to the bed using clearance bolts and four fitted bolts. The fitted bolts are to be mounted on each side at the forward and after end of the gearbox.

5. Dismount the shaft coupling, and move it back to give access to the push-pull rod coupling.

6. Push the servomotor piston rod (J-03-3) to its extreme forward position.

7. Smear the threads with "Molypan" or similar and screw the flanges on to the rods ends. If the push-pull rod is too far aft to allow fitting of flange screws (53) with the flange in place, insert the screws in the flange (52) before this is mounted on the rod. The flanges should be flush with the thread ends on the rods. (See drawing).

8. Smear the flange screws (53), with "Molypan". Push the servomotor piston aft and screw the flange screws into the piston rod flange by hand. (By moving the piston, the control handle on the reduction gear should simultaneously be moved to "ahead" pitch).
If it is difficult to reach the screw heads with a wrench, the piston can be moved forward by using air pressure (7 kp/cm^2) at the aft side of the servo piston. (Connect at one of the hydraulic pump connections and pull control handle on reduction gear to "astern").
When doing this, it is important to retain the propeller shaft in its correct position by using a wood spacer between the shaft and servo.

9. Be sure that the rod spigot enters properly in the piston rod.

10. Tighten the screws (53) properly and lock with locking screws (71).

11. Mount the shaft coupling as described in section "Shaft coupling, Mounting." (J-99).

A. Precautions before starting main engine.

1. Check the oil level in the gear box. Replanish if necessary.

2.x) Open air supply valve and adjust the pressure according to "Data sheet". (For installations supplied with water seperator and air filter with mechanical drainage, blow off moisture).

3. Set the selector switch for stand-by oil pump in position "Man" and switch on the main switch for the pump.

4. Depress the push button on engine room control panel or starter thus starting the stand-by pump.

5. Check that the oil pressure are according to "Data sheet."

   Note: The oil pressures may be somewhat higher when the oil is cold.

6. Switch on the alarm circuit.

7.x) Switch over to "Bridge" control.

8.xx) Check that the clutch is disengaged.

9. Check that the propeller is in neutral pitch.
   The main engine can now be started upon a signal from the bridge.

lo. When the main engine is started and the mechanical main oil pump has gained normal oil delivery, stop the stand-by pump by means of the push button on the engine room control panel.

11. Turn the selector switch for the stand-by pump in position "Auto." This pump will now start automatically in case of main oil pump failure.

x) Not available for installations with mechanical remote control, and el-hydr. remote control.

xx) Not available for installations without clutch (AG)

B. General operating rules.

1. Check all pressures and the oil temperature regularly. Any discrepanicies should be investigated at once.

   The servo pressure may vary considerably, especially during maneuvres, but also during constant operationdue to small self adjusting movements of the propeller.

   The oil temperature should be kept as indicated in "Data Sheet" by adjusting the water flow through the oil cooler.

2. The sterntube glands, the servomotor box and the oil pumps should be checked regularly for overheating and unusual sounds.

3. Regularly check the equipment for oil leaks that may develop. Keep the equipment clean and tidy.

4. Check that the oil level in the gravity tank is always at the top when running.

C. Changing to engine room control.

When the control of propeller and engine is to be carried out form the engine room, proceed as follow:

1. Make sure that the position of the control handles on the bridge and in the engine room correspond. (For inst. with control column in engine room.)

2. Set the change-over valve on the engine room control stand in position "Engine room control". The electric warning signals about control transfer to the engine room will automatically be activated, and the propeller can be controlled from the engine room.

D. Changing to bridge control.

1. Before changing to bridge control, make sure that the bridge and engine room control handles correspond.

2. Change-over valve on engine room control stand should be set in position "Bridge control". The electric warning signals about control transfer to the bridge will automatecally be activated, and the propeller can be controlled from the bridge.

E. "Finished with engines".

1. Switch off the alarm circuit.
2. Switch off the stand-by servo pump main switch.

3x) Shut the air supply.

It may be convenient to combine the "Finished with engines" procedure with a check on the alarm circuit and a automatic starting of the stand-by pump. This can be done as follows:

1. Stop the main engine. The stand-by pump should now start automatically, and the alarm should sound.
   Accept the alarms for servo pressure and start of stand-by pump.
2. Stop the stand-by servo pump with buttons and switch off its main switch.

3x) Shut off the air supply. The alarm should sound. Accept the alarm for air supply.

Note: Only for installations supplied with type E and head tank for lubrication oil.
If the installation is provided with a head tank for propeller lubrication, the oil pump feeding this has to be switched into "AUTO" position. Check that the main switch is in ON position.
If the electric supply to the main switch board is shut down, due to repair etc., the head tank must be filled periodically.
See also paragraph "Propeller lubrication" (J-66).

x) Not available for installations with mechanical and el-hydraulic remote control.

Hydraulic and pneumatic mechanisms are precision units, and their continious smooth operation depends on proper care. Therefore follow the instructions given below.

Every day.

1. Check the oil level on the gearbox by means of the dip stick. Replenish if necessary.
2. For installations with water separator and air filter with mechanical drainage, blow off moisture.
3. Check the oil level in the gravity tank.
4. Make a visual check on the complete equipement for oil leaks that may have developed.

Inspecting during service.

1. The minimum servo oil pressure should be as indicated in "Data sheet". If the pressure drops too low, the clutch will slip.
2. Check that the oil temperature of the gearbox is as indicated in "Data sheet."
3. Check the water flow through the cooler now and again.

3 Days after extensive overhouls or dismantling:

1. Only for installations supplied with suction filter. Check suction filter for the pumps. Clean filters on gas oil and blow off with air blast if necessary.

Every month:

1. To ensure efficient operation stict attention must be paid to the oil. If any water has leaked into the oil system, the oil has to be changed and the leakage repaired.
2. If a circulation system is provided for the propeller lubrication, approx 3-4 liters of new oil should be circulated through the system.
   Refer to: "Propeller hub lubrication Procedures" (J-66).
3. x)Replenish anti-freezer with "kilfrost" or similar in cold weather.

Every month:

1. x) Change and reactivate air drying substance if saturated.
2. Lubricate mechanical control transmissions.

x) Only for installations with pneumatic remote control.

Every 6 months.

1. Check mechanical control transmissions. Retighten if necessary.

2.x) Clean the oil filter (J-87). Ensure that the lid fits properly when reassembling the filter. If the filter leaks, the oil pump will suck air into the hydraulic system. Remarks: Use sealing washers under the screw head.

3.xx) Clean air filters on transmitter valves, and screens in drier output conditions (J-60-6).

4.xx) Lubricate moving parts in control columns, also the transmitter valve plungers (use silicon grease on plungers). (For Westinghouse transmitter valves, see "Chart of lubricants summary".

Yearly inspection.

1. Take oil samples from the gearboc for analysis. The oil analysis should in addition to normal chemical analysis also include partide counting. Oil clenlyness level should be better than ISO 17/14. Change oil if necessary.

2. Check the water side of the oil cooler. If necessary clean it according to instructions given in section: "Oil cooler".

3. Examine the gearwheels throughly for faults or cracks.

4. Check pipes and gearbox for leakages.

Every dry-docking, preferably every year.

1. Check the oil in the propeller hub and take oil samples. Draining and refilling is described in section "Propeller hub lubrication. Procedures".

2. Check the sterntube glands for leakages.

3. Check the propeller hub for leakages.

4. Check that the air accumulator in the propeller hub is empty. Remove the drain plugs (J-01-34) / (J-62-18) at the top and the bottom of the hub and drain off possible oil or waters.

   If emulsifying oil is used in the system and this has become thick through mixing with water, it may be necessary to use pressurized air through the top plug to force it out.
   (Max 1 kp/cm2)

4. Check that the propeller blades are undamaged and that all bolts and plugs are tight and properly secured.

Every 2 years.

1. Lubricate the sliding faces of the change-over valve with silicon grease.

x) Valid only for installations with suction filter.
xx) Valid only for installations with pneumatic remote control.

OIL TYPES

for Volda Controllable Pitch Propellers with Reduction gear.

The following oil types are recomended for use in gearbox, propeller and sterntube: x)

Antar	:	Epona Z 100
BP	:	Energol GR-XP 100
Caltex	:	RPM DELO 300 Oil SAE 30 or Meropa Lubricant 100
Castrol	:	Alpha SP 100 or Hyspin AWH 100
Chevron	:	Chevron DELO 300 SAE 30 or Chevron NL Gear Compound 100
Esso	:	Spartan EP 100
Fina	:	Fina Giran 100 or Stellano 320 (Caprano 312 must be confirmed by Volda for each case).
Gulf	:	EP Lubricant HD 100
Mobil	:	Mobil DTE 18 or Mobilgear 627
Norol	:	Vekselolje CC 100
Nynas	:	GL-15
Reginol	:	Industry gear EP 100 or ADR 100 or Motor oil MDI SAE 30
Shell	:	Gardinia oil 30 or Melina oil 30
Texaco	:	Meropa (50% 68 + 50% 150) or URSA Oil Ekstra Duty SAE 30

x) In case of sterntube with Cedervall glands use recomended oil types from Cedervall.

Max. viscosity 250 cst. at 40 C.

Fault 1.

It is impossible to change the propeller pitch or the movement is too slow.
Possible causes:

A. If the servo oil pressure is low or non existant:

1. Insufficient oil in the system.
2. Leakage on the suction side of the oil pump, allowing this to suck air. Oil is foaming.
3. Pressure pipes leakages.
4. Pump (aggregate) failure.
5. Leakage in safety valve (J-85). Valve stuck in open position.
6. Excessive clearance in bearing (J-o3-1o). Possible oil leakage from the bearing can be seen trough gearbox inspection openings.(For G 38o, see (j-o3-14) instead of (J-o3-1o).
7. Oil is too thin or too hot.

B. If the servo oil pressure is normal.

1. Main slide valve (J-o3-9) is stuck. Change to "Engine room" control and try to operate the propeller with the mechanical control handle on the gearbox. The spool valve should have a free movement of approx. 19 mm releative to the piston. If this is in order, the fault lies in the remote control. (For G 38o free movement is approx. 11 mm).
2. Switch back to "Bridge" control and check input and output gauges on the reduction valve.

3.x) If both are normal, check the driers and the valves before and after the driers for blocked passages.

4.x) If input gauge shows less than specified in "Data sheet", check main pressure gauge on air tank and supply valve.

5.x) If input gauge shows more than specified in "Data sheet" and it is impossible to adjust the reduction valve to this pressure output, there must be:

a. A blockage in the reduction valve or
b. Excessive leakage in the system (this can be heard as a rustling of air through the valve).

In the first case the reduction valve should be renewed or overhouled. In the second case the leakage must be traced and rectified.
Leakages in pneumatic valves are mostly due to dirt on the needle seatings or, more seldom, a ruptured diaphragm.

Special reference no for G 750.
J - 17 - 22 is for G-750 (J-17-2)

x) Only for pneumatic remote control.
For other types of remote control, see the guidlines for these.

6.xxx) Move the brigde control handle and observe the pressure on the "Ahead" and "Astern" gauges on the remote control panel. If the ahead and astern pressures are faulty, check in turn the transmitter valve (J-83-16), the direction valves (J-83-6 and 7), pitch limit valves (J-83-12f and 12 a), the coupling valve (J-83-40) and the pneumatic actuator (J-82-10).

C. If the servo oil pressure rises considerably and blows the safety valve when the slide valve is moved. (With declutched propeller):

1. Seizure in propeller hub or shafting.

2. Seizure in servomotor.
Disconnect the push pull rod connection to determine of which end the seizure is. The faulty unit will have to be dismantled for inspection.

D. If the oil pressure is constantly too high:

1. The choke valve in valve block (J-17)

2. Restricted pressure line from oil pump to servo.

Fault 2.
Clutch will not engage or is engaged with too low clutch pressure.
Possible causes:

E. If the oil pressure is too low:

1. Same causes as under A.

2. Choke valve in valve (J-17)

3. Choke valve spring weakened or broken.

4.xx) Valve piston sticking.

5.xx) Valve spring weakened or broken.

F. If the oil pressure is normal:

1. Electric supply cut off. Relays or Solenoid valve damaged.
Wiring broken. Check valve movement by operating the emergency pitch positioner at each valve coil.

2.xx) Leakage or blockage in the oil inlet to the clutch.

3. Insufficient of faulty movement of solenoid valve.

x) For installations with automatic pitch control.

xx) Not available for installations without clutch (AG).

Special. Reference no. for G 750:
(J-17-17) is for G-750 (J-17-3 and 4)
(J-17-14) is for G-750 (J-17-3 and 4)
(J-17-35) is for G-750 (J-17-3 and 4)

xxx) Only for pneumatic remote control.

x)

Fault 3.

The clutch will not disengage.
Possible causes:

G. If the propeller shaft rotates considerably slower than with the clutch engaged:

1. Excessive lubrication of clutch plates, or too thick oil.
2. Clutch piston not completely withdrawn.
3. Insufficient or faulty movement of the solenoid valve.

H. If the propeller shaft rotates with the same speed, regardless of the clutch control.

1. Refer to F1.
2. Seizure or other faults inside clutch.

Fault 4.

Servo oil pressure at full engine speed lower than min. servo oil pressure specified in "Data sheet".
Possible causes:

I.

1. Choke valve in valveblock (J-17)
2. Spring in choke valve too weak.
3. Same causes as under A.

Fault 5.

Propeller pitch difficult to adjust accurately.
Possible causes:

K.

1. Excessive backlash in transmission between auxiliary servo and reduction gear(Ev. transmission in control stand on bridge).
2. Faults in the auxiliary servo.
3. Faults in the remote control system, see in fault finding prosedure for this system.

Fault 6.

Reduction gear running too hot. (Gearbox oil temperature above that specified in "Data sheet").
Possible causes:

L.

1. Insufficient cooling water.
2. Oil cooler clogged.
3. Bearings running hot.
4. Clutch slipping.

x) For AG-installations (inst. without clutch) don't care about the faults referring to the clutch.

Fault 7.

Rattling noise from gearbox.
Possible causes.

M. If rattling occurs at a certain engine speed only:

1. Torsional vibration resonances.
Avoid running the engine at this speed.

N. If gear rattles at all engine speeds:

1. Gearwheels or bearings damaged.

Fault 8.

Excessive oil consumption. (The gravity tank needs frequent topping up).
Possible causes:

O.

1. Sterntube gland leaking.
2.x) Propeller hub leaking.
3. Leakage from oil seal (J-o6-4)/(J-1o2-169) in propeller shaft.
4. Leakage from oil seal (J-o6-12) in shaft coupling, or from plug (J-o6-11)/(J-1o2-154).

Fault 9.

Excessive oil consumption. (Gearbox needs frequent topping up).
Possible causes:

P.

1. Leakage in oil cooler.
2. Leakage from pipe connections etc.
3. Leakage from oil seal on input or output shaft.

Fault 1o.

Gearbox oil contaminated with water.
Possible causes:

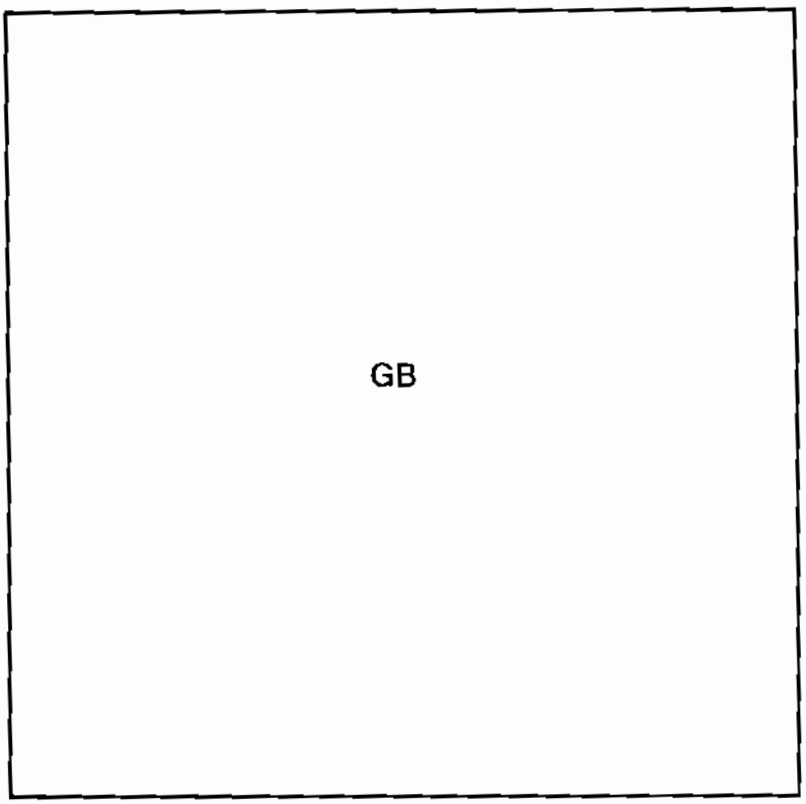
Q.

1. Leakage in oil cooler.
2. Bilge water entering gearbox.
3. Condensed air moisture.

x) Only for oil lubricated propeller hub.

INSTRUCTIONS
PLATE HEAT EXCHANGERS

1000 B-GB



SERIAL NO.:

Printed in Denmark by E[illegible]

APV BAKER AS • 6000 KOLDING • DENMARK • PHONE +45 75 50 11 33 • TELEX 5 13 45 THERM DK • TELEFAX +45 75 50 34 34

CONTENTS

ENCLOSURES AT THE BACK OF THE MANUAL

Drawing No.: _____

Diagram No.: _____

Gasket table No.: _____

_____

_____

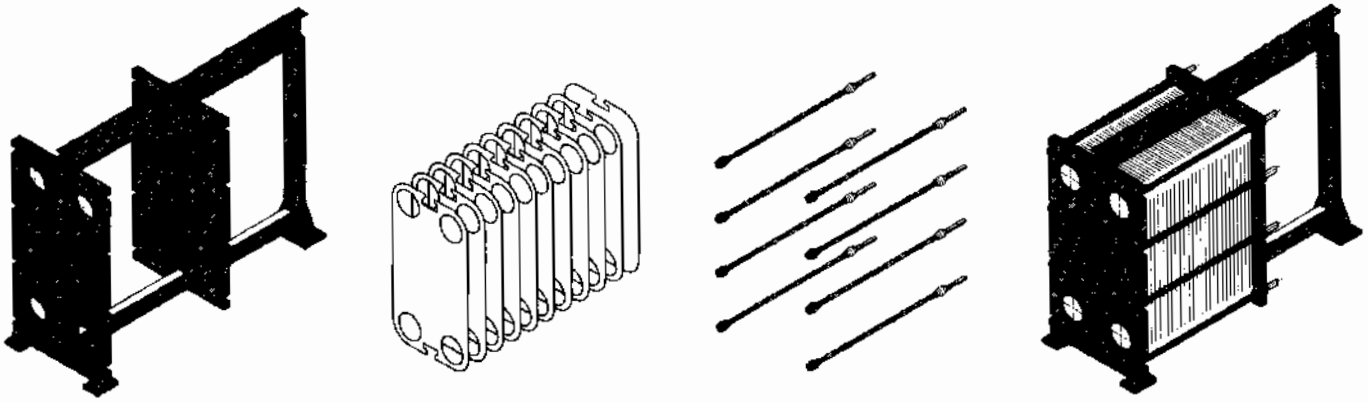


Fig. 1

1) CONSTRUCTION - FUNCTION

1-1) PRINCIPLE OF THE PLATE HEAT EXCHANGER

The plate heat exchanger consists of a head built together with a carrying bar, a guide bar, and a column to a stationary frame.
A follower is suspended between the column and the head. This movable follower slides along the carrying bar and is guided by the bottom guide bar.
The plates are fitted with gaskets (fig. 1) and each plate is suspended between the fixed head and the movable follower.
Compression of the plate pack within the plate heat exchanger frame is accomplished by either edge or spindle clamping.
Each frame size can be designed with all connections on the fixed head, or some connections on the follower. Additional inlet and outlet connections can be provided by using an intermediate frame.
All APV Baker plates are cold-pressed in various materials chosen for each specific duty.
The plates are pressed with special corrugations which ensures turbulent flow between the plates and hence high heat transfer coefficients.

1-2) EDGE-CLAMPED FRAMES

Edge-clamped frames are clamped with bolts placed along the edge of the head and the follower.
Depending on the size of the heat exchanger, this frame type is available both with and without column.

1-3) SPINDLE-CLAMPED FRAMES

A spindle-clamped frame always includes a column. The frames are clamped by means of one of two spindles which extend from threaded bushes in the column and compress the follower against the plate pack.
For high pressure, this type of plate heat exchanger can also be equipped with bolts placed along the edge of the head and follower. These bolts are not used for clamping, but for pressure absorption during operation.

1-4) FRAME TYPES

The following designations are given to the various alternatives:

E: One spindle - stainless - spindle-clamped
T: Two spindles - stainless - spindle-clamped
B: Bolts
M: Painted, edge-clamped
R: Stainless, edge-clamped

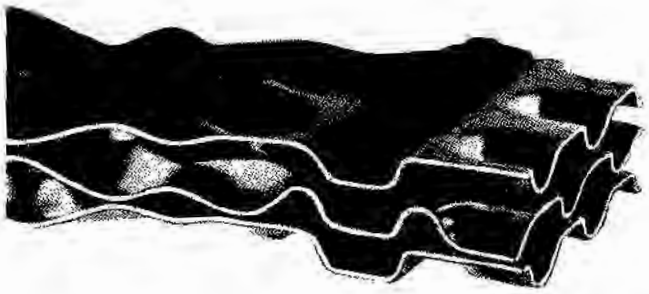


Fig. 2

Fig. 3

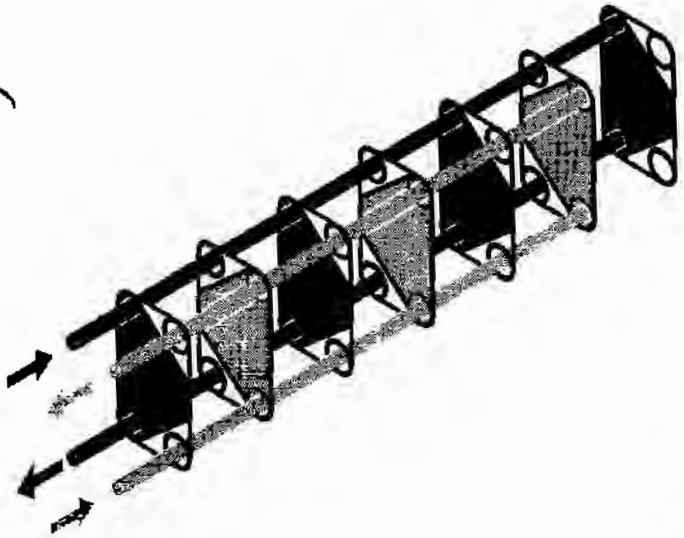


Fig. 4

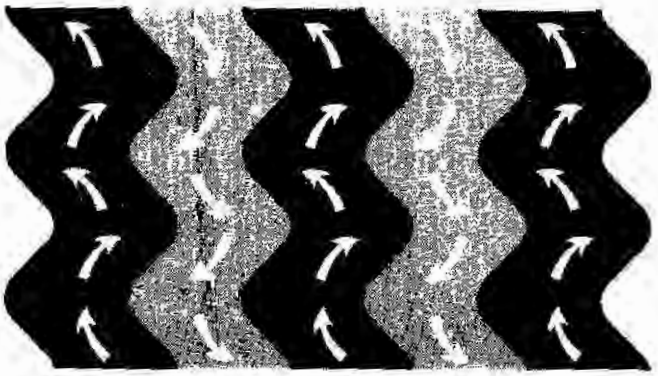


Fig. 5

1-5) MOUNTING

K : Ball type feet - adjustable
G : Floor mounting
V : Wall mounting
S : Column

1-6) EXAMPLE OF FRAME DESIGNATION

MGS-16

M : Painted, edge-clamped
G : Floor mounting
S : Column
16: Design pressure 16 kp/cm² (1.6 MPa)

RK-10

R : Stainless, edge-clamped
K : Ball type feet
10: Design pressure 10 kp/cm² (1.0 MPa)

1-7) PLATE PACK - MEDIA

All plates are fitted with glued-on gaskets which, after clamping of the plate pack, ensures an effective seal between fluids and atmosphere (fig. 2). In addition, intermixing of the fluids is eliminated by a double gasket seal around the inlet ports (fig. 3). This ensures that, in the unlikely event of a leakage, it is vented to atmosphere to give a visible warning. Every second plate in the plate pack is turned through 180°. This means that the double gasket seal occurs around every second inlet to the channels between the plates. The plate pack now forms a series of parallel flow channels in which the fluids flow in a counter current regime (fig. 4 and 5).

