

Nature du document <i>Nature of document</i> <p style="text-align: center;">TECHNICAL SPECIFICATION</p>
Titre <i>Title</i> <p style="text-align: center;">CORRECTIVE MAINTENANCE ----- LIQUID RING VACUUM PUMP HYDRO -----</p>

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B	Date - Service <i>Date - Department</i> Nom - Visa <i>Name - Visa</i>	29/04/98 C.MATHY	29/04/98 M.DEVINEAU	29/04/98 J.P.SURGET	+ Annexe Page 15
A	Date - Service <i>Date - Department</i> Nom - Visa <i>Name - Visa</i>	26/09/97 C.MATHY	26/09/97 M.DEVINEAU	26/09/97 J.P.SURGET	
Indice <i>Index</i>		Rédaction <i>Writing</i>	Vérification <i>Verification</i>	Approbation <i>Approval</i>	Modifications <i>Modifications</i>

Identification du client
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AS/97-546/MTY/MP

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Nature du document <p style="text-align: center;">TECHNICAL SPECIFICATION</p>	Réf. <p style="text-align: center;">AS/97-546/MTY/MP</p>		
Titre <p style="text-align: center;">CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO</p>	<table style="width: 100%; border: none;"> <tr> <td style="width: 60%; border: none;"> Date <p style="text-align: center;"><i>KB</i></p> </td> <td style="width: 40%; border: none;"> Page <p style="text-align: center;">2</p> </td> </tr> </table>	Date <p style="text-align: center;"><i>KB</i></p>	Page <p style="text-align: center;">2</p>
Date <p style="text-align: center;"><i>KB</i></p>	Page <p style="text-align: center;">2</p>		

CORRECTIVE MAINTENANCE

DISASSEMBLING PROCEDURE

Refer to the following drawings :

- | | |
|--|--|
| <ul style="list-style-type: none"> ◆ General assembly drawing, longitudinal cutaway, ◆ Tapered roller bearing assembling and disassembling procedures, ◆ Disassembling procedure for the cylindrical roller bearing | <ul style="list-style-type: none">] see tools] and] device |
|--|--|

IMPORTANT NOTE :

For improved convenience in re-assembling the HYDRO unit, it is good practice to locate and mark accordingly the position of all component parts as they are removed or disassembled.

Where the unit is to be thoroughly dismantled, follow the sequence below :

- ◆ Where the unit is driven through a pulley and belt type transmission, remove :
 - the transmission protective guard,
 - the pulley from the HYDRO unit shaft.

- ◆ Where unit driving is through a coupling device:
 - merely disconnect both coupling mating parts.

- ◆ Disconnect and remove the whole piping supplying the injection fluid for the packing ring. Drain off pump body and flanges.

- ◆ Disconnect the HYDRO unit from the gas suction and discharge lines.

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date KB
	Page 3

ON THE SIDE OPPOSITE TO DRIVE SIDE :

- ◆ Remove stop (588) along with its sealing element (592).
- ◆ Separate bearing box assembly (584), from the tapered roller bearings on shaft (521), following the procedure specified in the body of drawing N° 372 093.
- ◆ Remove flange (565) and directional control (547), upon removing the assembling tie rod fastening nuts (506).

ON THE DRIVING SIDE

- ◆ Remove outer bearing cap (582) along with the related V-ring (592).
- ◆ Firmly hold the shaft to prevent the impeller from tilting down during the next disassembling step.
- ◆ Pull out flange (565) along with directional control (546), upon removing the nuts from tie rods (506). The stuffing box may be pushed over the V-ring (592), in spacer (534). The outer race along with the rollers are left in the assembled condition within the flange.
- ◆ Pull out the shaft and the impeller.

FURTHER DISMANTLING OPERATIONS

- ◆ Separate the flange from the directional control by removing the related fastening screws (572) or similar nuts.
- ◆ For removing the bearing races, basically follow the procedures or sequences specified in drawings :

N° 372 093 - for the tapered roller bearings
N° 372 094 - for the cylindrical roller bearings.

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Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date K B
	Page 4

- ♦ Membrane in the high vacuum churn valves.

The unit as a whole being in the as-assembled condition, access may be gained to the high vacuum churn valves directly from the outside.

Remove the servicing covers fastened onto the flanges, then the churn valve holding plate (557). The churn valve membrane may now be removed (560).

INSPECTION AND MAINTENANCE

Refer to drawing N° 372 087 - General arrangement drawing, cutaway.

SEALING PRINCIPLE

The necessary sealing between the flange chambers and the directional control chambers is achieved through a non-drying cement (HERMELEX type of HERMETIC built).

In specific applications, this cement filling is replaced with a gasket of proper material and thickness.

The inside of the pump is sealed against the outer atmosphere by means of O-rings.

The threaded portions of the tie rods screwed into the pump body are sealed by means of THREAD SEALING LOCTITE or another material suitable for the involved field application of the unit.

Some units incorporate stuffing boxes which are assembled through blots or studs which protrude into the pump.

In such cases, the related threads should be LOCTITE sealed.

HIGH VACUUM CHURN VALVES

Such valves are intended