1-8) INTERMEDIATE FRAMES

In case of a plate heat exchanger operating simultaneously with e.g. up to six media in one and the same plate heat exchanger, intermediate frames are inserted (fig. 7).
These intermediate frames divide the plate heat exchanger in various sections. The intermediate frames are equipped with exchangeable corner blocks (fig. 6).
The corner blocks form the connecting link between the respective sections of the plate heat exchanger and/or connections for pipes. Two connecting branches can be provided in the same corner block with connection to their respective section in the plate heat exchanger (fig. 6).

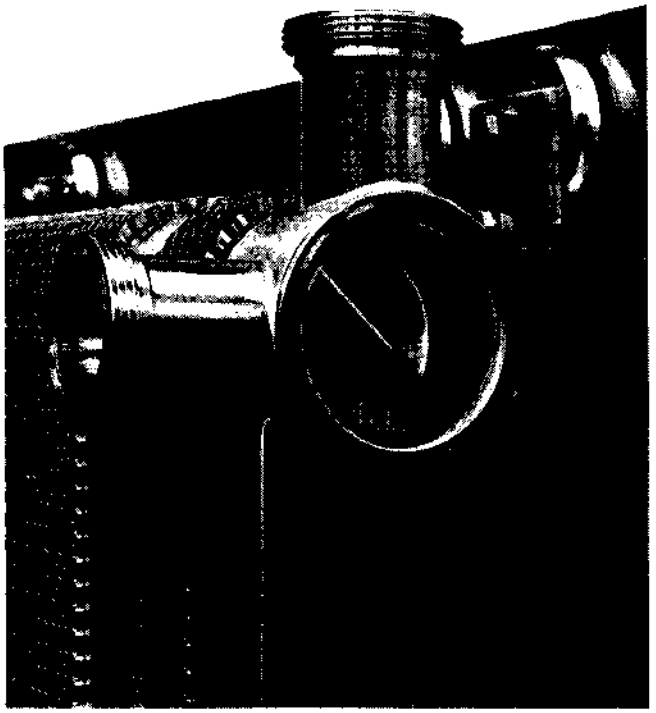


Fig.6

1-9) SEPARATING PLATES

Plate heat exchangers with more than one section, but requiring no inlet/outlet branches in the separation can be equipped with separating plates (strong sheet, 2-10 mm), alternatively with flow plates equipped with reinforced blankings.

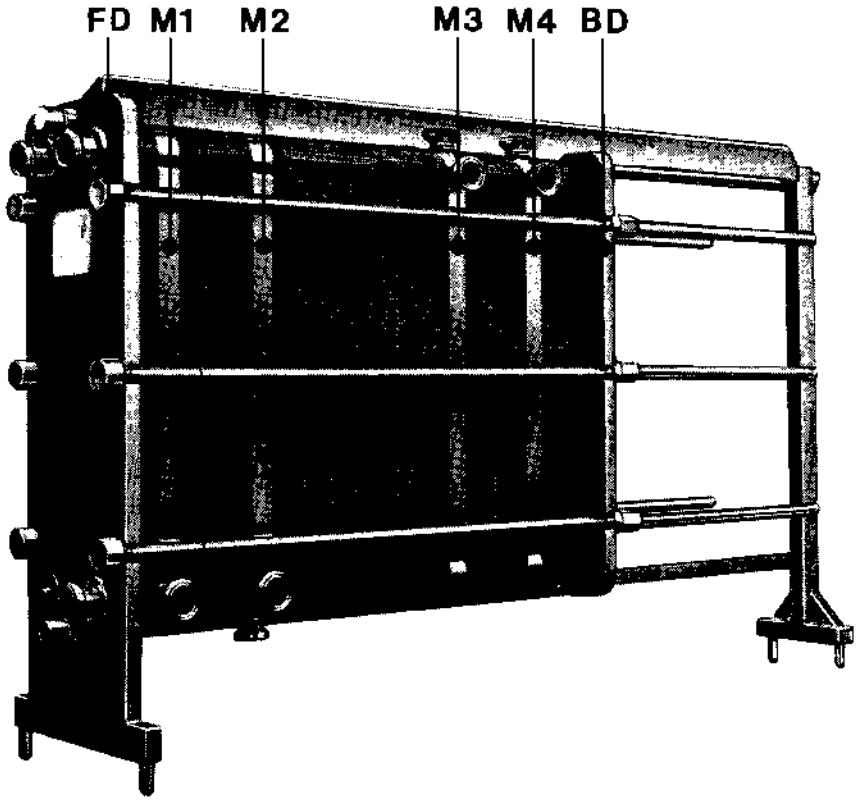


Fig. 7

2) ASSEMBLY DRAWING - DIAGRAM

2-1) ASSEMBLY DRAWING (FIG. 8)
Inside the back pocket of this manual you will find an assembly drawing. This shows all principal dimensions as well as connection specifications and identification.

FD = Head
M = Intermediate frame
BD = Follower
H = Horizontal connection
V = Vertical connection

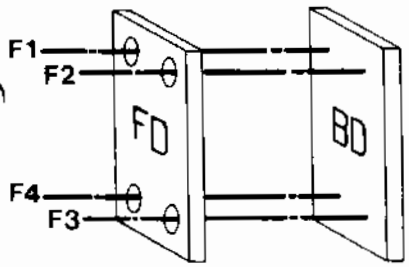


Fig. 8 a (see also fig. 4 on page 5)
1 section
1 pass

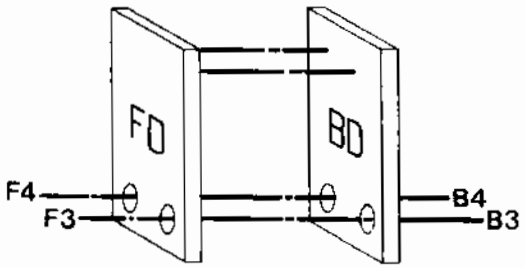


Fig. 8 b
1 section
2 passes

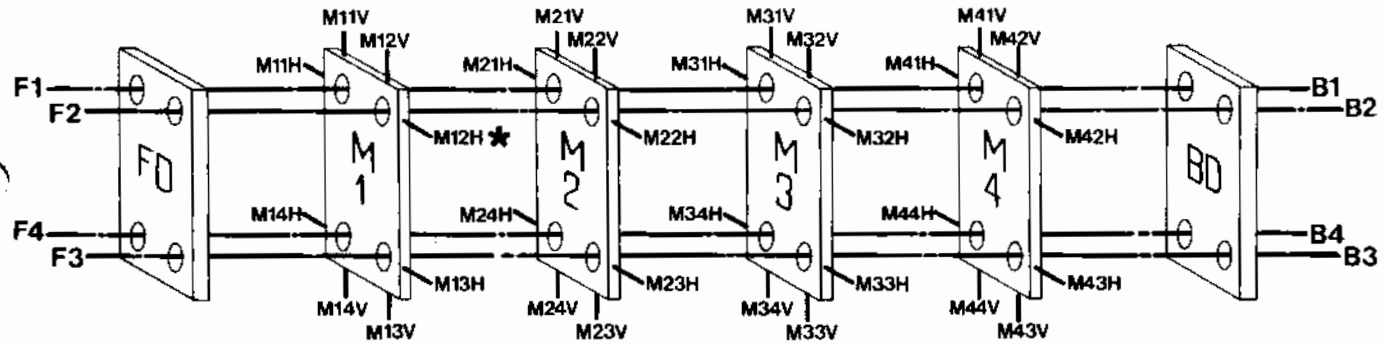
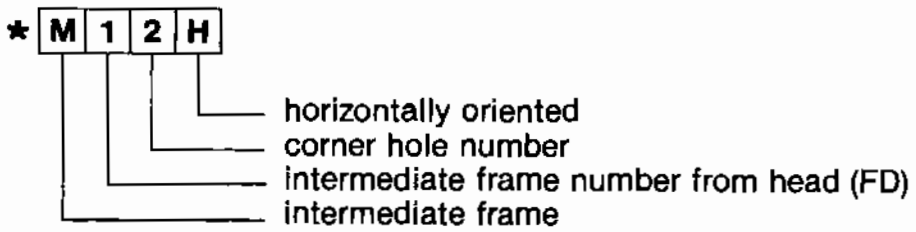


Fig. 8 c
5 sections



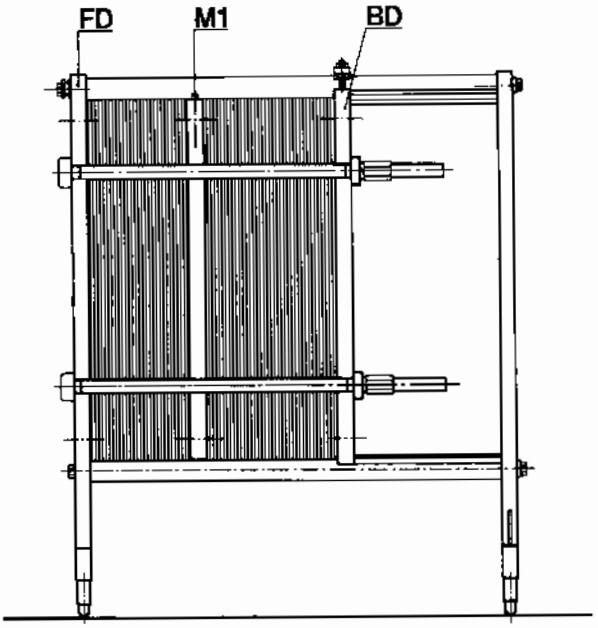


Fig. 9

5116

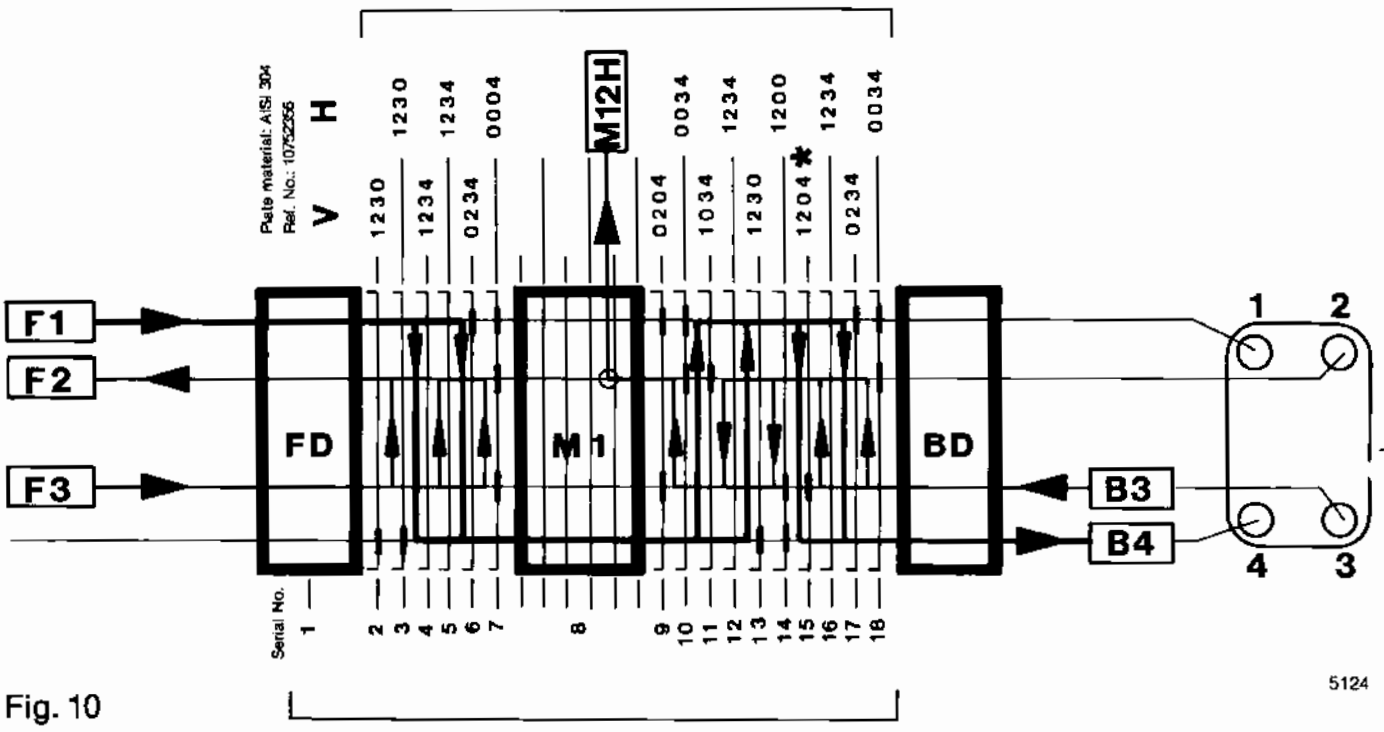


Fig. 10

5124

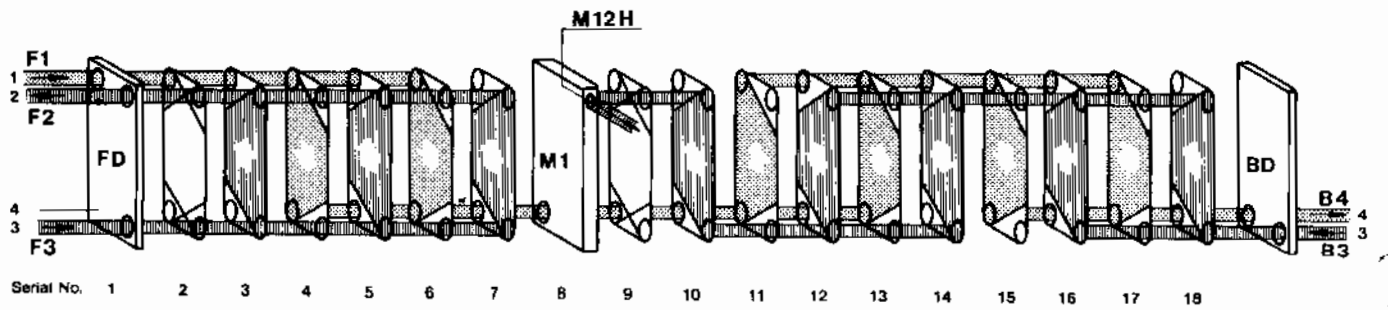


Fig. 11

5132

2-2) DIAGRAM (FIG. 10)

Inside the back pocket of this manual you will also find a diagram showing the schematic plate configuration and fluid flow regime. The plate pack is suspended between the head (FD) and the follower (BD).
The gasket side of the plates must always face towards the head (FD).
On the right-hand side of fig. 10 can be seen a single plate viewed from the gasket side. The corner holes of the plate are designated 1, 2, 3 and 4 as shown on the drawing.
Interconnecting lines have been drawn from the plate pack to the four corner holes of the plate. The flow channels for each fluid are marked with a thick or a thin line to ease identification.

2-3) EXAMPLE

Figs. 9, 10 and 11 show the same plate heat exchanger with a heating and cooling section separated by an intermediate frame M1.
The cold fluid enters the heating section via F1 in FD and flows through two parallel channels in one pass before entering the cooling section via hole 4 in the intermediate frame. From here the fluid is cooled in two passes, each with two parallel channels, before leaving the plate heat exchanger through B4 in the follower.
The heating medium enters through head (F3 in FD) and leaves again through head (F2 in FD).
The cooling medium enters through follower (B3 in BD) and leaves through the corner block of the intermediate frame (M12H).

2-4) REFERENCE NUMBERS

The material quality and reference number of the plates is stated in the top left-hand corner of the diagram fig. 10 (plate 1075 2356) - this number designates a plate without corner holes and without gasket. The letters V at the bottom and H at the top are explained in section 3) PLATES.

2-5 PUNCH CODE

The four digit number shown over the plates (fig. 10) is a punch code and indicates which plate corner holes are open to allow fluid flow.
For example: 1204* means that this plate is open in corners 1, 2, and 4, whereas corner 3 (0) is closed.

2-6) SERIAL NUMBERS

The numbers of the diagram - under the plates - are serial numbers, i.e. indication of the placing of the plates in the plate pack of the plate heat exchanger.
Serial numbers start with number 1 for the head and after that continuous numbers for each plate, intermediate frame or separating plate.
When extending the plate pack, the existing numbers are used, but the new plates are marked with an extra figure e.g. 16, 17, 18, 18-1, 18-2, 18-3, 18-4, 19, 20 etc.

2-7) CAPACITY

The data list on the diagram gives the capacities and other criteria used for the design of the plate heat exchanger.

3) PLATES

3-1) MARKING

The plates are marked with material codes and reference numbers and also have the letter V or H stamped at either end (fig. 12).
Looking towards the gasket side, the plate is designated a left plate when the V is upwards or a right plate when the H is upwards.
V-plates have inlet and outlet via corner holes 1 and 4, respectively. H-plates have inlet and outlet via corner holes 2 and 3, respectively (fig. 13).

3-2) GASKETS

The gaskets are cemented into a groove along the edge of the plate. The gaskets for V and H-plates are identical. This means that V and H-plates with gaskets are identical, but by turning through 180° seal off alternating corner holes in every second plate (fig. 13).

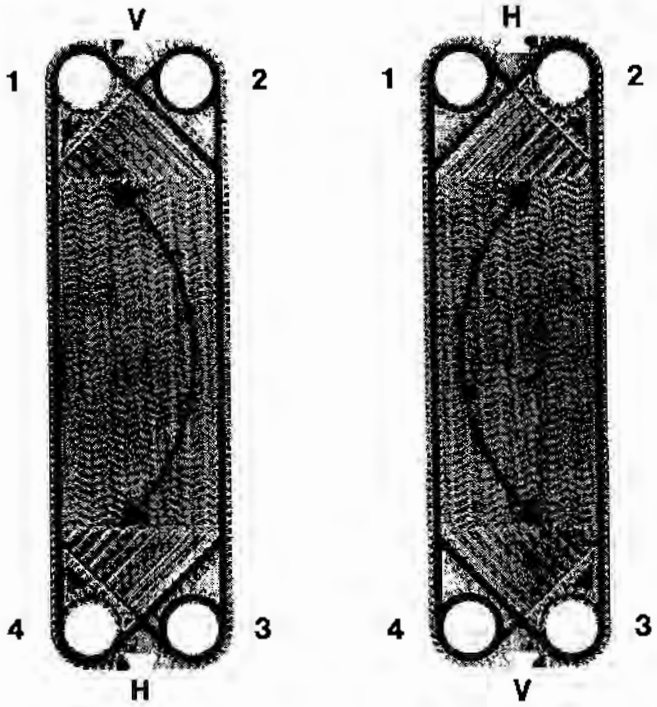


Fig.13

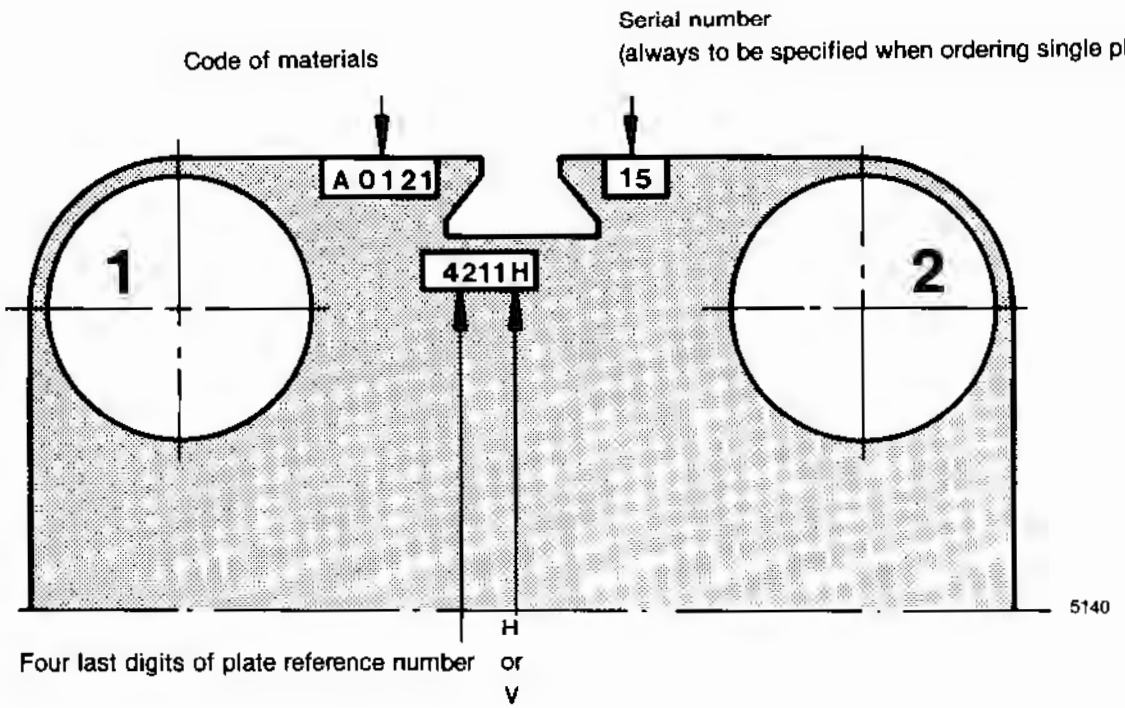


Fig. 12

4) MOUNTING INSTRUCTION

4-1) SPACE REQUIRED

The plate heat exchanger should be placed in such a way that service and inspection can easily be effected.
It must be possible to take off guardplates or insulating jacket, if any, without having necessarily to remove the connecting pipes.
This must be considered when installing the unit. All engagements are carried in a straight pipe section without thermometer, manometer or draw-off taps at a distance of 100 mm from the unit (more in case of increased insulating thickness). The distance to finish-insulated pipes should be 100 mm from the insulating jacket guardplate. The follower must be free to move along the full length of the carrying bar as shown in fig. 14.
On at least one side of the plate heat exchanger there must be sufficient space to unhook the plates from the carrying bar by a slight tilt away from the vertical (fig. 15).
At the same time it must be possible to tighten or remove the clamping bolts and inspect the plate heat exchanger.

4-2 DRAIN

Ideally a drain should be located close to the plate heat exchanger. If the drain leads to public sewage system, the possible risk of pollution should be considered. If either fluid cannot run directly to drain, suitable spill trays should be placed beneath the unit. If necessary, these should be fitted with a level alarm.

4-3) PIPE CONNECTIONS

The plate heat exchanger must be connected up according to the enclosed assembly drawing. All pipe connections must be carried out in such a way that the plate heat exchanger can easily be opened for inspection.
Threaded connections should be mounted either with unions with plane tightening or unions with conical tightening connected to bends.
Flanged connections must be removable. Fig. 16A shows a correctly connected unit whilst 16B shows an arrangement that must not be used under any circumstances!
If necessary, a suitable filter should be installed on the fluid inlet.
Isolating valves are also recommended on all connections. Thermometers, pressure gauges etc. should be used as required for monitoring the plate heat exchanger performance.

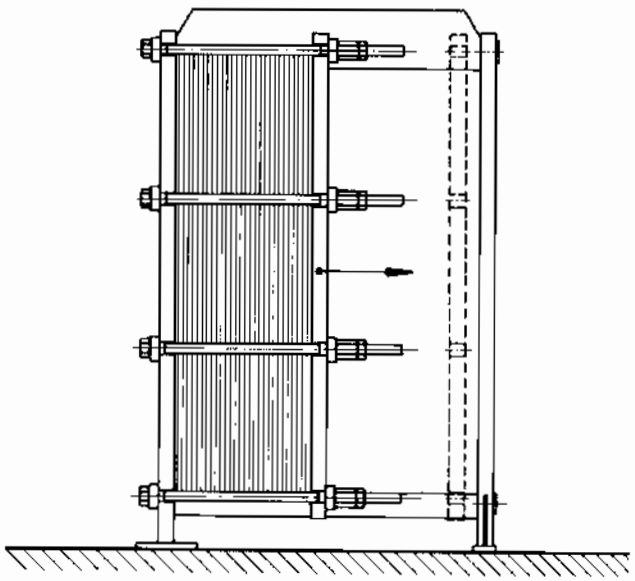


Fig. 14

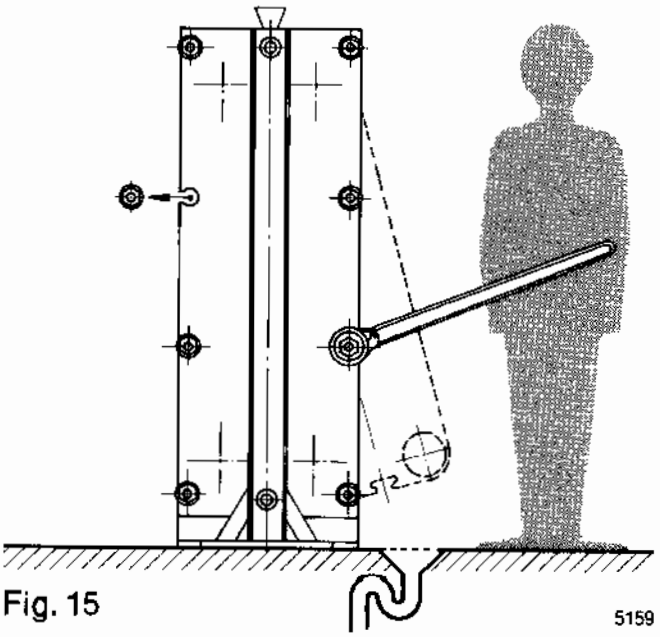


Fig. 15

5159

CORRECT PIPE MOUNTING FIG. 16A
In order to permit possible replacement of rubber liners in connections, the pipe joints on the head (FD) 1 and 2 and the follower (BD) 3 and 4 must be connected to removable pipe sections.
In addition, the pipe joints on the follower (BD) 3 and 4 must be removable in order to enable the plate heat exchanger to be opened for cleaning and inspection.
During opening, it must be possible to move the follower (BD) 5, without hindrance, along the full length of the carrying bar.
For re-tightening of the plate pack, the pipes onto the follower (BD) 5 and any intermediate frames must be flexible. This can be achieved by the use of expansion joints. To prevent undue strain on the plate heat exchanger from the connecting pipes, all pipes must be unloaded by suitable pipe holders.
For CIP (cleaning in place), without opening, piping material and layout must be chosen accordingly.

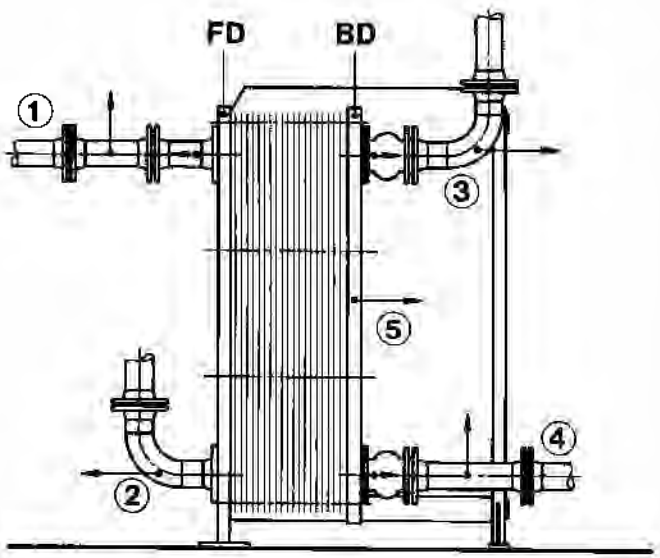


Fig. 16 A

4-4) PRESSURE PULSATIONS / VIBRATIONS
Piston pumps, gear pumps, dosing devices etc. must not be able to transfer pressure pulsations/vibrations to the plate heat exchanger as this may cause fatigue fracture in the plates.

4-5) PERMISSIBLE PRESSURE
Working, testing and maximum differential pressures for the plate heat exchanger are given on the metal machine plate on the head (fig. 17).

WORKING PRESSURE = the highest pressure to which the plate heat exchanger may be subjected during operation!

TESTING PRESSURE = the highest pressure at which the plate heat exchanger may be tested!

DIFFERENTIAL PRESSURE = the maximum permissible difference in pressure from one side of the plate to the other.

For plate heat exchangers with several sections, the stated working and testing pressures only apply if all sections are pressurised. If each section operates at different pressures, or one of the sections is not under pressure, leaks may occur in the lower pressure section.

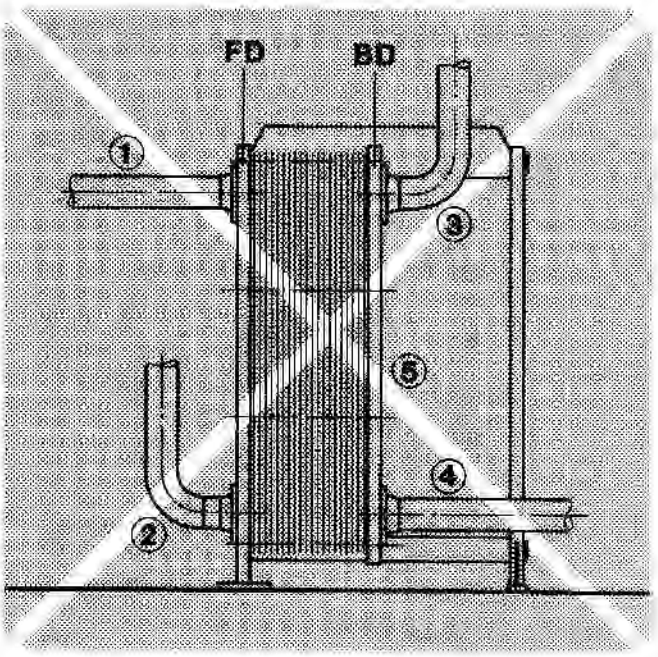


Fig. 16 B

5167

The maximum permissible difference in pressure between two sections separated by an intermediate frame (M) is 6 kp/cm² (0.6 MPa). If the two sections are not equal in size, the permissible difference in pressure is reduced.

EXCESS PRESSURE PROTECTOR must always be mounted (fig. 18), if the plant is likely to develop a higher pressure than that stated on the machine plate. This condition may arise during pump start-up, expansion or valve change-over etc.

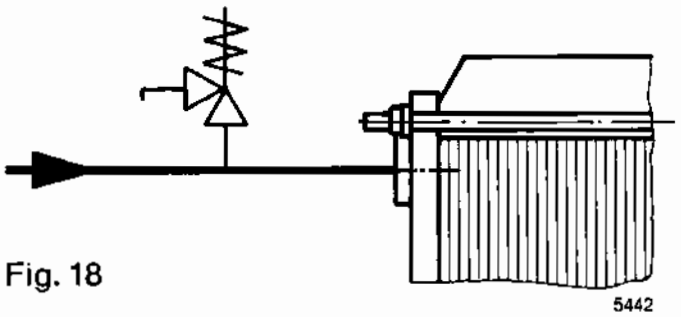


Fig. 18

4-6) LIQUID HAMMERING

The plate heat exchanger is sensitive to liguid hammering. This can occur during regulation, change-over, pump start-up etc. In order to avoid this situation, the use of throttling of air-operated valves, damping relays in electrical control gear, automatic pump start with closed valves etc. is recommended.

4-7) SHIELDING

The plate pack must be shielded, when:

- possible splashes may cause damage
- corrosive media are being used
- the working temperature may cause scalding
- required by the local authorities

APV Baker can supply guardplates for all plate heat exchanger types. When thermal shielding is desirable or required, an insulating jacket can be supplied. This jacket fits the heat exchanger exactly and can be taken off without removing the connecting pipes.

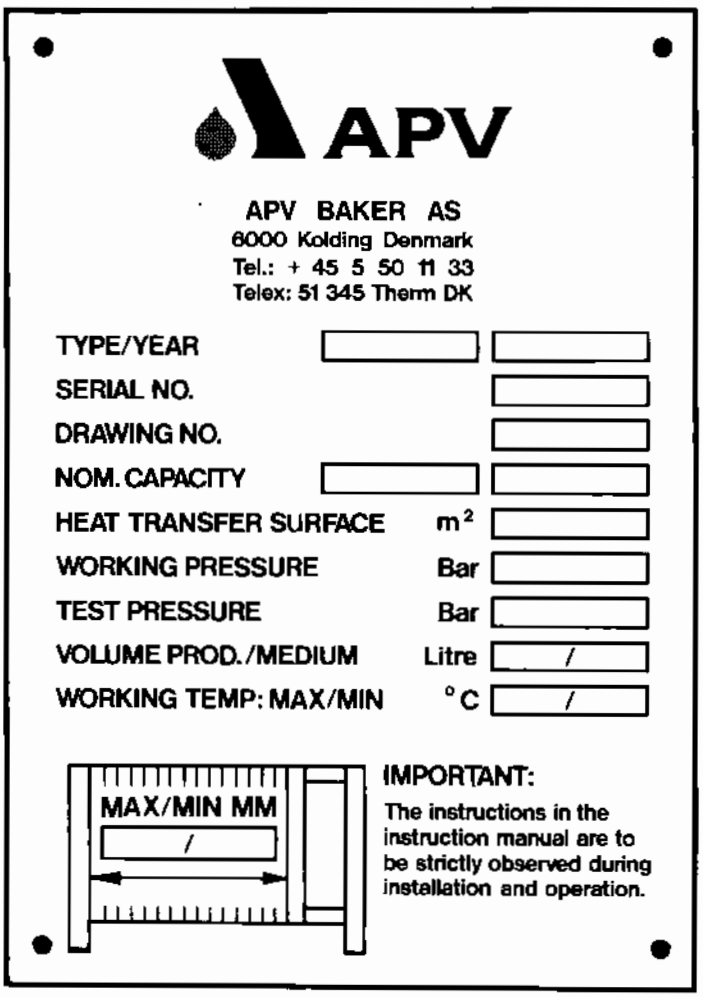


Fig. 17

4-8) ASSEMBLING OF EDGE-CLAMPED FRAME (FIG. 19)

- Start by erecting the head (FD).
  Secure the guide bar (E) to the head by bolts and block it up (1), bolt the column (2) on the guide bar (E).

- Place the follower (BD) on two blocks (3) approx. 200 mm from the head (FD). Place two spacer blocks (4) at the top between the head and the follower.
  Retain the follower (BD) with a rope (R), and remove the scotching (1).

- Bolt the carrying bar (C) on the column and the head with the fittings (5).

- Fit the fittings with rollers (6) on the follower (BD), so that the rollers are exactly opposite each other. Mount the guide fitting (7) on the follower. Adjust the height of the follower by means of the roller fittings. Remove the blocks (3 and 4) and the rope (R).

- Push the follower to the column. Worm the plates (A) on the carrying bar one by one, turn them over the guide bar, and push them towards the head. Insert the plates in serial-numerical order as stated in the diagram. The serial numbers must be upwards and the gasket side must face towards the head.

- When all the plates have been correctly assembled, push the follower against the plate pack - mount the clamping bolts (H) - apply a high-pressure lubricant to the threaded ends of the bolts. Clamping should be carried out using a ratchet spanner (8) or a similar suitable tool.
  Start clamping with two bolts diagonally opposite each other. These bolts can be tightened almost to the minimum plate pack dimension. Continue by clamping all bolts in a diagonal manner.
  On completion, the head and the follower must be completely parallel!
  The minimum clamped plate pack dimension is shown on the machine plate on the head (fig. 17, page 13).

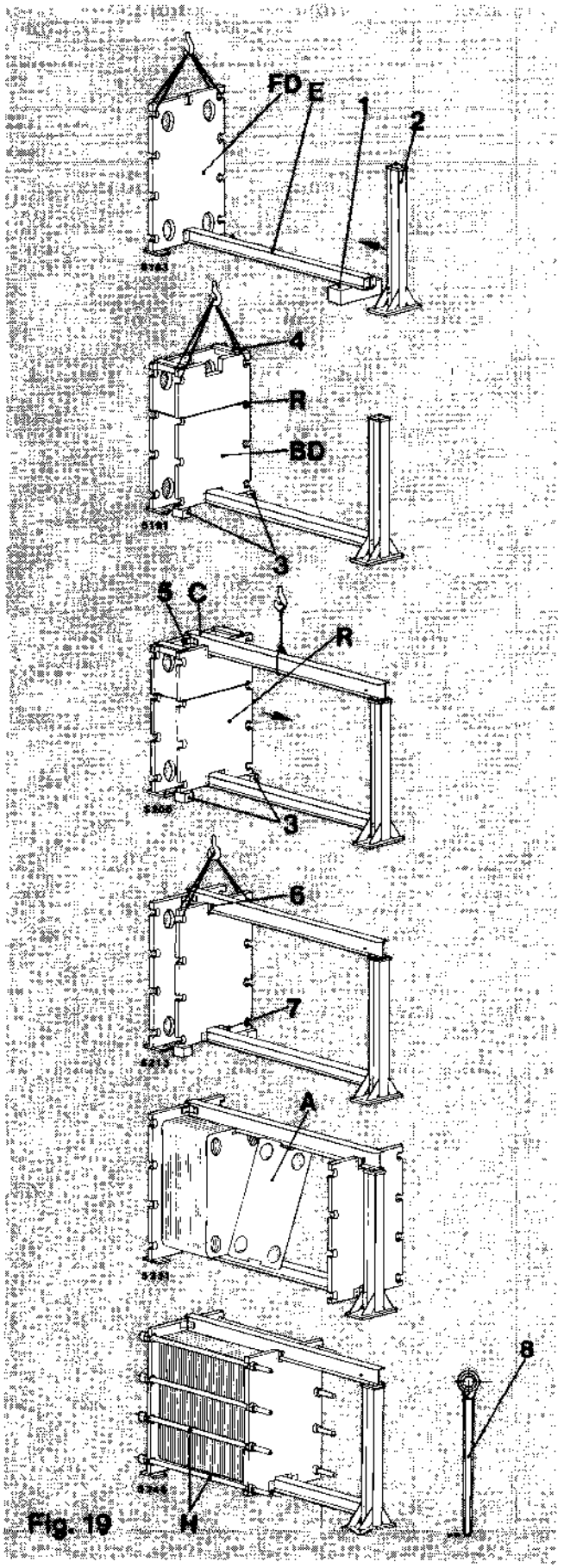


Fig. 19

4-9) ASSEMBLING OF SPINDLE-CLAMPED FRAME (FIG. 20)

- Apply a high-pressure lubricant to the thread of the carrying and guide bar. Erect the head (FD), fit in the guide bar (E) with the guide pin turning towards the head and clamp it. Block up the guide bar to horizontal position (1).

- Lay a board (3) on the guide bar - place the follower on top of this, swing it up towards the head, and attach it to this with a rope (R).

- Fit the carrying bar (C) with the guide pin turning towards the head and attach it. Place a strong board (4) between the guide and carrying bar. The two bars must be parallel.
  Adjust the column (2) to correct height by means of the adjustable ball type feet and attach it on both guide and carrying bar. Mount the supporting fittings for the follower on the carrying bar. Remove the scotching (1), boards (3 and 4), and rope (R).

- Tighten up the nuts (5), and level the frame by means of the adjustable ball type feet, which must be unloaded during adjustment.
  Apply a high-pressure lubricant to the thread and axle journal (6) of the spindle. Screw the spindle into the threaded bushing of the column. Apply a high-pressure lubricant also to the thrust pad (7) and the sliding surface of the carrying bar.

- Push the follower to the column. Worm the plates (A) on the carrying bar one by one, turn them over the guide bar, and push them towards the head.
  Insert plates/intermediate frames in serial-numerical order as stated in the diagram. Serial numbers must turn upwards, and the gasket side must face towards the head.

- Push the follower against the plate pack, and insert the push rod (8). Adjust the height of the follower by means of the eccentric axle journals on the supporting rollers, so that the spindle centres with the thrust pad on the follower. Use a ratchet spanner (9) (or a similar suitable tool) for clamping. The clamping measure is indicated on the machine plate (fig. 17, page 13).

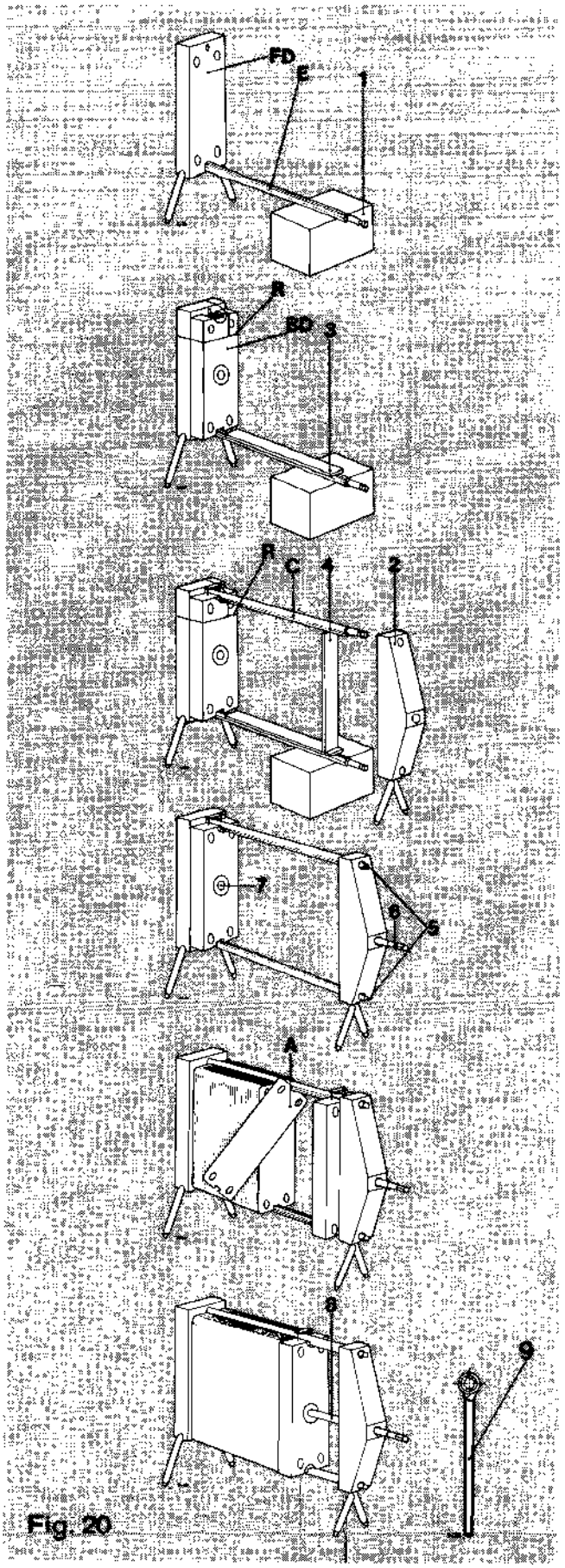


Fig. 20

5) START-UP AND OPERATION

5-1) CLAMPING
Before the initial start-up, check that the clamped plate pack dimension is as specified on the machine plate (fig. 17, page 13) on the plate heat exchanger in question.

5-2) START-UP
Sudden pressure surges must be avoided as these may cause leakage or damage to the plates and gaskets. Pumps should therefore be started against closed valves which can then be gradually opened until the desired flow rate is achieved.
In a plate heat exchanger using steam as the heating media, the cold fluid should be introduced to the plate heat exchanger before the steam is turned on.
The above precautions apply to all types of plate heat exchangers during start-up. The potential damage possible due to incorrect start-up increases proportionally with increased liquid flows and the length of connecting pipework!

Plate heat exchangers with new EPDM gaskets should be started up (initial start-up) by increasing the temperature slowly, max. 25°C (77°F) per hour.

5-3) LEAKAGE DURING START-UP
During the initial start-up, minor leaks may occur until the plates and gaskets have reached their design working temperature and all sections are correctly pressurised.

5-4) VENTING
When correct working temperature and working pressure have been reached, the system must be vented.
The air in the plate heat exchanger is driven out by the liquid flow, provided that the capacity is as stated in the diagram.
Air in a plate heat exchanger reduces the heat transmission and increases the pressure drop, thus increasing the risk of corrosion!

5-5) OPERATION
During operation, temperatures and pressure drops must be regularly checked. Increased pressure drop and/or falling temperatures indicate that there are coatings on the plates. The plate heat exchanger now needs cleaning.
During operation, the same precautions against rises of pressure must be observed as during start-up!

5-6) LEAKAGE DURING OPERATION
See section 11 »FAULT-FINDING«.

6) SEPARATION AND ASSEMBLING

6-1) COOLING AND PRESSURE RELIEF
Before opening the plate heat exchanger, it must be cooled below 40°C (104°F), and it must not be pressurised!

6-2) SEPARATION OF EDGE-CLAMPED FRAME
Keep two diagonally placed bolts clamped - dismount the rest of the bolts - take care that the follower (BD) does not keel over!
Loosen the two last bolts uniformly (max. difference 25 mm) - then push the follower towards the column (fig. 21).

NOTE! When using plate heat exchangers on board ships, the follower (BD) must be secured in order to avoid danger during the movements of the ship at sea.

6-3) SEPARATION OF SPINDLE-CLAMPED FRAME
Remove securing bolts, if any - then loosen the spindle. When using frame types with two spindles, loosen the two spindles uniformly (max. difference 25 mm) - then push the follower (BD) towards the column (fig. 22).

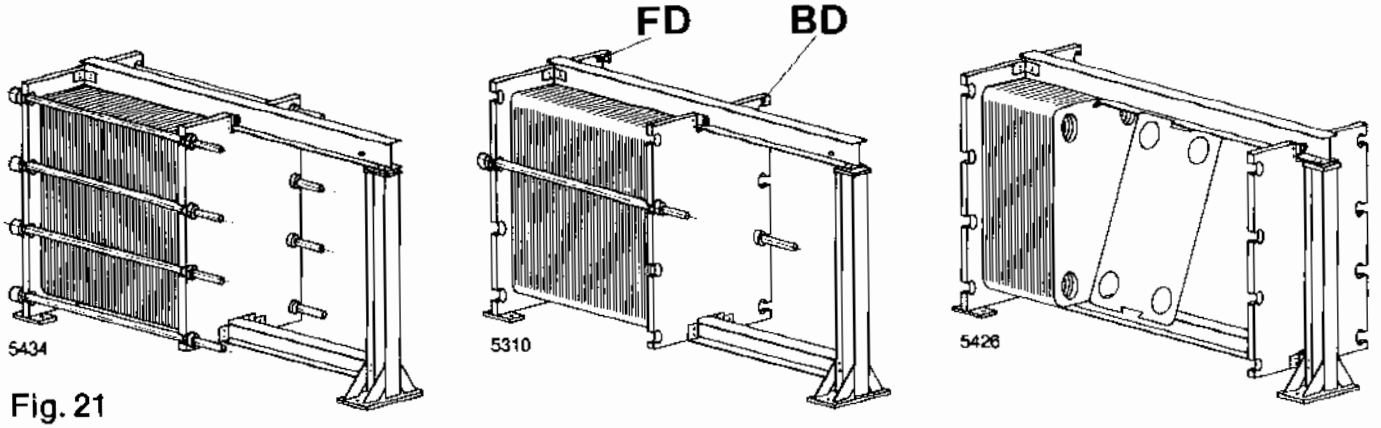


Fig. 21

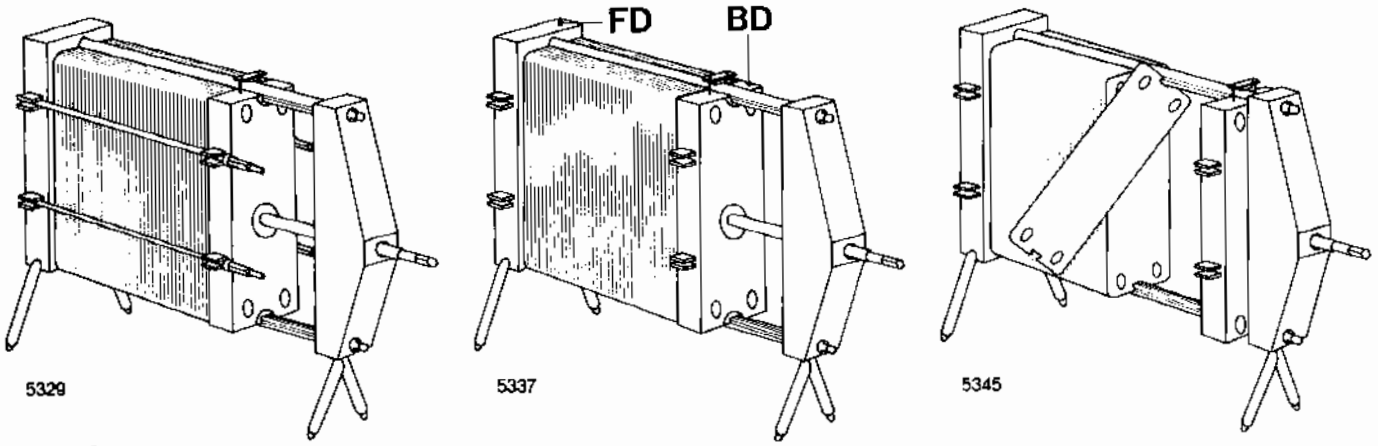


Fig. 22

6-4) INSPECTION / CLEANING

Check every plate gasket carefully!
Before assembling, both plates and gaskets must be completely clean!
Remove settlings, scalings, cakings, if any, from the plates.
Where lubricating oils have been used, degrease the gaskets and the joint faces of the plates! Even tiny impurities such as grains of sand or bristles will cause leakage and may damage the gaskets.

6-5) ASSEMBLING

If the plates have been dismounted, they must be correctly inserted according to serial numbers!
The head has No. 1, and the serial numbers of the following plates and the intermediate frames, if any, are No. 2, 3, 4, 5 etc.
The serial number is marked in the top right-hand corner of the plates - do not forget that the gasket side must face towards the head (FD).

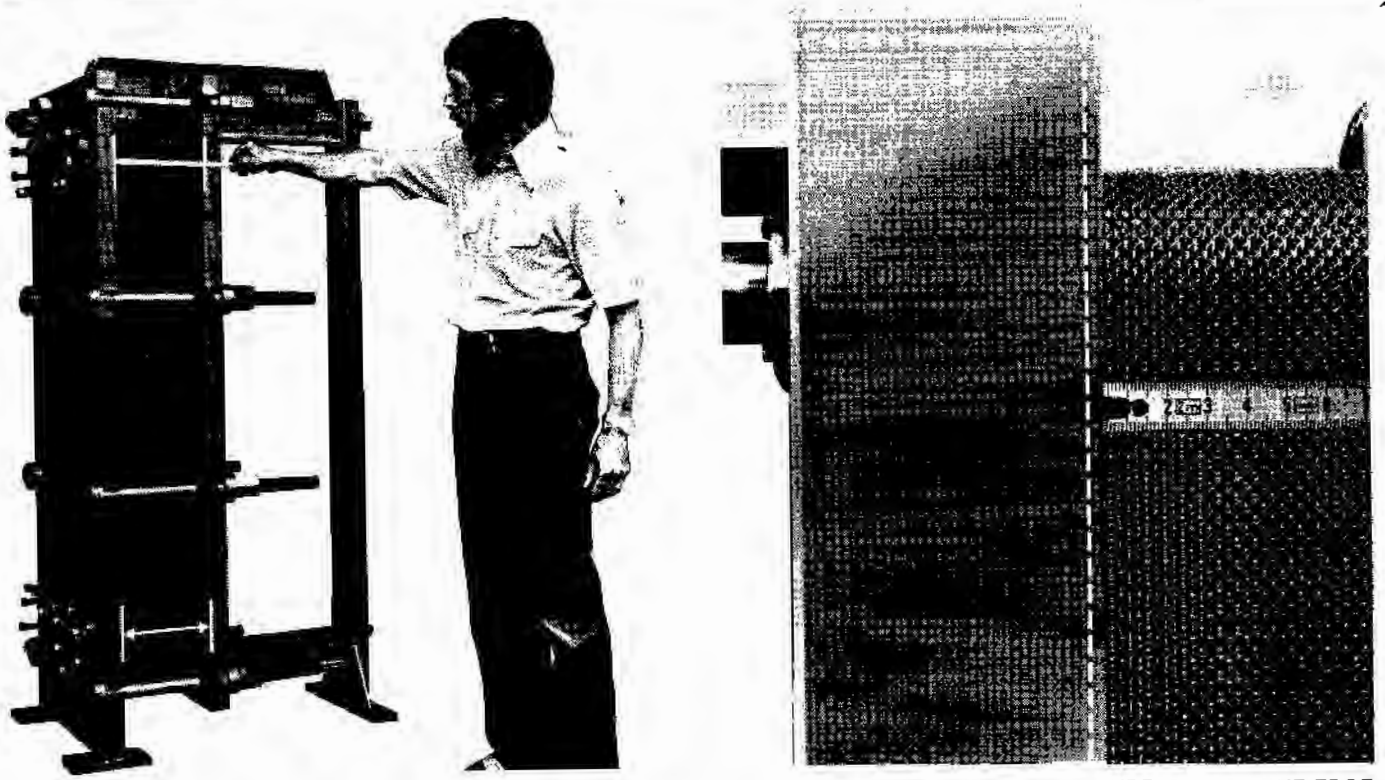


Fig. 23

MEASURED WITHIN THE EDGE
(only for spindle-clamped frames)

6-6) CLAMPING

The minimum dimension for clamping is stated on the machine plate (fig. 17, page 13) placed on the head - and the assembly drawing.
The plate heat exchanger must be clamped to minimum measure + 0.05 mm per plate.
APV Baker recommends clamping to minimum measure after approx. one month's operation - alternatively, immediately after installing new plates or new gaskets.

New gaskets in EPDM quality are clamped step-wise the first time:

1. Minimum measure + 15%
   2 hours' interval or more.
2. Minimum measure + 7.5%
   12 hours' interval, preferably more.
3. Minimum measure + 0.05 mm per plate, alternatively minimum measure.

The head and the follower must be exactly parallel. Therefore, clamping must be measured at the top and the bottom and on both sides of the head and the follower! (fig. 23).

6-7) LONG WORKING BREAKS

If the plate heat exchanger is out of operation for a long time, it is advisable to empty it, separate the plates, and **clean** the unit.
Clamp the plate heat exchanger lightly together, and leave it covered in order to protect the gaskets against dirt and the effect of light!

7) CLEANING

The capacities and resistance to corrosion of plate heat exchangers depend on the plate pack being kept clean.
Coatings on the plates can be removed manually or through CIP-cleaning - cleaning in place.

7-1) MANUAL CLEANING

After separation of the plate heat exchanger, remove the individual plates and clean them with a soft brush and a suitable detergent (see 7-3). In case of thick layers of scale or organic materials, the plates can be placed in a vessel with suitable cleaning fluid. Do not in any circumstances use steel brush, metal scraper or similar scraper tools which will damage both plates and gaskets. A high-pressure cleaner can be used with care - however, never with sand or similar abrasives added.

7-2) CIP-CLEANING

A condition for using CIP-cleaning (cleaning in place) is that the coating of the plates is soluble, and that all materials in the system of circulation are resistant to the cleaning fluid used.
Cleaning can also be effected without circulation by pouring a suitable detergent into the system (7-3).

After some time of standing, wash out the detergent again with clean water.
Cleaning by circulation requires the establishment of the necessary circulation system. For the correct quantities of circulating detergents, see the enclosed diagram.

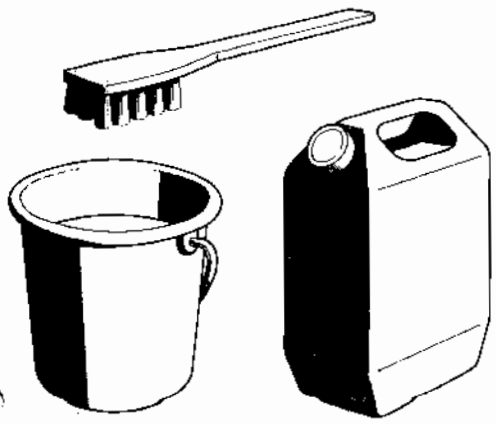
EXAMPLE OF CIP-CLEANING PROGRAMME

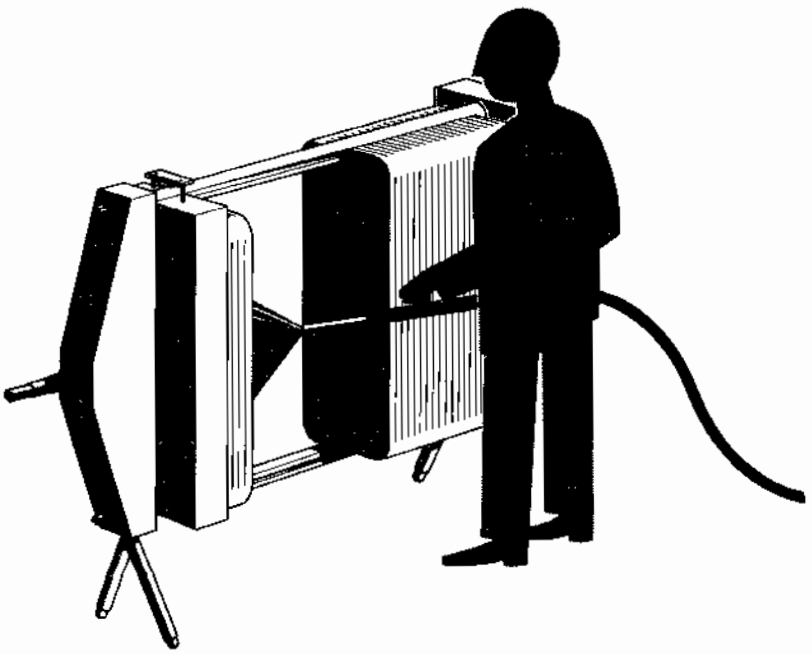
- Drain-off product residues and cooling / heating media
- Rinse with cold or lukewarm water
- Circulate with warm cleaning fluid solution
- Rinse with warm water
- Rinse with warm water with softener added to it
- Rinse with cold or lukewarm water

7-3) DETERGENTS

The definition of a suitable detergent is brief and to the point. Coatings on the plates must be removed without damaging plates and gaskets. It is important not to decompose the passivating (protective) film of stainless steel - the film contributes to preserving the resistance of the steel to corrosion.

Do not use chlorine-containing agents such as hydrochloric acid (HD1)!!!





EXAMPLES:
- OIL AND FATS are removed with a water emulsifying oil solvent, e.g. BP-SYSTEM CLEANER.
- ORGANIC AND GREASY COATINGS are removed with SODIUM HYDROXIDE (NaOH) - max. concentration 1.5% - max. temperature 85°C (185°F). 1.5% concentration corresponds to 3.75 l 30% NaOH per 100 l water.
- FURRINGS AND SCALE DEPOSITS are removed with NITRIC ACID (HNO_3) max. concentration 1.5% - max. temperature 65°C (149°F). 1.5% concentration corresponds to 1.75 l 62% HNO_3 per 100 l water.
  Nitric acid has an important constructive effect on the passivating film of stainless steel.

7-4) CONTROL OF CLEANING

The plate heat exchanger must be opened for inspection at regular intervals. This is especially necessary during the running-in period, until experience has been gained on the effectiveness of the cleaning process.
Through these inspections, it will gradually be possible to determine circulation times, temperatures and chemical concentrations with great certainty!

Insufficient cleaning is most often due to:
- Too small circulation quantity
- Too short cleaning period
- Too low chemical consumption in relation to the coating of the plates
- Too long periods of operation

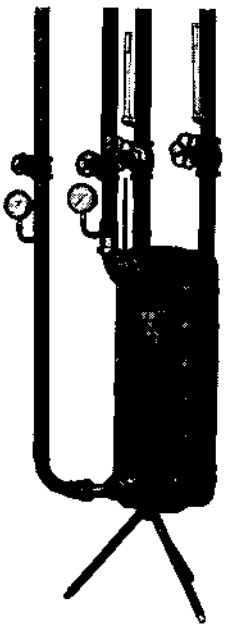
7-5) CONTROL OF CLEANING FLUID CONCENTRATION

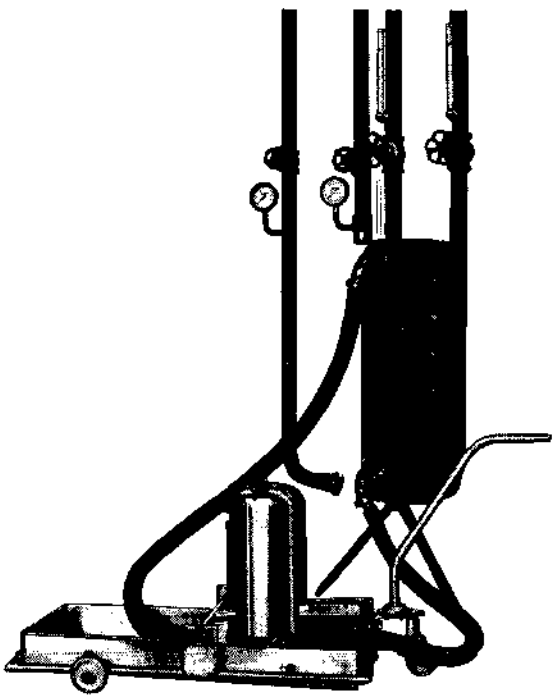
SODIUM HYDROXIDE (NaOH) solution is titrated with 0.1 n HYDROCHLORIC ACID (HC1) with methyl orange or methyl red as indicator.
NITRIC ACID (HNO_3) solution is titrated with 0.1 n SODIUM HYDROXIDE (NaOH) with phenolphthalein as indicator.

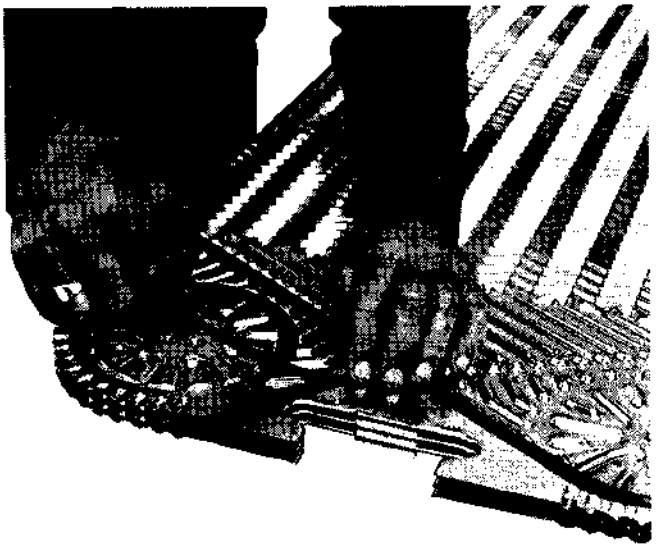
The concentration of the cleaning fluid in % can be calculated from the titration result according to the following formula:

$$\text{CONCENTRATION} = \frac{b \times n \times m}{a \times 10}\,\%$$

a = ml cleaning fluid taken out for titration
b = ml titration liquid used for change of colour
n = normality of titration liquid
m = molecular weight of cleaning fluid (NaOH molecular weight 40 - HNO_3 molecular weight 63).







8) REPLACEMENT OF GASKETS

On the diagram inside the back pocket of this manual you will find an order list for gaskets and details of glue type and quantity. Also given is information concerning the degreasing solvent for the new gaskets.
The first plate after the head og intermediate frame is called an end plate and must have a gasket in all grooves. These gaskets are, in fact, two »normal« gaskets cut in half an glued in place around all grooves. You should carefully note how the old gaskets are assembled before removing them!

8-1) REMOVAL OF OLD GASKETS

- PLIOBOND glued gaskets can be loosened by heating in water at 100°C (212°F). The plates are cleaned, and coatings, if any, are removed.
  See section 7-3 on page 19.

8-2) CLEANING

New gaskets and the gasket grooves of the plates are cleaned with a cloth moistened with degreasing agent. The gluing surfaces must be absolutely clean - without finger prints etc.
As degreasing agent use what is stated on the enclosed diagram.
Alternatively, use: TRICHLOROETHYLENE, CHLOROTHENE VG, ACETONE, METHYL ETHYL KETONE or ETHYL ACETATE.
It is important that all the degreasing agent has evaporated, before the glue is applied. This will normally take approx. 15 min. at 20°C (68°F).
It is advisable to clean the gluing surfaces of the gaskets with fine-grain sandpaper instead of degreasing agent.

8-3) GLUING

- PLIOBOND 25, which is a nitrile rubber glue on solvent basis (25% solids), is applied with a brush in a thin layer on the backs of the gaskets. The gaskets are put to dry in a clean and dustless place! The gasket grooves of the plates are now coated with a thin layer of glue, and the gaskets are cemented into the grooves. The insertion of gaskets start at both ends of the plate - and continues with the straight sections along the edges.
The gluing process is most easily effected by laying the gaskets and the plates on a table - as the gaskets are cemented into the grooves of the plates, the plates should be stacked. The plates with the gaskets are now suspended in the frame which is clamped lightly, for rubber gaskets e.g. to the minimum dimension indicated on the machine plate plus 0.2 mm per plate.
The plate heat exchanger is heated to 90-100°C (194-212°F) by means of water or steam - the temperature must be kept for 1½ to 2 hours!
The liquid pressure must be kept as low as possible. On plate heat exchangers for food, pipe branches which are not connected to water/steam must be kept free, in order to permit glue vapours to escape! If there is no possibility of heating the plate heat exchanger, it must stand at a place as warm as possible with dismounted connections. The drying time will at 20°C (68°F) be approx. 48 hours. At e.g. 40°C (104°F), the drying time is reduced to approx. 24 hours.
When the glue vapours have vaporized, the plate heat exchanger can be clamped again as stated in section 6-6 on page 18.

8-4) NON-GLUE PRESTOFIX GASKETS
PRESTOFIX is a non-glue gasket designed as a conventional gasket. It is designed with a special clip-on feature which locks it into recesses in the gasket groove on the plate. (Fig. A).

When replacing PRESTOFIX gaskets the old gasket is removed completely. Before fitting the new PRESTOFIX gasket check that the plate gasket groove is clean and free from residual rubber, particularly in the clip-on pockets.

New gaskets are mounted by means of a small tool. The new gasket is placed in the gasket groove and the clip-on features are pushed with the mounting tool sidewise into the outer pockets of the groove. Then the clip-on features are pressed into the pockets on the inner side. (Fig. B).

The PRESTOFIX gasket is centred in the gasket groove and locked securely by the recess on both sides of the gasket groove. Thus the PRESTOFIX gasket will always be able to resist the tension which will inevitably arise when the plate heat exchanger is disassembled. (Fig. C).

The first plate after the head and the intermediate plates which have no physical contact with the product are equipped with a glued gasket as described, see 8.3. However it will seldom be necessary to change these as their only purpose is to fill out the gasket groove thereby supporting the rest of the plate pack.

The PRESTOFIX gasket is available for food as well as non-food purposes. When assembling, the EPDM quality gasket should be wiped with a cloth wetted with silicone oil to facilitate the separation from the connecting plate when disassembling the plate pack.

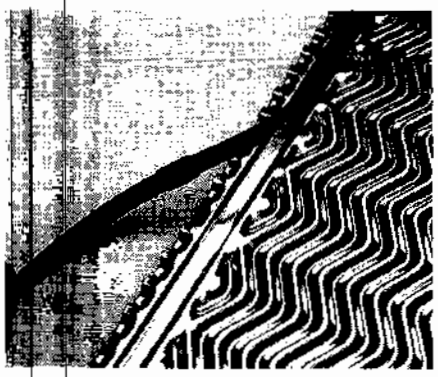


fig. A

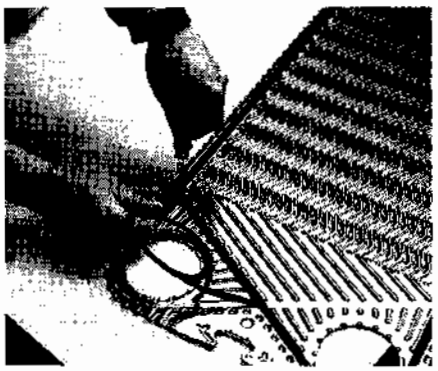


fig. B

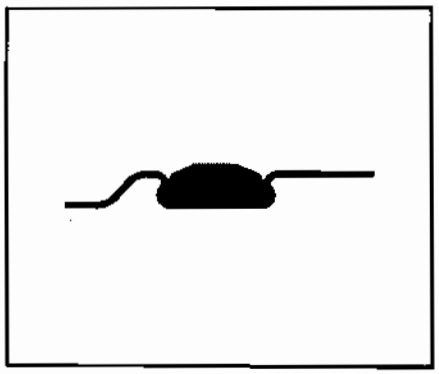
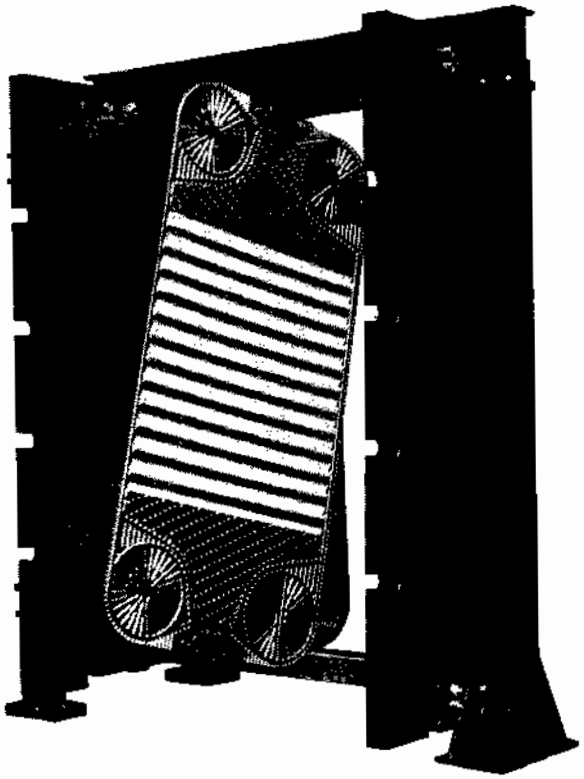


fig. C

9) REPLACEMENT OF PLATES

Before inserting a spare plate in the plate pack, it must be checked that the spare plate is identical with the defective plate - the same corner holes open, and the marks V and H must face right.
A defective 4-hole plate can be removed from the plate pack without inserting a spare plate, if the adjoining 4-hole plate is also removed. The new number of plates will then be = S-2.



This changes the clamping measure of the plate pack to M1 which will be:

$$M1 = \frac{M\ (S\text{-}2)}{S}$$

M = The original clamping dimension stated on the machine plate.
S = The original number of plates in the plate pack.
The transmission area of the plate heat exchanger is reduced in relation to the original number of plates. At the same time, the pressure drop will increase.

10) RECONSTRUCTION

The modular construction of the plate heat exchanger ensures an easy extension or possible reduction in the capacity. (Fig. 24).

APV Baker's files contain the data of all supplied plate heat exchangers. All the customer has to do is to state the type designation, serial number and the wanted change - and APV Baker will submit a suggestion/quotation for the reconstruction.

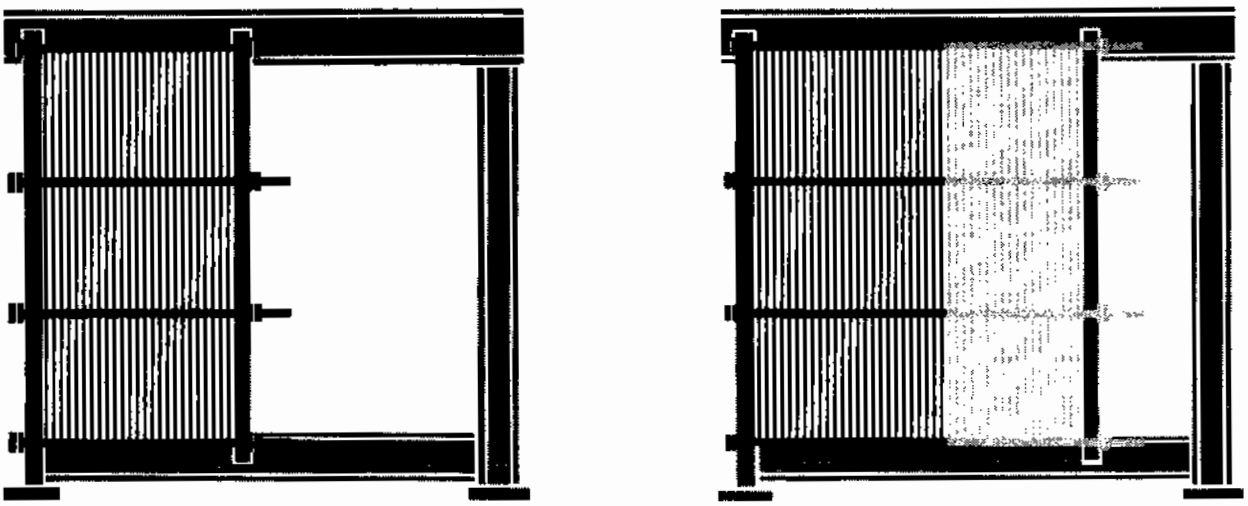


Fig. 24

11) FAULT-FINDING

11-1) DECREASING CAPACITY
In case of reduced heat transmission and/or increasing pressure drop, the plate heat exchanger must be opened and the plates cleaned - after that, the exchanger is clamped again to the dimension stated on the machine plate.

11-2) LEAKAGE - VISIBLE
• Check if the plate heat exchanger is operating with higher pressure than the permissible working pressure.
If so, the pressure must immediately be reduced to the correct working pressure.
• Tighten up the plate heat exchanger - however, never under the stated minimum dimension!
Never tighten up, when the plate heat exchanger is under pressure!
Check that the head and the follower are parallel after tightening-up!
• Separate the plate heat exchanger for inspection. Check if the plates are deformed or fouled. Check that the gaskets are elastic, non-deformed, and that the faces of the joints are clean. Clean very carefully all plates and gaskets before assembling the plate pack - tiny impurities such as sand grains may cause leakage!
• If the plate pack is still leaky after cleaning and tightening to minimum dimension, it is recommended that you change the gaskets.
• Leakage through the drain holes of the gaskets may occur. The reason is either that the gasket to the drained area is defective - or that the plate is badly corroded in the drain area!

11-3) LEAKAGE - NON-VISIBLE
The leakage is ascertained by the fluids getting mixed and is due to holes in one or several plates - it can only be repaired by replacement of the plate/s in question.
A suspected leakage can be localized in the following ways:

• Remove the pipe on one of the lower pipe connections - then put the opposite side under pressure.
If the medium continues to run out of the lower pipe connections - after the pressure has stabilized - several plates are leaking!
Dismount the plate pack and check each plate carefully.
Check suspected plates with a dye penetrant!

• Separate the plate heat exchanger, and put all plates to dry.
Suspend the plates in the plate heat exchanger again and re-clamp. Circulate medium at full capacity on one plate side (every second plate channel). Keep the other plate channels un-pressurised and free from liquid!
Stop the circulation after some minutes of operation and open the plate heat exchanger again. Take care to avoid water spraying onto the dry plate side!
By a careful study of the plates it will be possible to find moist areas, if any, on the otherwise dry plate sides.
Check these areas with dye penetrant!

• Separate the plate heat exchanger and check all plates with dye penetrant!

12) SPARE PARTS / ACCESSORIES

Generally, we distinguish between two frame types - an edge-clamped frame (fig. 25) and a spindle-clamped one (fig. 26).
When ordering spare parts, please use the following disignations according to figures 25 and 26:

FD = head
BD = follower
A = plates
C = carrying bar
E = guide bar
M = intermediate frame with corner blocks
1 = spindle
2 = column
3 = clamping bolts
4 = securing bolts
5 = guardplate (page 28)
6 = lead-in socket (page 28)
7 = insulating jacket (page 28)

When placing any order, please state the type and serial number of the plate heat exchanger, which can be taken from the machine plate!

TYPE	*	YEAR	
SERIAL NO.			*
DRAWING NO.			

ORDER EXAMPLE:
8 clamping bolts with nuts - total length 725 mm - plate heat exchanger type M 92 - serial number 19651.

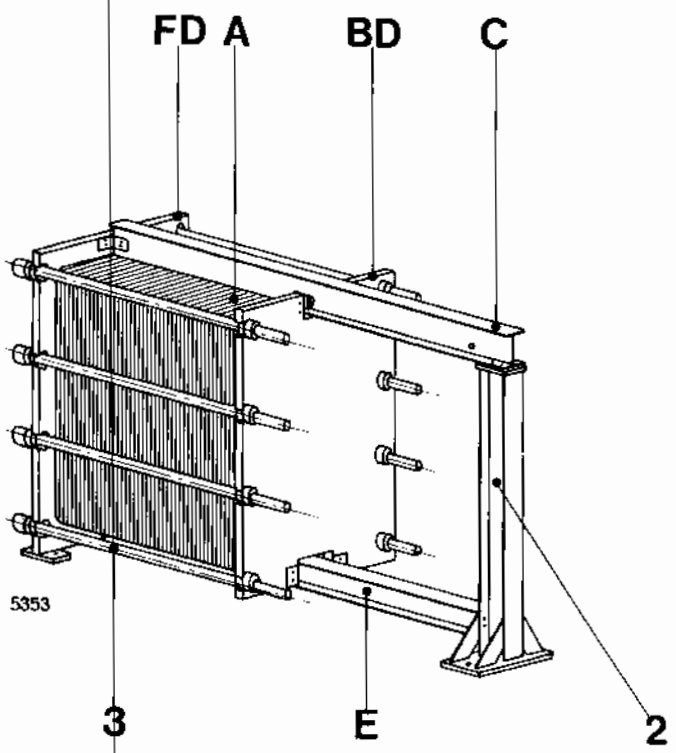


Fig. 25

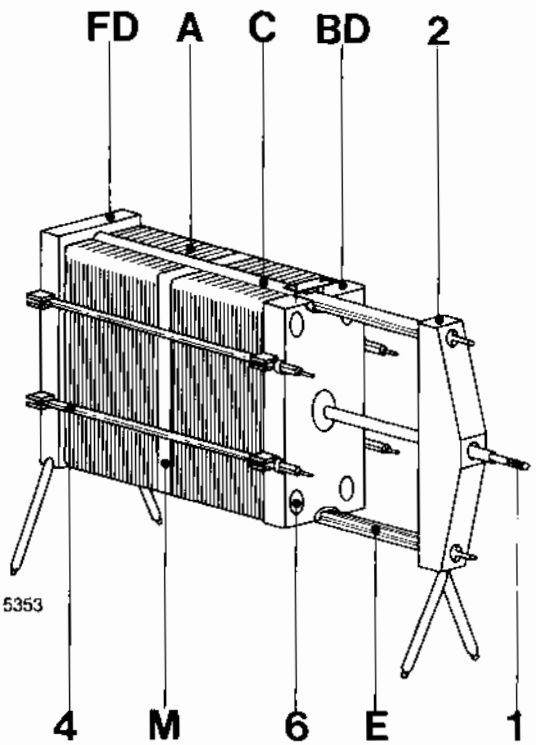


Fig. 26

12-1) PLATES

One or several plates in a plate pack may be damaged - this will necessitate a replacement of the plate/s in question.
In case of corrosion, all plates in the section in question as well as the whole plate heat exchanger must be examined very carefully!
Fatigue fracture normally necessitates a replacement of all the plates - there is a risk that the whole material is close to the fatigue-fracture limit.
The physical conditions around the plate heat exchanger must be carefully checked in order to localize the causes of the damage!
When ordering plates, please state the serial numbers of the plates and the type and serial number of the plate heat exchanger.
The serial numbers of the plates can be found in the top right-hand corner of the plates (fig. 12, page 10) - the type and serial number of the plate heat exchanger can be taken from the machine plate!

MATERIAL CODE:

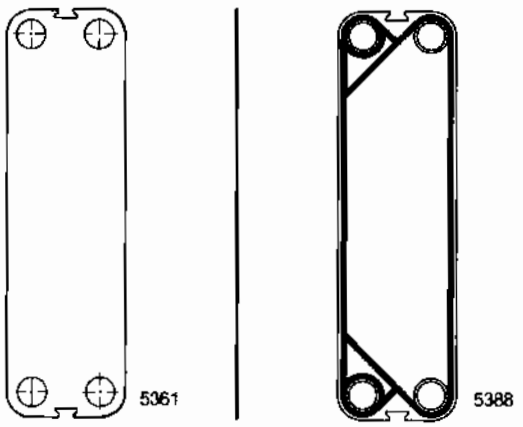
CODE	DESIGNATION	PREVIOUSLY USED CODE
A	Stainless steel W 1.4301 (AISI 304)	C E G J M R
B	Stainless steel W 1.4436 (AISI 316)	D F H K N P
S	Stainless steel W 1.4449 (Avesta 832 SL)	
T	Titanium ASTM B 265 grade 1	
W	Stainless steel W 1.4401	
X	Stainless steel W 1.4539 (Avesta 254 SLX)	
Y	Stainless steel (Avesta 254 SMO)	
Z	HASTELLOY C276	
	Monel	U
	Cu-Al	M

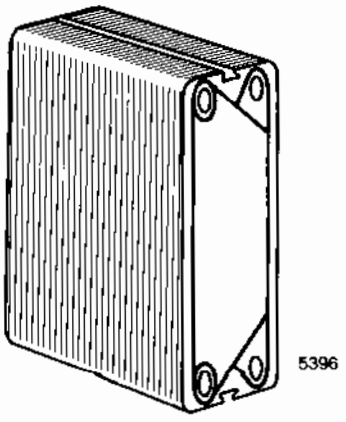
ORDER EXAMPLE:
4 plates with glued-on gaskets, serial numbers 11, 12, 13, and 14
- plate heat exchanger type H 17
- serial number 19 156

ORDER EXAMPLE OF A COMPLETE SET OF PLATES:
1 complete set of plates with glued-on gaskets - plate heat exchanger type M 107 - serial number 28 452.

ORDER EXAMPLE OF A COMPLETE SET OF PLATES FOR ONE SECTION:
1 complete set of plates with glued-on gaskets for the heat recovery section - plate heat exchanger type K 55 - serial number 32 254.

The plates are marked with a material code (fig. 12, page 10) symbolizing the steel quality. The four digits after the letter are APV Baker's internal press operation number.
When knowing the material code, APV Baker can procure a certificate of the plate.





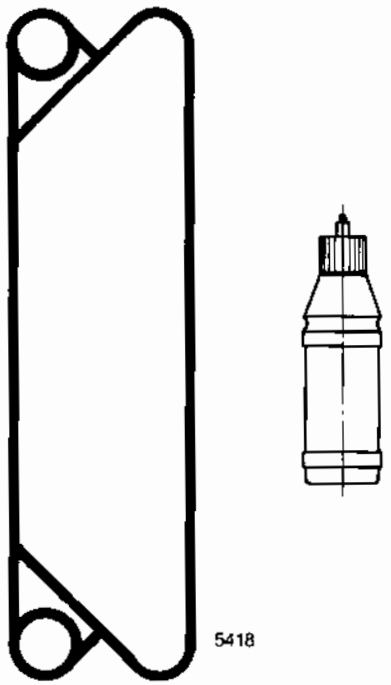
12-2) GASKETS

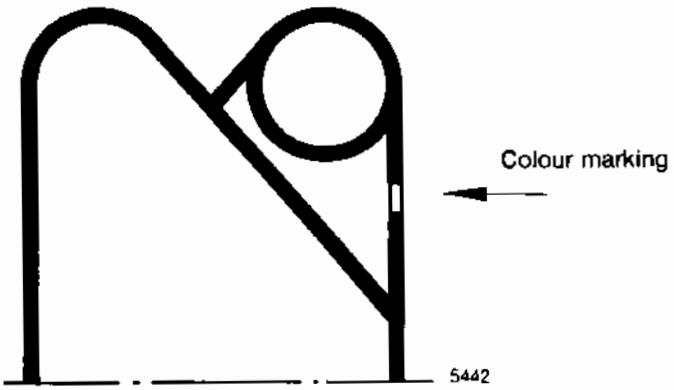
A complete set of gaskets comprises both gaskets for plates as well as lead-in and rubber sockets for lead-in bushes where applicable.

ORDER EXAMPLE:
1 complete set of gaskets and glue for plate heat exchanger type H 12 - serial number 37 999.
When ordering a few/several gaskets, please state the serial numbers of the plate/s and the type and serial number of the plate heat exchanger.

ORDER EXAMPLE:
Gaskets and glue for plates with serial numbers 17 and 18 - plate heat exchanger type P 105 - serial number 29 899.

The rubber quality of the gaskets is identified through colour marking:
NITRILE: No colour marking
BUTYL YELLOW colour marking
EPDM: GREY colour marking
VITON: VIOLET colour marking





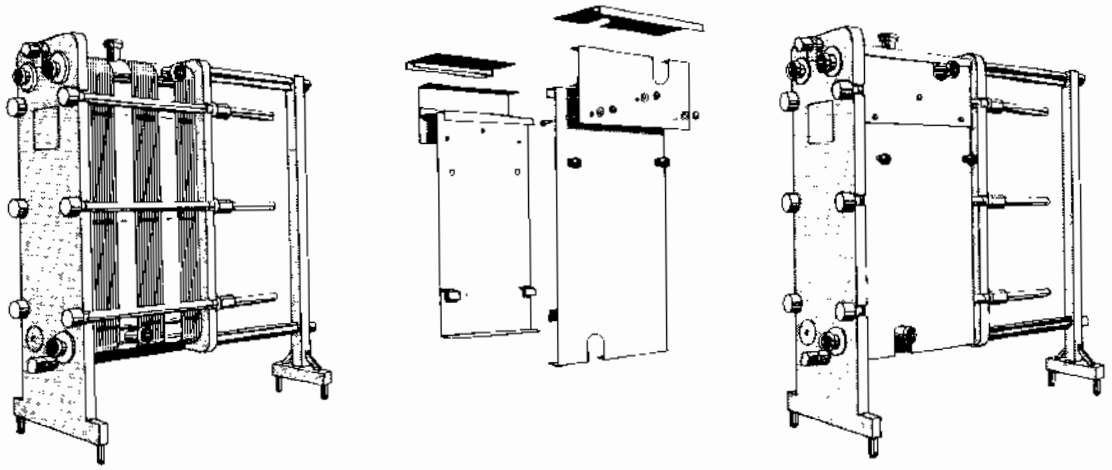
12-3) STORAGE OF GASKETS

Gaskets must - irrespective of material - be treated with care!
Rubber gaskets must not be bent sharply - trodden on - and on the whole not be subjected to deformation!
The best means of storage of rubber gaskets is spread on shelves and stacked in small piles in a dark room or covered with black plastic!
They can lie folded, but must have a radius of min. 100 mm and still only in small piles!

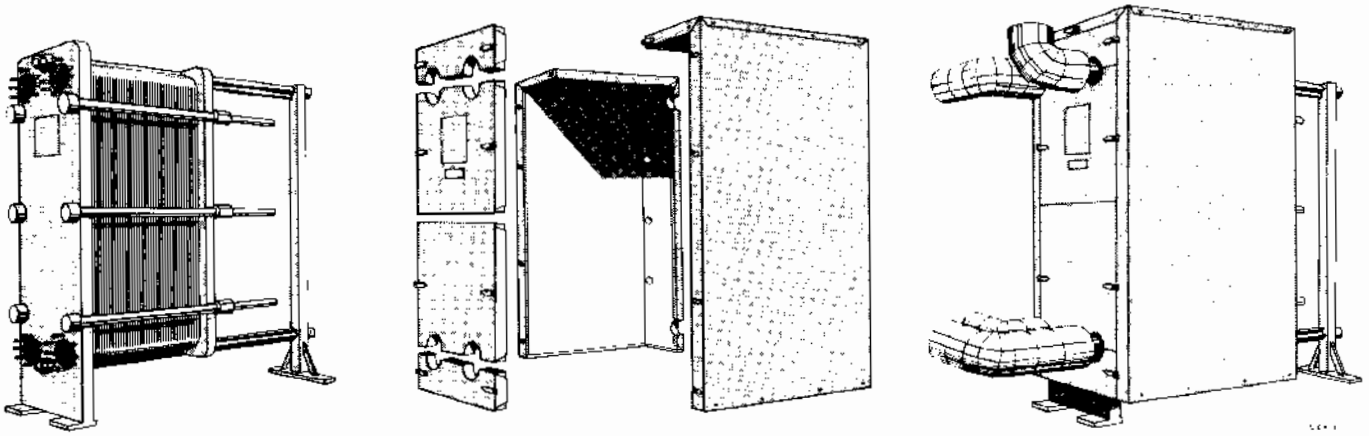
Rubber gaskets MUST ALWAYS be stored on their side!
The storage temperature lies between approx. 25°C (77°F) and – 10°C (14°F).

- Rubber gaskets must never be exposed to direct sunlight or ultra-violet rays!
- Rubber gaskets must not be exposed to welding light, sparks etc.!
- Rubber gaskets must always be kept apart from various liquids and their vapours!

12-4) 1 GUARDPLATES



12-4) 2 INSULATING JACKET

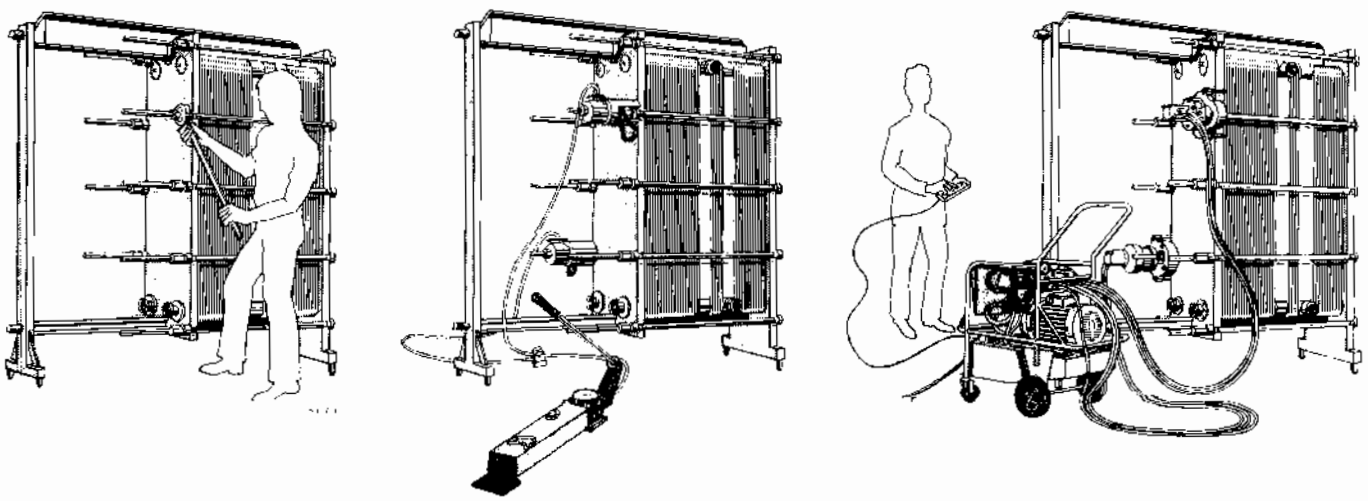


12-4) 3 CLAMPING TOOLS

12-4) 3-1 Ratchet spanner

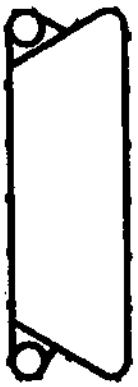
12-4) 3-2 Nut tightener hydraulic

12-4) 3-3 Nut tightener electro-hydraulic



Pakning/Gasket/Dichtung

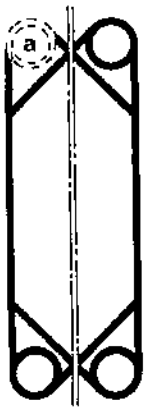
Materiale/Material		Code No.
NBR		1725 1007
EPDM		1725 1015
FPM	PT-1	1725 1287
	PT-2	1725 1139



"PARACLIP" pakning/-gasket/-Dichtung

Materiale/Material	Code No.
NBR	1725 1759
EPDM	1725 1767

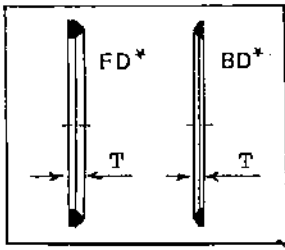
("PARACLIP" - not for end plate)



I hver afdeling skal den første plade efter (FD) fast dæksel,(S) skilleplade eller (M) mellemramme forsynes med pakning, således at der, når pladen er monteret i stativet, er pakninger i alle pakningsspor.
2 stk. pakninger tilskæres som vist, og hjørneringene "a" afskæres ved hjørner, hvor der er monteret en pakning i dækslet,skillepladen eller mellemrammen.

In each section, the first plate after the head (FD), separating plate (S) or connector plate (M) is to be equipped with an end gasket so that there is a gasket in each gasket groove when the plate has been mounted in the frame.
2 gaskets are cut to as shown and the corner rings "a" are cut away at the corners where a gasket is mounted on the head, separating plate or on the connector plate.

In jeder Abteilung wird die erste Platte nach dem festen Deckel (FD), der Trennplatte (S) oder der Anschlussplatte (M) mit einer Dichtung versehen, damit alle Dichtungsspuren mit Dichtung versehen sind, wenn die erste Platte im Gestell montiert worden ist.
2 Stck. Dichtungen werden zugeschnitten, und die Eck-Ringe "a" werden an den Ecken abgeschnitten, wo eine Dichtung im Deckel, in der Trennplatte oder in der Anschlussplatte montiert worden ist.



Pakning for hjørneklods og gennemføring / Gasket for corner block and nozzle / Dichtung für Eckklotz und Durchfuhrung						
		Material				
	T	NBR	EPDM	FPM PT-1	FPM PT-2	FPM PT-3
FD	7,25	1725 1503	1725 1511		1725 1317	1725 1325
BD	3,75	1725 1376	1725 1384		1725 1546	1725 1333

*For skilleplader og for hjørneklodser på mellemrammer skal høj pakning placeres på den side af pladen, der svarer til (FD) fast dæksel, og lav pakning på den side der svarer til (BD) bevægeligt dæksel.

For separating plates and for corner bloks on connector plate the high gasket is to be placed on the side which corresponds to the head (FD), and the thinner gasket on the side which corresponds to the follower (BD).

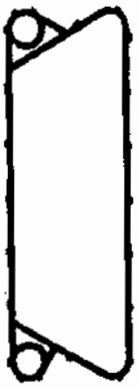
Für Trennplatten und für Eckklötze auf Anschlussplatten ist die hohe Dichtung auf der Seite der Platte anzubringen, die dem festen Deckel (FD) entspricht, und die niedrige Dichtung auf der Seite anzubringen, die dem beweglichen Deckel (BD) entspricht.

	NBR	EPDM	FPM
Farvemærkning af pakningskvalitet:	ingen eller blå	grå	violet
Colour marking af gasket quality:	none or blue	grey	violet
Farbenkennzeichnung der Dichtungsqualität:	keine oder blau	grau	violett

PAKNINGER GASKETS DICHTUNGEN			APV Baker N35 – 15
Sign. 88.01.20 Juul	Ant. 88-01-20 GJ	Rev. 4 91.01.18 SM/NCJ	Side 1 af 2

Joint/Junta /Прокладка

Matière/Material/ Материал		Code No. кода
NBR/ Нбр		1725 1007
EPDM/ Епдм		1725 1015
FPM/ Фтм	PT-1	1725 1287
	PT-2	1725 1139



"PARACLIP" Joint/-Junta/
ПАРАКЛИП Прокладка

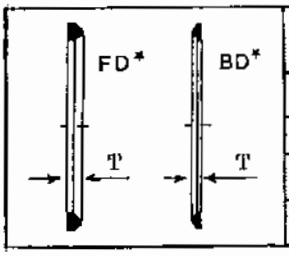
Matière/Material/ Материал	Code No. кода
NBR/ Нбр	1725 1759
EPDM/ Епдм	1725 1767

("PARACLIP" - not for end plate)

Dans chaque section, la première plaque après le bâti (FD), la plaque séparatrice (S) ou le cadre intermédiaire (M) doit être équipée d'un joint de sorte que toutes les rainures soient equipées de joint quand la plaque a été montée dans le bâti.
2 joints sont taillés comme montré sur le dessin, et les anneaux d'angle "a" sont coupés aux angles où il y a un joint dans le bâti, dans la plaque séparatrice ou dans le cadre intermédiaire.

En cada sección debe la primera placa después del cabezal firme (FD), la placa separadora (S), o bastidor separador (M) ser equipada con una junta, asi que cuando la placa esté montada en el bastidor hayan juntas en todas las ranuras de las juntas.
Dos juntas se recortan como ilustrado y los orificios de las esquinas "a" se cortan en las orillas, donde ya se encuentran juntas en el cabezal firme, en la placa separadora, o en el bastidor separador.

В каждой секции первая пластина после (FD) / Неподвижной плиты / или (S) / разделительной плиты / или (M) / промежуточной плиты / должна быть снабжена прокладками так, что она при монтаже имеет прокладки во всех прокладочных канавках.
Режут две прокладки так как указанно на чертеже, и отрезывают кольца "a" в том случае, если имеется прокладка в плите или в разделительной плите или в промежуточной плите.



	Joint pour pièce angulaire et traversée / Junta para taco de esquina y conexion / Прокладка для углового блока и прохода.					
	Matière / Material / Материал					
	T	NBR Нбр	EPDM Епдм	FPM PT-1 Фтм	FPM PT-2 Фтм	FPM PT-3 Фтм
FD	7,25	1725 1503	1725 1511		1725 1317	1725 1325
BD	3,75	1725 1376	1725 1384		1725 1546	1725 1333

★ Pour plaques séparatrices et pour blocs angulaires à cadres intermédiaires, le joint haut doit être placé sur le coté de la plaque correspondant au bati (FD), et le joint bas sur le coté correspondant au plateau de serrage (BD).

Para placas separadores o para bloques de esquina en bastidores separadores se colocan la empaquetadura gruesa en al lado de la placa, que corresponde al (FD) cabezal firme, y la empaquetadura delgada en el lado de la placa que corresponde al (BD) cabazal móvil.

При разделительных пластинах и при угловых блоках на промежуточных плитах высокая прокладка должна быть размещена на той стороне пластины, которая отвечает неподвижной плите /FD/, и низкая прокладка должна быть размещена на той стороне, которая отвечает прижимной плите /BD/.

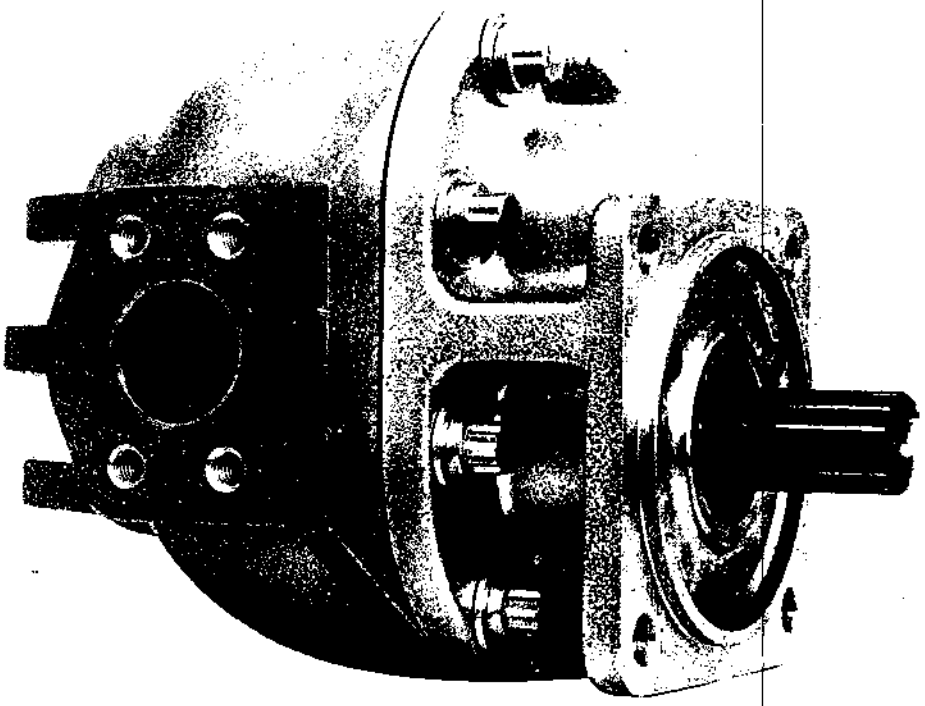
	NBR	EPDM	FPM
Marquage de couleur de la qualité de joint:	aucun ou bleu	gris	violet
Marca en color de la calidad de la junta:	ninguna o azul	gris	violado
Краска прокладки	Нбр отсутствие или синяя	Епдм серая краска	Фтм фиолетовая

APV Baker	JOINTS JUNTA ПРОКЛАДКИ		
N35 – 15			
Side 2 af 2	Sign. 88.01.20 Juul	Ant. 88-01-20 GJ	Rev. 4 91.01.18 Sø/NCJ

TYRONE MOBIL-MASTER

GEAR PUMPS AND MOTORS

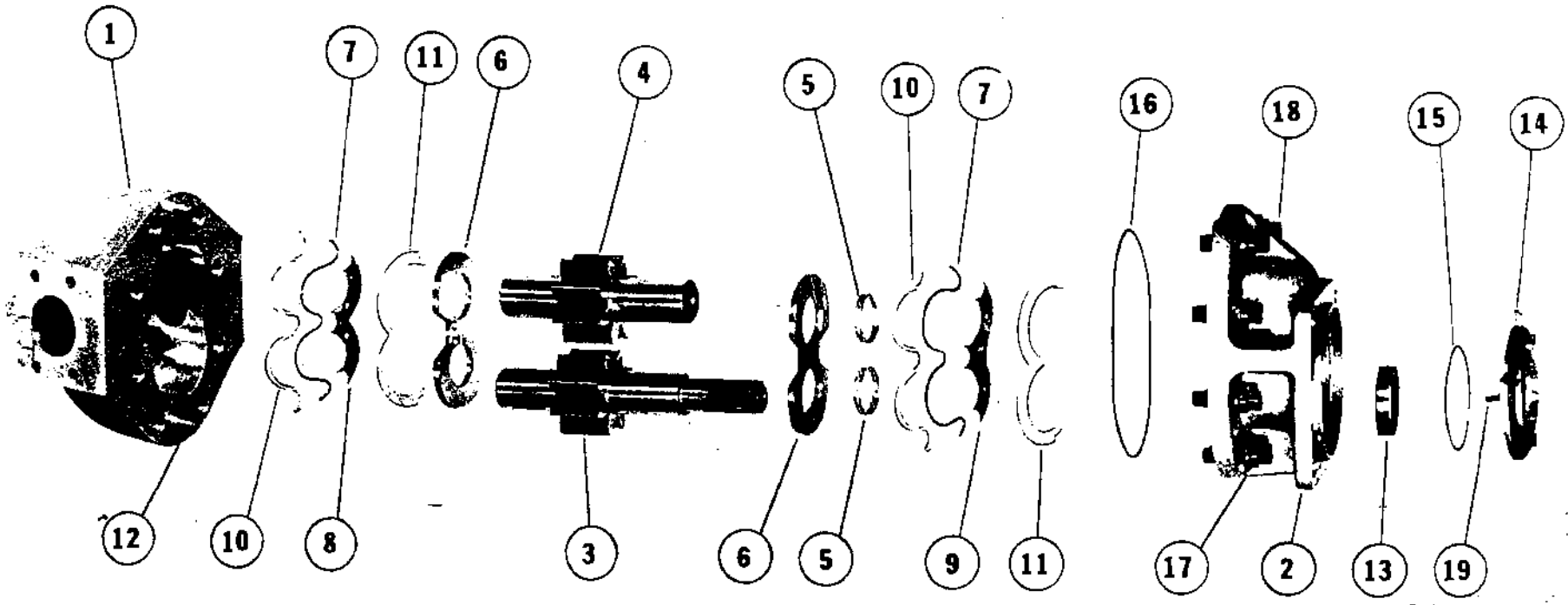
SERIES 25 SINGLE



Service Instructions

TYRONE HYDRAULICS *Corinth, Miss.*

REPRESENTANT FOR NORGE
SJONG HYDRAULIKK A.S
Postboks [illegible], Ellerstad, OSLO 6
Biskop Jens Nielssens gt. 5, Tlf. (02) 69 66 43

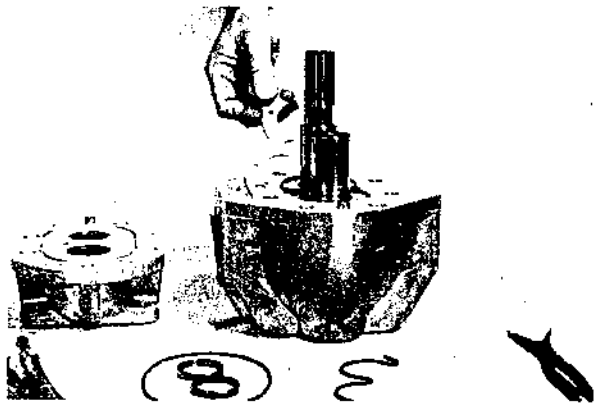


SERIES 25 SINGLE PUMP

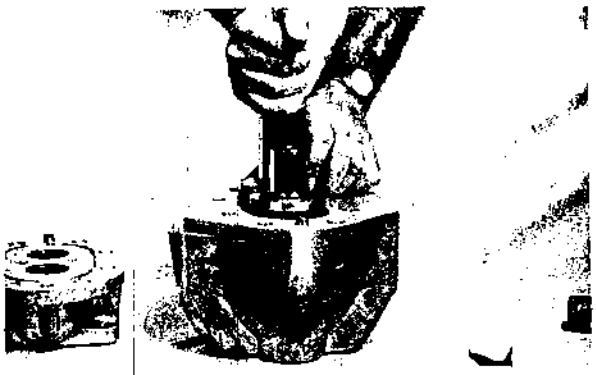
DISASSEMBLY

1. Clean the outside of the pump thoroughly.
2. Place the pump in a machinist's vice securely, shaft up, using a clean block of wood between the flats on either side and the jows of the vice. This keeps from marring the machined surface of the pump and causing leakage at the port connectors.
3. Remove all capscrews from the flange.
4. Coat the shaft extension with clean grease. This will help to keep from damaging the rubber lips of the seal during removal of the flange.

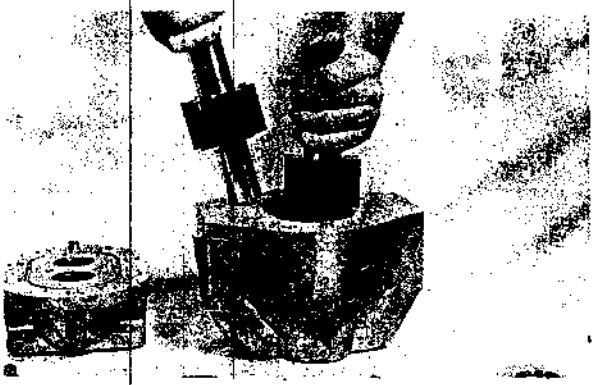
5. Lift the flange off the pump, keeping the flange as straight as possible during removal. If the flange is stuck, use a wood mallet or plastic hammer to tap around the edge and loosen.



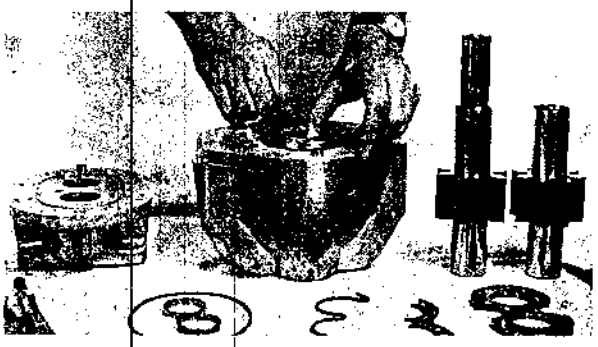
6. Remove all O-rings, ring retainer, steel rings, isolation plate, and back-up rings that are in view.



7. Grasp the drive shaft extension and lift the drive shaft slightly with a quick upward motion. This will dislodge the pressure plate from inside the bore of the body. Using the thumb and forefinger of the other hand in the slots of the pressure plate and releasing the hald on the drive shaft, lift the pressure plate from the pump.

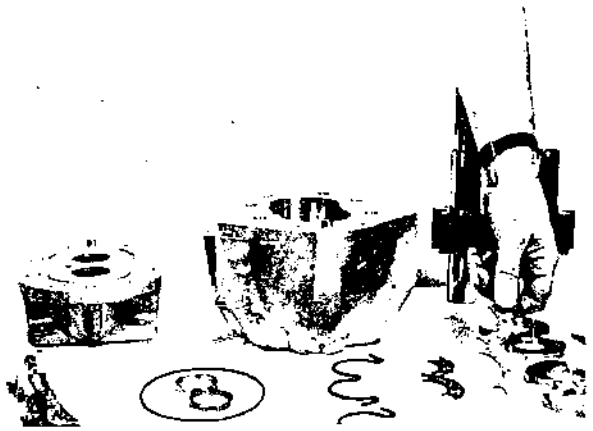


8. Lift the gears straight up out of the pump body.



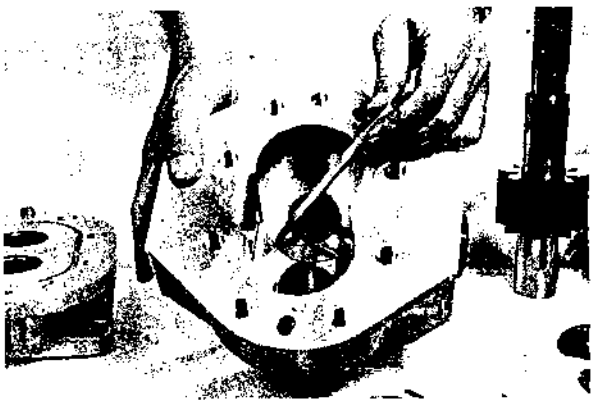
9. Using the thumb of each hand in the holes in the bottom pressure plate, lift it from the pump, working it easily out. USE EXTREME CARE IN THE REMOVAL OF THIS PLATE. DO NOT PRY OR FORCE IT OUT.

10. Remove the remaining O-ring, back-up ring, retainer ring, and isolation plate.



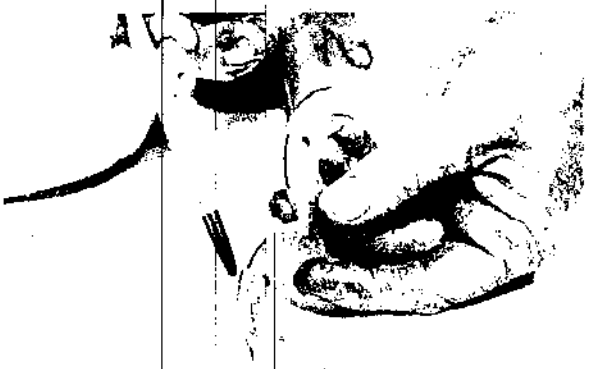
11. Wash all parts thoroughly with clean solvent and blow dry. This should remove any foreign matter trapped in the pump.

12. Inspect the parts carefully. For detailed instructions see INSPECTION OF PARTS.



13. Place the body of the pump so that the isolation plate retainer cusp is to your right. The cusp is shown above in the bottom of the pump body.

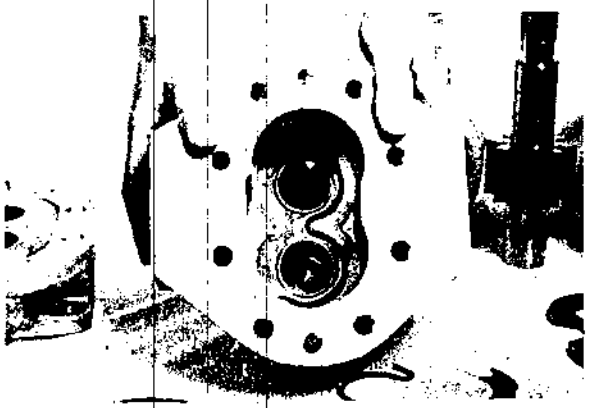
14. Using clean hydraulic oil, coat the inside of the pump body liberally. This will insure easier assembly.



15. Examine the two isolation plates. You will find that they are slightly different. Choose the one which has rounded edges as shown. Install this

one in the bottom of the pump, with rounded edges down and long end to the drive shaft side of pump.

16. Install O-ring retainer into place on the opposite side of the bores from the isolation plate.



17. Place the back-up ring into position around the bores as shown above.

18. Install the O-ring in place against the back-up ring so that it seats itself into the groove in the edge of the back-up ring.

19. Pick up one of the pressure plates and note the bronze side. You will notice that one of the sides has rounded trap slot milled into it. This side faces the discharge side of the pump. The discharge side is opposite the isolation

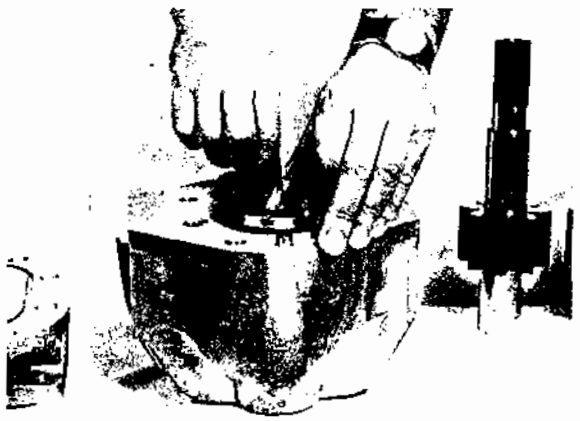


plate. Keeping the plate as level as possible, slide into place in the bottom of the body. DO NOT FORCE THE PLATE ! If it binds on the way down, work it slightly until it slides into place.

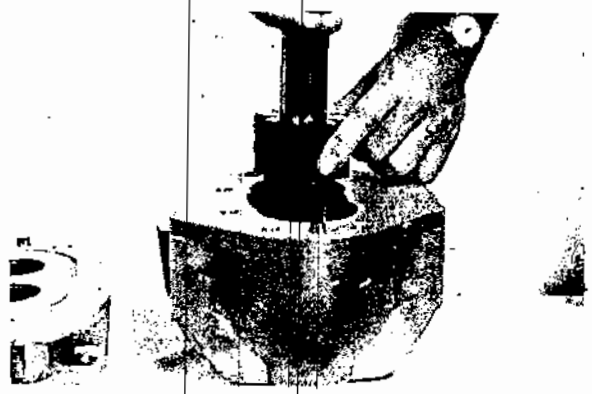
20. Check the name plate on the body of the pump for the pump rotation.

EXAMPLE

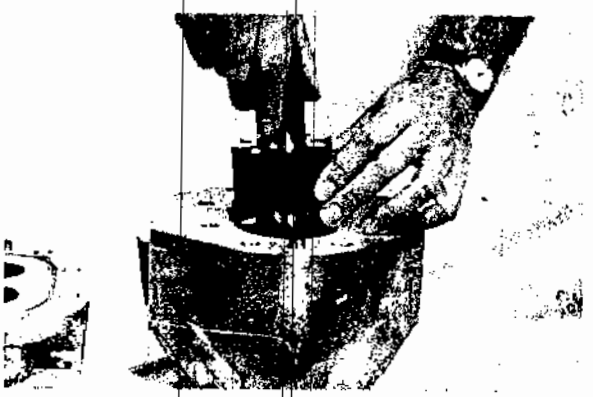
Model No.
25660A-D
Denotes Counterclockwise Rotation

Model No.
25660C-D
Denotes Clockwise Rotation

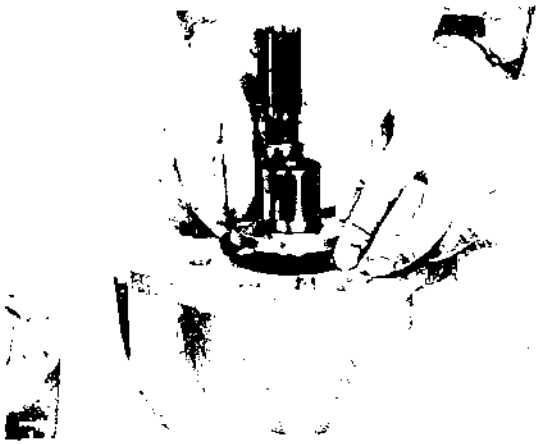
21. If the pump is of clockwise rotation, the drive shaft is placed into the bore nearest you. If the pump is of anti-clockwise rotation, the drive shaft goes into the bore oway from you.



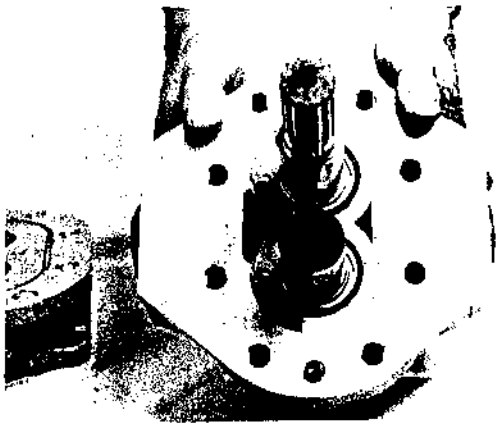
22. Insert the drive shaft into the proper bare for this pump. Do not drop into ploce, but slide it into place gently as dropping will damage the bronze pressure plate.



23. Install the idler gear into the apposite bore of the pump. The long journol on the idler gear should be up.



24. Pick up the other pressure plate. Holding the bronze side down, and the rounded trap slot facing the discharge side af the pump, install it into position over the gears.



25. Slide the two steel rings over the shafts and seat them into the recesses in the pressure plate.

26. Place the remaining isolation plate in place on the suction side on top of the pressure plate. Either side up is right, but with long end to drive shaft.

27. Install the retainer ring.

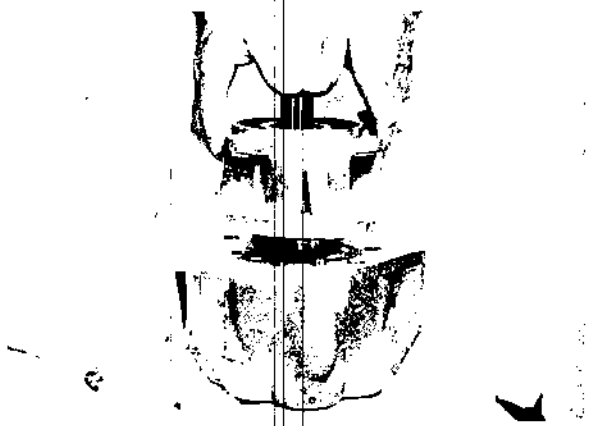
28. Install the back-up ring.

29. Install the O-ring as in the bottom of the pump.

30. Examine the seal. If it is damaged or if previous leakage has been evidenced, replace. (See SEAL REPLACEMENT for detailed instructions.)

31. Gently wipe the machined surface of the flange with emery cloth. Wash in solvent and blow dry.

32. Install the body O-ring into the groove in the flonge. Use heavy grease to hold it in place.



33. Coat the drive gear extension with heavy grease to protect the lips of the seal.

34. Slide the flange over the drive gear extension and seat it agoinst the pump body.

REASSEMBLY

35. Insert two of the capscrews with washers installed into opposite holes and torque to 175 lbs. ft.

36. Using a 10" wrench, check to see if the drive shaft will turn. Shaft will be tight but should turn freely with a maximum of 5 to 10 lbs. torque.

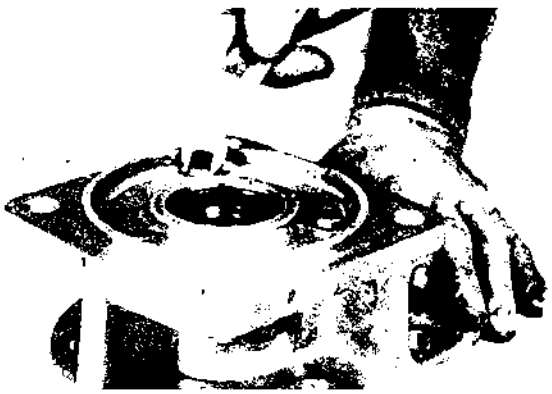
37. If shaft will not turn as stated, disassemble the pump and examine for burrs or foreign material causing build-up or interference in the parts.

38. Remove the cause and reassemble as before.

39. When shaft turns properly, tighten the remaining nuts and torque to 175 lbs. ft. each.

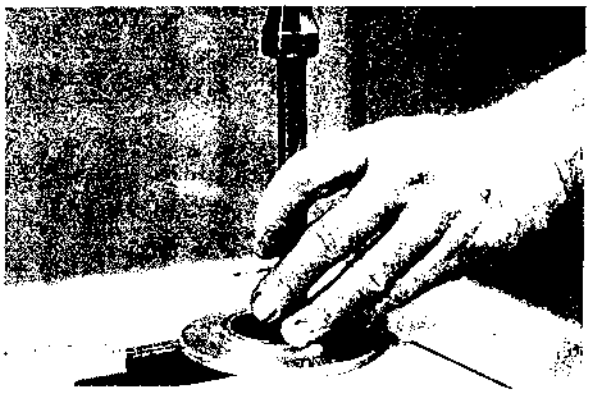
1. Stand the pump on end, shaft up.

2. Using a brush and solvent, wash the entire flange end of the pump ONLY, and blow dry. This is to remove any foreign material which might get into the pump during replacement of the seal.



3. Remove the seal retainer capscrews.

4. Lift the seal retainer off the flange.



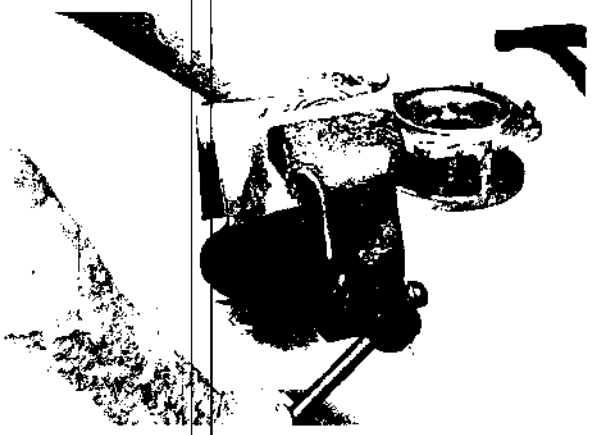
5. Press the old seal out of the retainer. USE EXTREME CARE IN REMOVAL OF THE SEAL. Press it straight out of the bore of the retainer. Do not mar the machined face of the retainer.

6. Wash the seal retainer in solvent and blow dry.

7. Place the cast surface of the retainer against the stotionary jaw of a machinist's vise.

8. Place the metal face of the seal in position against the retainer. Be sure that the seal is well centered over the bore.

9. Place a clean block of wood against the rubber face of the seal and by tightening the vise, press the seal into the bore.



THE SEAL WILL SEAT ITSELF WITH ABOUT HALF OF THE SEAL THICKNESS PROTRUDING FROM THE RETAINER. THIS PROTRUSION SERVES AS A PILOT IN RE-INSTALLING THE RETAINER.

BEARING REPLACEMENT—INSPECTION OF PARTS

BEARING REPLACEMENT

MOBIL-MASTER SERIES 20 & 25

Mobil-Master Series 20 and 25 Pumps are built with the highest capacity bearings available. However, if the pump is run on a system with contaminant present in the oil, or under certain other conditions, bearing failure may be experienced. In the event of bearing failure the bearings may be replaced if the gears have not cut a track in the housing deeper than .015 inches.

To remove the old bearings, disassemble the pump and place the body in a vise. Clamp on the sides of the body using cardboard to prevent marring by the vise jaws.

Using the small keyhole type hack saw, cut through the bearing opposite the oil groove. Be sure the saw cuts completely through the bearing shell, but cuts as little as possible into the aluminum bore.

After the cut is made, grip the bearing with vise-grip pliers and remove with a twisting motion (body bearings). Flange bearings can be wedged out with a screw driver. Take care not to damage the bores. After removal, wash the parts thoroughly in solvent. Press in the body bearings so that they protrude above the surface .220/.230. Press flange bearings in .090 below surface. The split in the bearing goes in the same location as was the oil groove in the bronze bearings.

Install the remaining parts of the repair kit and replace on the machine. No break-in is necessary and the unit is ready to operate at full capacity.

INSPECTION OF PARTS

1. Visually inspect all parts. There will be a gear track on the inside of the pump body. Measure the depth of this gear track. If the groove is deeper than .005 (five thousandths) of an inch, the body should be rejected for further use. If the track is less than .005, the body is all right for reassembly provided it is not cracked or damaged otherwise.

2. Examine the pressure plates. They should not show excessive wear on the bronze side. If deep curved wear marks are visible, reject them.

3. Examine the gears. If excessive wear is visible on the journals, sides or face of the gears, or at the point where it rotates in the seal, reject them.

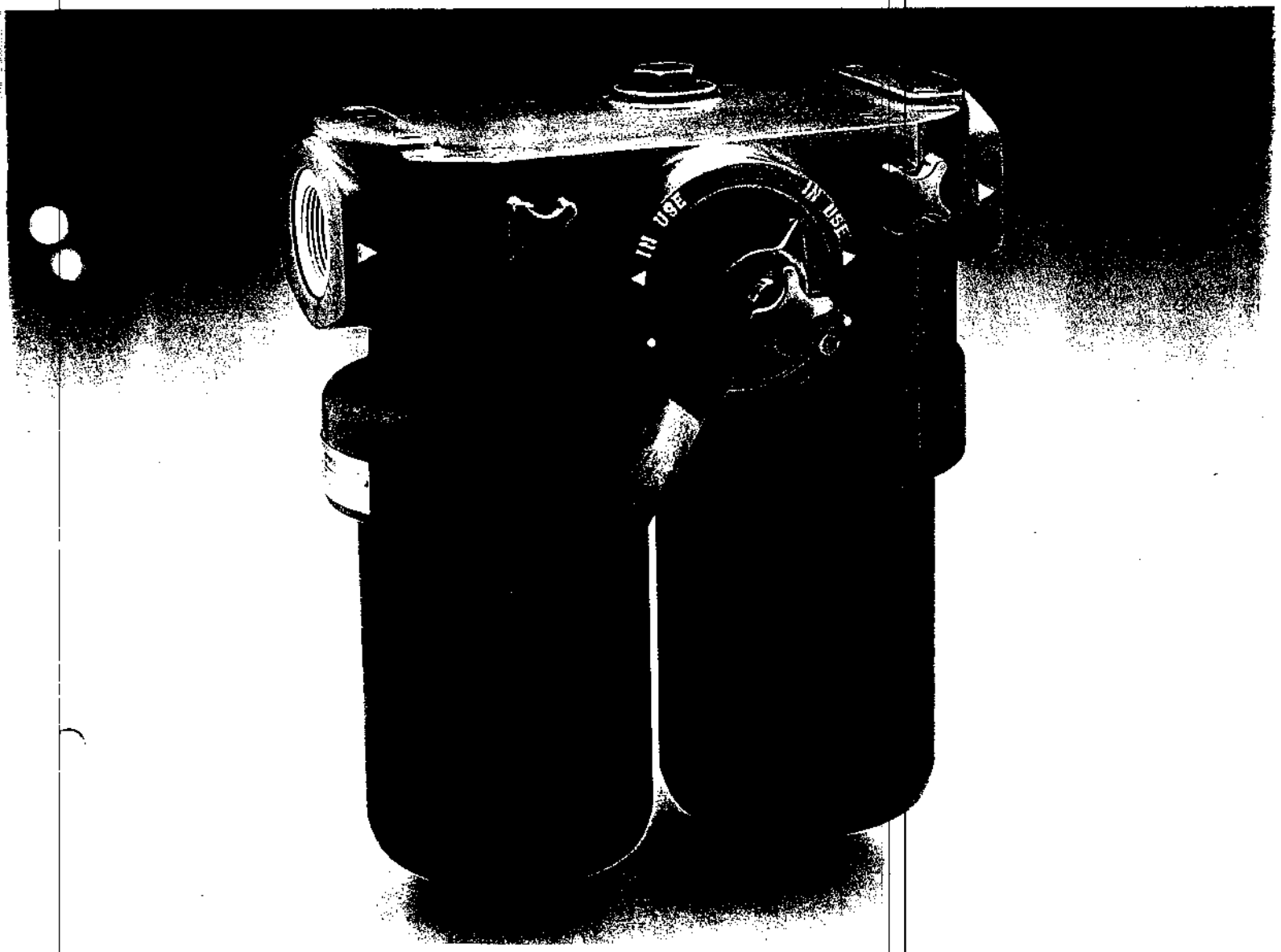
4. If any of the internal parts show excessive wear, replace all the parts with the cartridge kit.

March 1987

High Pressure Duplex Filters

Model 32PD

Flow rates to 250 l/min
Maximum pressure 210 bar



Parker
Fluidpower

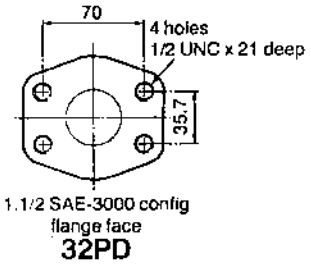
High Pressure Duplex Filters

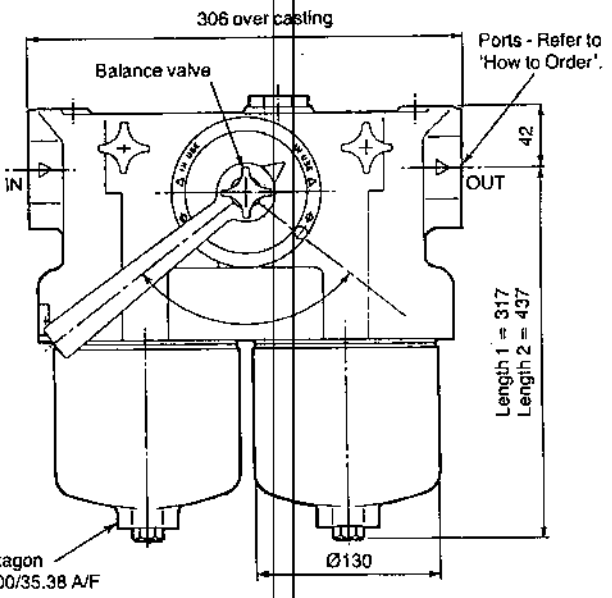
Parker 32PD filters are specifically designed for continuous pressure
ration duties, to protect critical components in lubrication, machine tool, marine and general hydraulic systems.

* Modular design – with integral changeover valve.
* The changeover valve operates on the upstream side of the filter and there is no leakage between the upstream and downstream fluid.
* Visual/Electrical indicator options.
* Continuous filtration even during element change.
* Spool type bypass valve – giving excellent opening/closing characteristics.
* Filters incorporate Parker quality Media tested to ISO standards.

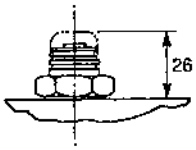
Installation Details

Dimensions in mm

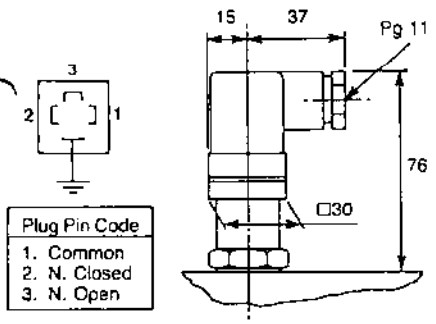




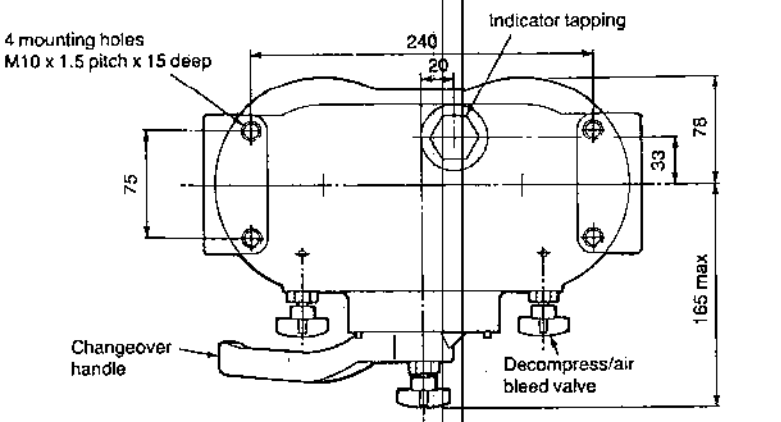
Optional Indicators



Visual – Refer to 'specification'.



Electrical – Refer to 'specification'.



Operation

Duplex pressure filters have two filter elements in separate bowls mounted in a common head. Only one element is operational at any given time whilst the other is isolated for servicing. As dirt builds up on the element and servicing becomes necessary, a changeover valve is turned to bring the clean element into operation and isolate the dirty element ready for maintenance at a convenient time. In this way continuous filtration is possible without any need to shut down the system for element maintenance. The changeover valve is designed so as not to increase the pressure drop across the filter during rotation of the handle.

Filter Division

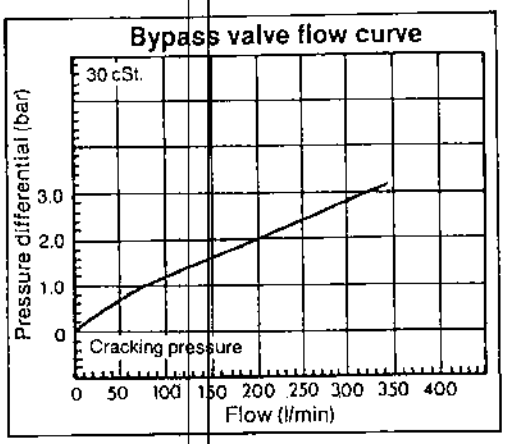
Parker Fluidpower

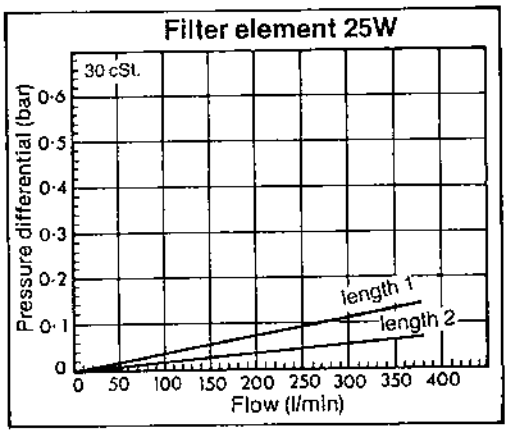
Filter Selection

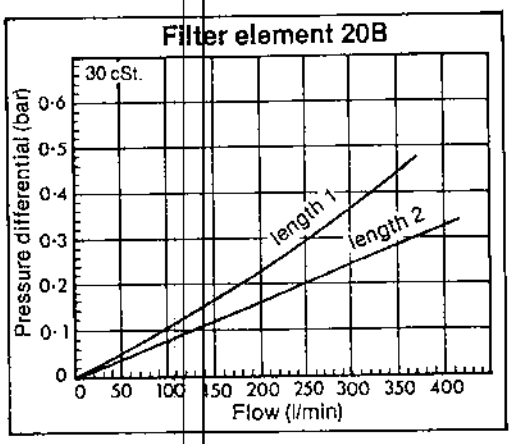
Refer to page 4 for the required element media and select the filter from the following curves.
Recommendations for sizing of filters are given in Parker leaflet no. 2370-1: "How to select a filter for optimum cost-effective operation", (available on request). The ratio between the bypass setting and the pressure drop across the filter with a clean element should be at least 2:1 preferably 3:1.
All filters were tested in accordance with ISO 3968: "Determination of pressure drop flow characteristics of hydraulic fluid power filters", using mineral oil fluid SAE 10 at 30 cSt. viscosity.

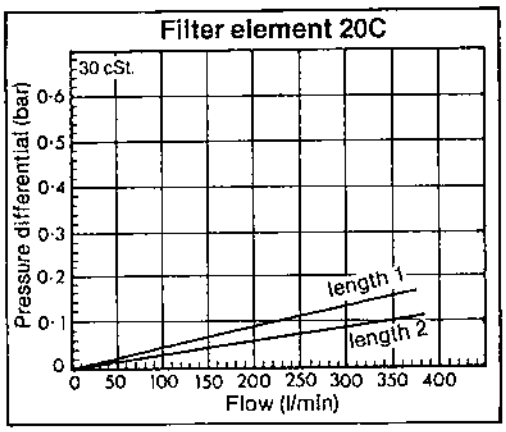
Bypass Valve

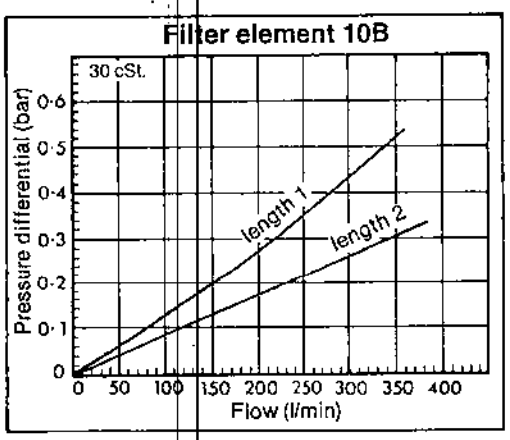
Under normal operating conditions, the spool bypass valve is closed. When pressure drop across the filter exceeds the preset level, bypass flow commences.

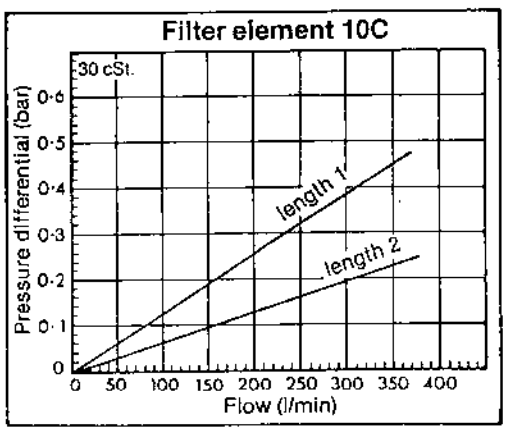


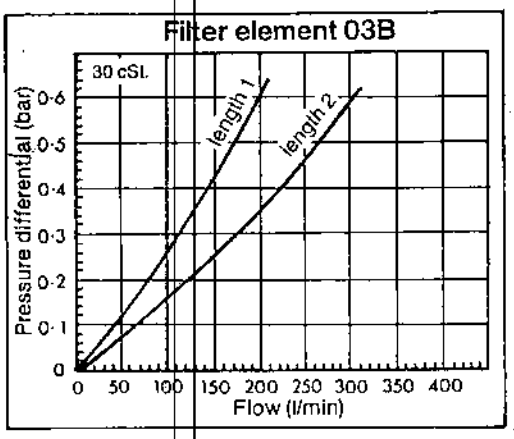






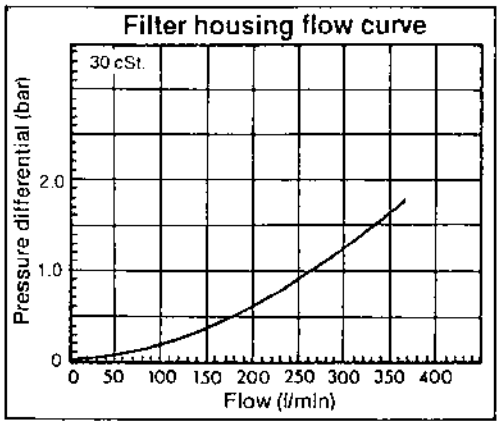






Filter Division

Parker Fluidpower



Typical Application Example

To find the pressure drop (Δ p) across a complete filter with a clean element.
Consider a filter F3-32-PD-1-10B-V-50-D-1 handling mineral oil fluid at 50 cSt viscosity and 200 l/min flow rate.

Total filter Δ p = housing Δ p + element Δ p
Housing Δ p = 0.6 bar (viscosity effects are negligible).
Clean element Δ p (30 cSt) = 0.28 bar (see graph).
Element Δ p is proportional to viscosity
$\therefore$ Clean element Δ p (50 cSt) = $0.28 \text{ bar} \times \frac{50}{30} = 0.47$ bar

Total filter Δ p = 0.6 + 0.47 = 1.07 bar.

Element Characteristics

Parker elements conform to the following standards:
ISO 2941 Element collapse/burst resistance.
ISO 2942 Fabrication integrity.
ISO 2943 Material compatibility.
ISO 3724 Flow fatigue characteristics.
ISO 4572 Multipass test.

Multipass Test Method

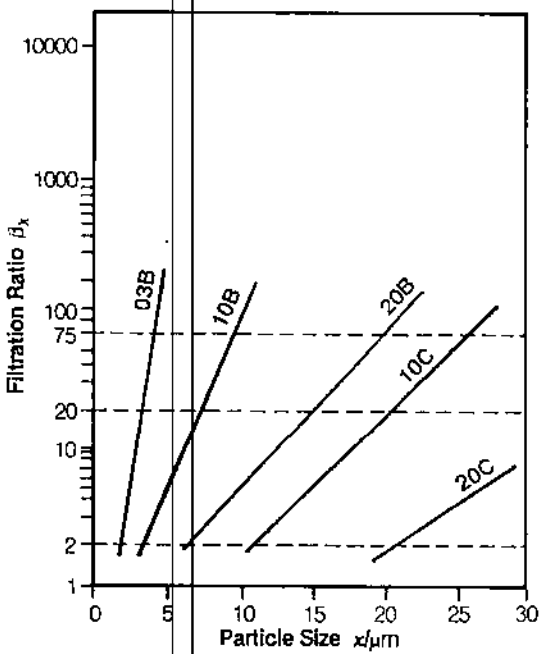
The filtering capability of the element is expressed in terms of filtration ratio

$$\beta x = \frac{\text{Number of upstream particles}}{\text{Number of downstream particles}}$$

Filtration Ratio/Filter Efficiency Chart

Filtration ratio β_x	Efficiency percentage (%)
1.0	0
1.5	33
2.0	50
20	95
50	98
75	98.7
100	99
200	99.5
1000	99.9
10000	99.99

Filtration Ratio ßx versus Particle Size



Standard Parker Element Media

Parker Media ref.	Type	Media
25W	surface - reusable	wire mesh - 25 micron absolute
20C	depth - disposable	cellulose - 20 micron nominal
10C	depth - disposable	cellulose - 10 micron nominal
20B	depth - disposable	composite - 20 micron absolute
10B	depth - disposable	composite - 10 micron absolute
03B	depth - disposable	composite - 3 micron absolute
20BH*	depth - disposable	composite - 20 micron absolute
10BH*	depth - disposable	composite - 10 micron absolute
03BH*	depth - disposable	composite - 3 micron absolute

*High collapse 210 bar.

Filter Division

Parker Fluidpower

Specification

Maximum working pressure: 32PD-210 bar
Minimum burst pressure: 32PD-630 bar
Operating temperature: – 40°C to 120°C
Seals: Buna (standard), Viton (optional)
Filter head material: SG iron.
Filter bowl material: Steel.
Filter compatibility: Hydraulic oils, H.W.B.F., water glycol,coolant fluids, phosphate ester & petroleum based fluids.
Element characteristics: see page 4.
Weight: 32PD-1, 44kg
32PD-2. 50kg

Indication:
Visual – Cartridge type pressure differential 'pop-up' indicator with automatic reset. Operating pressure 3.5 bar.
Electrical – Cartridge type pressure differential switch. Operating pressure 3.5 bar. 250v, 50-80Hz, 5A max. Appliance socket to DIN 43650 with cable gland Pg 11.
Bypass: The bypass opens when the pressure differential exceeds 3.5 bar.
Ports: Refer to 'How to Order'.

How To Order

Select the features required from the boxes below.
The example shown should be ordered as: F3-32-PD-1-10B-V-50-D-1

F3 | 32-PD | 1 | 10B | V | 50 | D | 1 | –

Seals
O Buna (standard)
F3 Viton (optional)

Model
32-PD-210 bar

Element Length
1. Single Length
2. Double Length

Standard Parker Element Media

25W	Reusable wire mesh. 25 micron absolute
20C	Disposable cellulose. 20 micron nominal
10C	Disposable cellulose. 10 micron nominal
20B	Disposable composite. 20 micron absolute
10B	Disposable composite. 10 micron absolute
03B	Disposable composite. 3 micron absolute
20BH*	Disposable composite. 20 micron absolute
10BH*	Disposable composite. 10 micron absolute
03BH*	Disposable composite. 3 micron absolute

*High collapse 210 bar

Indicators
N None
V Visual
E Electrical switch
Refer to specification.

Indicator/ Bypass Setting
50 3.5 bar (50 psi)

Ports
D 1¼ BSPF Female thread
Y 1½ SAE 3000 Flange face
Consult Parker for information regarding alternative ports.

Modifications
1. With bypass
3. With magnets & bypass
11. No bypass
12. With magnets - no bypass

Design Number
Stamped on the filter nameplate to assist with identification for spares purposes. State the full filter code, including design number, when ordering spares other than elements.

Replacement Element Part Numbers

Parker Media Ref.	Buna (Standard) Seal Element Part No.		Viton Seal Element Part No.	
	Single Length	Double Length	Single Length	Double Length
25W	G01067	G01097	G01087	G01117
20C	G01070	G01100	G01090	G01120
10C	G01071	G01101	G01091	G01121
20B	G01946	G01954	G01950	G01958
10B	G01068	G01098	G01088	G01118
03B	G01069	G01099	G01089	G01119
20BH*	G01948	G01956	G01951	G01959
10BH*	G01453	G01459	G01457	G01463
03BH*	G01454	G01460	G01458	G01464

Filter Accessory Part Numbers

Filter Seal Kit Numbers

Model	Buna	Viton
32-PD	G02373	G02375

Magnets

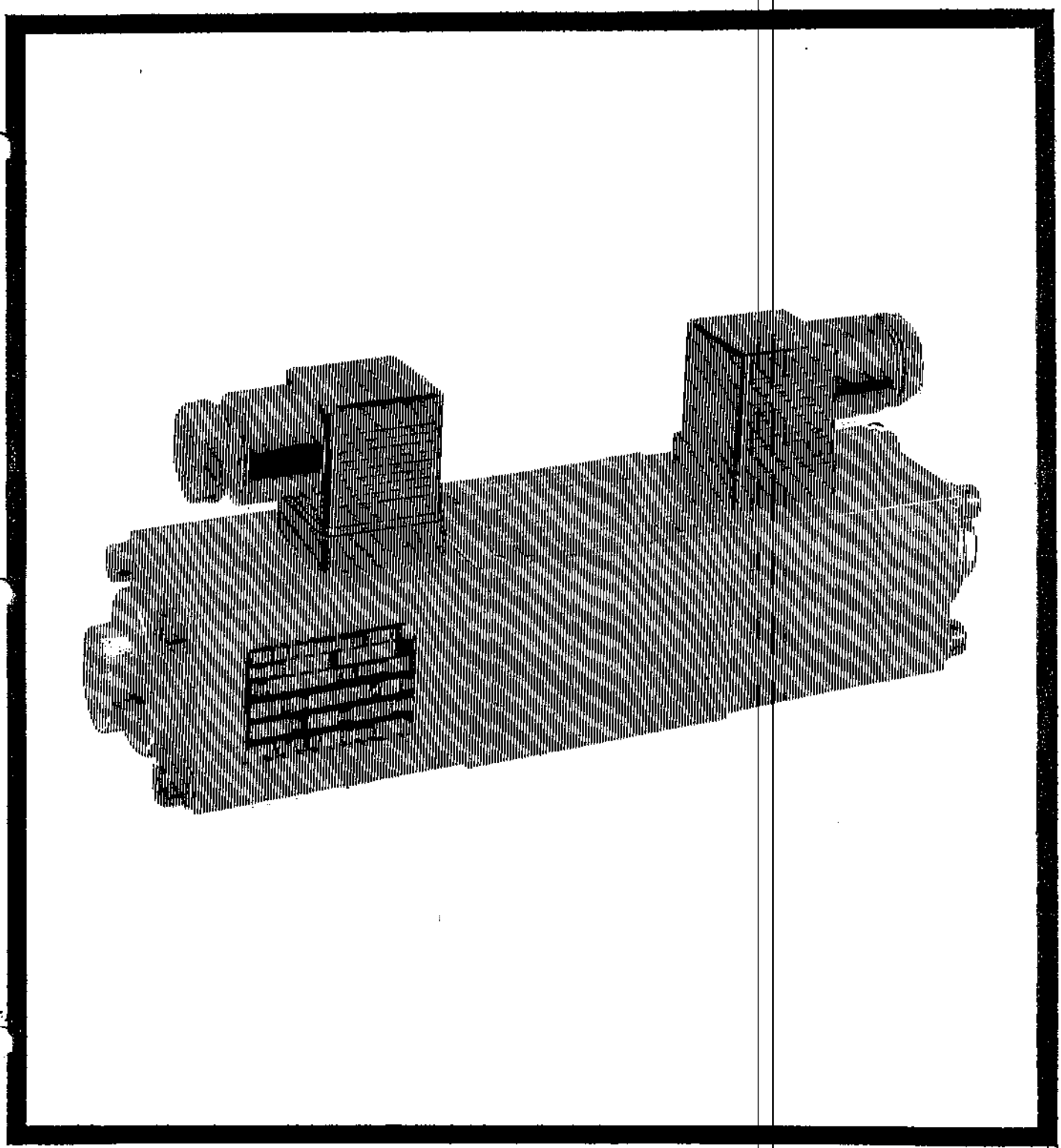
G01143

Indication

Setting		Electrical
50	G02369	G02371

ORSTA hydraulik

Soleonid Operated Directional Control Valves · Size 06 · Rated Pressure 32 MPa · TGL 26223/60



Soleonid operated directional control valves
Size 06 · Rated pressure 32 MPa · TGL 26223/60
for flowrate up to 60 dm^3/min

Features

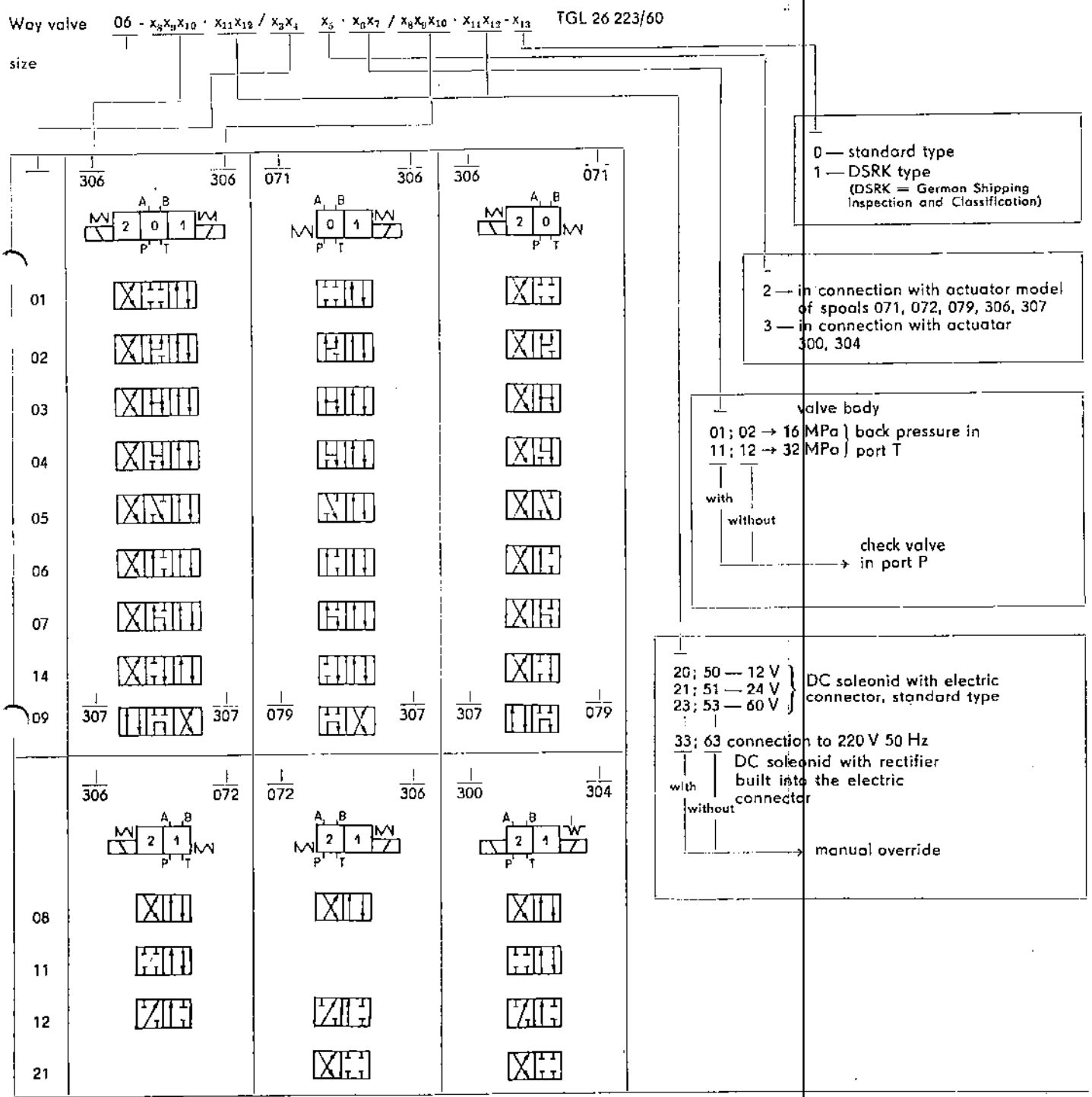
- Hole pattern according to international standards and TGL 26 290 (DIN 24 340 ISO 4401 and CETOP)
- Max. continuous operating pressure up to 32 MPa
- Wet armature DC soleonids
- With or without manual override
- Low pressure drop across the valve
- Check valve in the port P optional

Technical Data

Max. operating pressure in the ports P; A; B; T	32 MPa		
Max. flow	60 dm^3/min		
Temperature range of fluid	248 to 348 K (—25 °C to +75 °C)		
Viscosity range	$10 \cdot 10^{-6}$ to $1200 \cdot 10^{-6}$ m^2/s (10 to 1200 cSt)		
Ambient temperature range	248 to 328 K (—25 °C to +55 °C)		
Filtration	$\leqq$ 63 µm		
Fluid	Mineral base hydraulic fluids meeting the technical requirements according to TGL 17 542/01 and/03, ISO DS 131, CETOP RP 91, and DIN 51517 resp. DIN 51524		
Max. leakage			
— at Δp = 16 MPa	60 cm^3/min		
— at Δp = 32 MPa	110 cm^3/min		
Mounting bolt torque			
— for valve	6 ± 0.2 Nm		
— for actuator	6 ± 0.6 Nm		
Rated current at rated voltage			
— DC soleonid with electric connector, standard type	3.75 A 12 V	1.87 A 24 V	0.75 A 60 V
— DC soleonid with rectifier, built into the electric connector with connection to 220 V; 50 Hz	0.45 A		
Max. switching frequency	14 000 c/h		
Relative duty time	100 %		
Type of protection according to TGL RGW 778 (DIN 40050)	IP 55		

In deviation of the operating conditions as stated consult the manufacturer.

Valve Assortment
Ordering Code



Example: Way valve 06-072.00/122.12/306.20-0 TGL 26 223/60

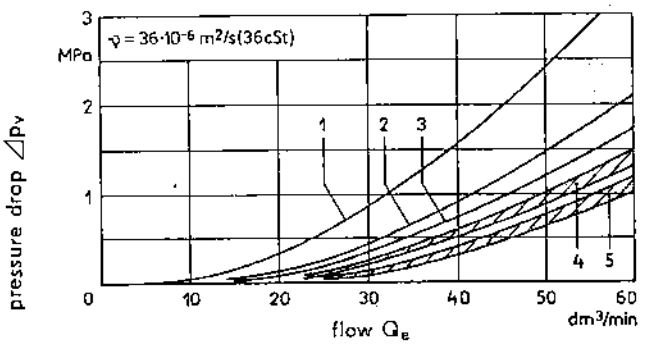
side x side y

In the designation of way valves with actuators $x_8x_9x_{10}$ = 071, 072 the places $x_{11}x_{12}$ have to be written with 0, because these actuators don't have connection with voltage (see example). More over it must be distinguished between the reference side "x" and "y". The symbol x_3x_4 = 09 is realizable in connection with actuators $x_8x_9x_{10}$ = 307 resp. 079 only.

Characteristics

$\Delta p_v = f(Q_e)$

without check valve in port P



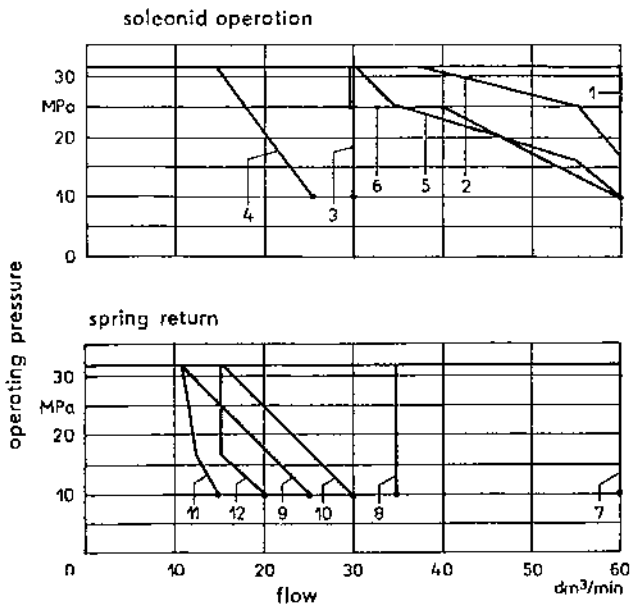
In control units with check valve in port *P* the pressure drops are about 25 % higher than the stated values. The opening pressure of the check valve amounts to 0,02 MPa.

Characteristic Curve	Flow Direction	Symbol (x_3x_4)
1	P-T	09
2	P-A (B) P-A	04, 05, 08, 14, 09 06*
3	P-A (B) A (B)-T P-A	01, 02* 08, 09 07*, 11
4	A (B)-T B-T A-T P-A (B)	01, 02, 04*, 06 07, 14* 07, 11, 21, 05* 03*
5	P-A (B) P-A A (B)-T P-T A (B)-T A-T	02, 03 06, 07 03* 03 03, 04 05, 07

* middle position

Switching Range

Viscosity range: $\nu = 10$ to $400 \cdot 10^{-6}$ m²/s (10 to 400 cSt)
The flow forces acting in operation within the valve limit the hydraulic power which is stated in dependonce of the flow direction.
In obtaining the valve position by soleonid operation, the limit of use for soleonid operation must be noted.
In using the spring force, then the limit of use for spring return must be noted.



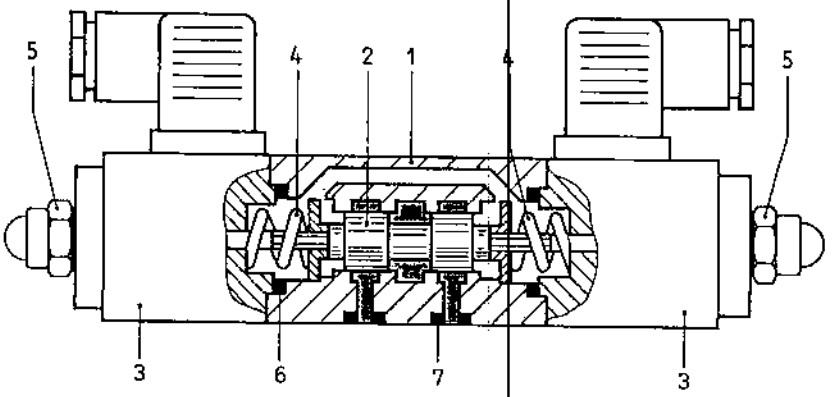
Characteristic Curve	Flow Direction	Symbol (x_3x_4)
1	P-A-B-T P-A (B)	01, 02, 03, 06, 08, 02, 03, 11, 12, 21
2	P-A-B-T	04, 05, 14
3	P-A (B) P-A-B-T	07 07
4	P-A-B-T	09
5	P-A (B)	01, 04, 05, 06, 08, 14
6	P-A (B)	09
7	P-A (B)	01, 03, 04, 05, 14
8	P-A-B-T	01 . . . 05, 14
9	P-A-B-T; P-A (B)	09
10	P-A-B-T	08, 11, 12, 21
11	P-A-B-T; P-A (B)	07
12	P-A (B)	02*, 06* 08, 11, 12, 21

* middle position

Mode of Operation

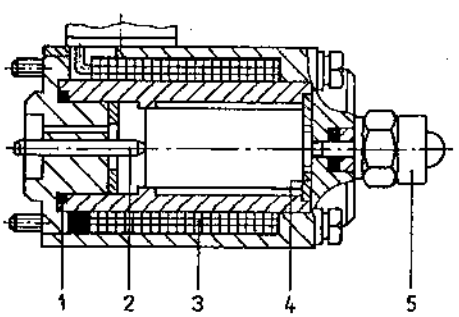
Directional control valves consist of one control unit (valve body (1) with spool (2)) and two actuators.
The actuators can be two soleonids (3) or one soleonid and one end cover. When de-energizing soleonids, the springs (4) hold the spool in normal position.
When energizing one soleonid (3), the spool (2) is being shift against the spring force (4) on the opposite valve side into the actuated position. In this way the flow directions according to the symbol are obtained.
When de-energizing the soleonid (3), the spool (2) is being reset into the normal position by means of the compression spring (4).
The manual overrride (5) allows the actuation of the spool (2) without energizotion of the soleonid (3).
There are directionol control valves with 3 positions 1; 0; 2 and directionol control valves with 2 positions 1; 2 resp. 1; 0 or 0; 2.
(6) 0-ring 20 x 3 TGL 6365 WS 1.957
(7) 0-ring 9 x 2 TGL 6365 WS 1.957

Two-position directional control valves can be equipped with detent. The combination consisting of actuator $x_8x_9x_{10} = 300$ with any control unit x_3x_4 and actuator $x_8x_9x_{10} = 304$ represents a two-position control valve with detent.
The detent of the actuator $x_8x_9x_{10} = 304$ is always mounted on the y-side of the valve, and it is so designed that each of the two positions is fixed.
The position obtained by soleonid operation is fixed also in de-energizing the soleonid. With that a continuous energizing is not required. Only when actuating the opposite soleonid, the spool is being moved into the other end position which is also fixed by detent and by de-energizing the soleonid.
With application of the directional control valves in parallel or sequency circuits control units $x_6x_7 = 01; 11$ with check valve in port P may be used in order to avoid undesirable pressure drops.



Soleonid

The armature chamber of the soleonid according to TGL 32 094 is of leak-proof type, and it is connected with the port T of the valve which can be pressure loaded. Therefore all moving parts of the soleonid are protected and lubricated as well as cushioned in oil.
Such oil immersed and leak-proof soleonids have a long service life because seals between movable parts are not required, thus there is no additional friction.
Advantages by using DC-soleonids:
— soft switching operation
— leak-proof at 32 MPa
— insusceptible to short-time overload as well as to undervoltage and overvoltage
— connection to AC 220 V; 50 Hz is possible by application of a rectifier built into the socket
— plugs according to international standards
With continuous duty of the soleonid a relatively high heating (~100 °C) occure at the surface of the soleonid. In unfavourable operating conditions and in consideration of the supply of electric power it must be provided for sufficient heat dissipation.



1 0-ring
2 rod
3 coil
4 seal
5 manual override

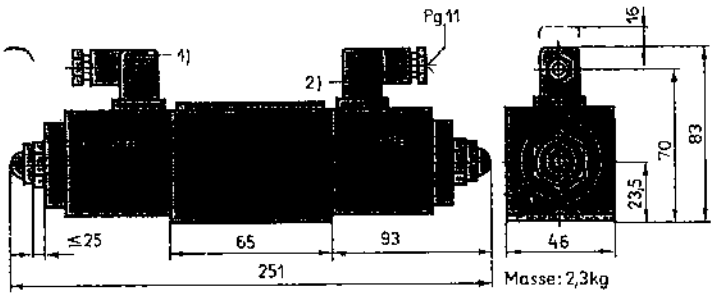
Switching Time

Conditions:
Viscosity: $\nu = 36 \cdot 10^{-6}$ m²/s (36 cSt)
Temperature of fluid: $T_{fl} = 323$ K $\pm$ 2 K (50 °C $\pm$ 2 K)
Soleonid is warmed up
The switching time applies to rated flow (10 dm³/min) and horizontal installation position of the directional control valve.
Deviations of these conditions may also cause deviations of switching times.

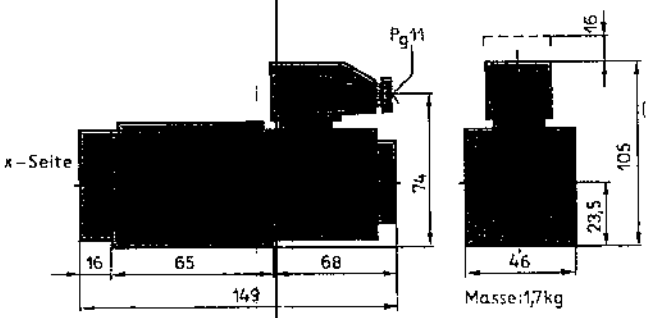
$x_{11}x_{12}$	Switching Time	Switch-on Time (soleonid operating)	Switch-off Time (spring return)
20, 50 21, 51 23, 53	DC soleonid with socket, standard type	70 $\pm$ 20 ms	60 $\pm$ 20 ms
33 63	DC soleonid with rectifier built into the socket	70 $\pm$ 20 ms	90 $\pm$ 20 ms

Main Dimensions/Directional Control Valves

Double-soleonid three-position valve (with manuol override), electric plug connector, stondord type.
Weight: 2.3 kg

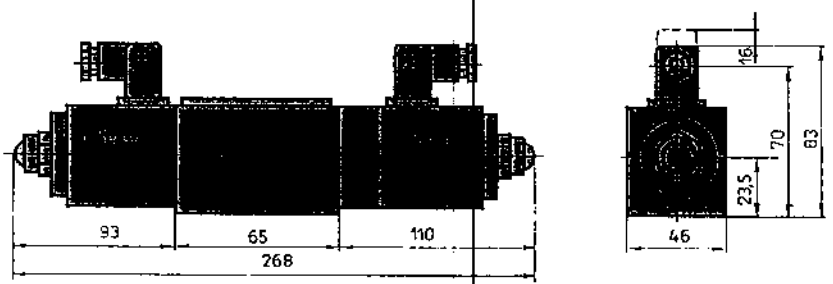


Single-soleonid two-position valve (without manual override) with end cover.
The plug connector shown is supplied in connection with DSRK-type volve (x_{13} = 1) and with DC soleonid with rectifier for AC ($x_{11}x_{12}$ = 33 resp. 63).
Weight: 1.7 kg

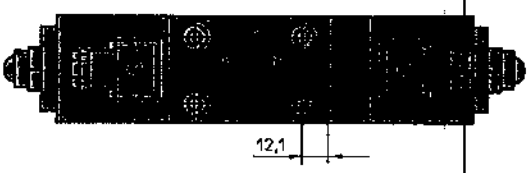


1) = colour: grey 2) = colour: black

Double-soleonid two-position valve with detent
Weight: 2.65 kg

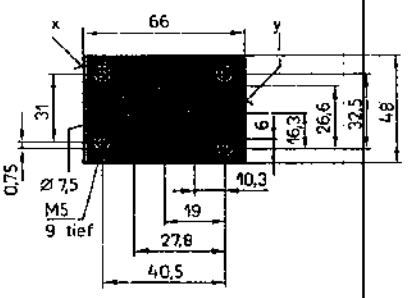


x-Seite = side x
y-Seite = side y



Fixing screws M 5 x 35
TGL 0-912-10.9-gol Zn ond 0-rings 9 x 2
TGL 6365 — WS 1.957 are supplied with valves.

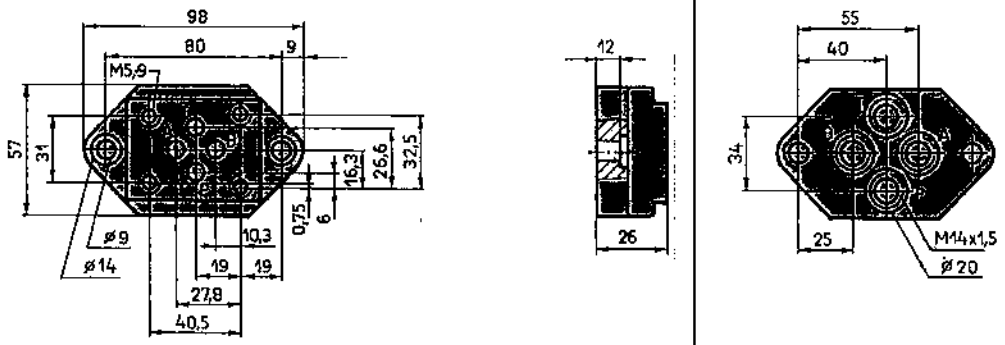
Hole pattern according to TGL 26 290,
DIN 24340, ISO 4401 and CETOP



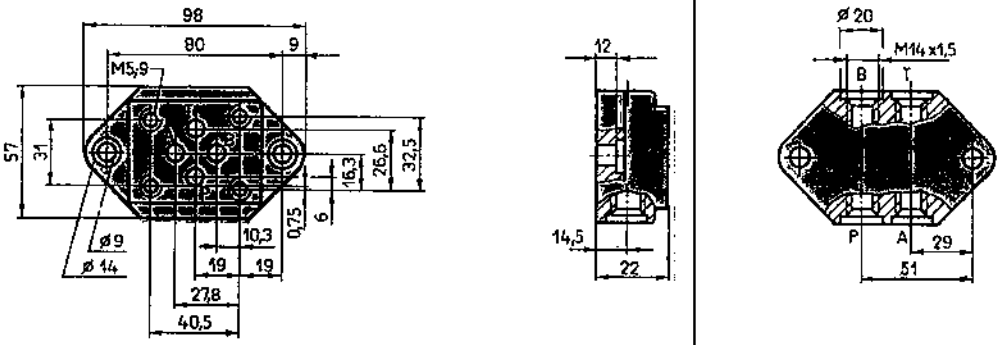
ORSTA hydraulik

Main Dimensions/Subplates TGL 26263/50

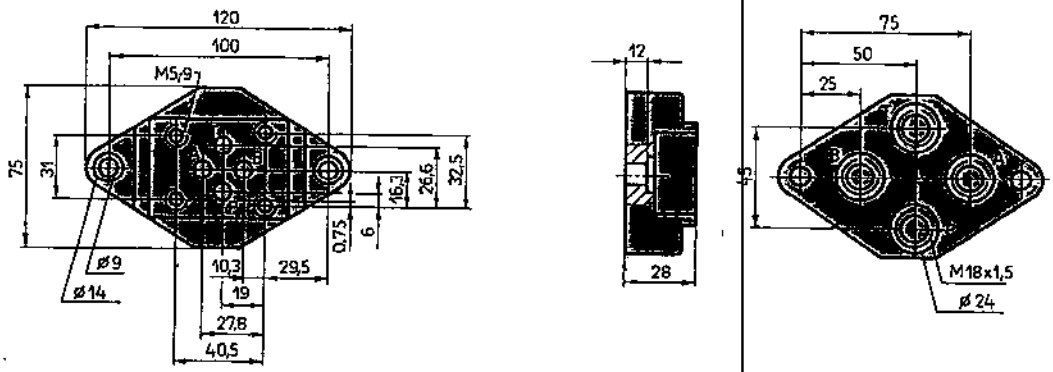
Subplate 06-01.1/0
TGL 26 263/50
Weight: 0.6 kg



Subplate 06-01.2/0
TGL 26 263/50
Weight: 0.6 kg



Subplate 06-05.1/0
TGL 26 263/50
Weight: 1.1 kg



Subplate 06-05.2/0
TGL 26 263/50
Weight: 1.5 kg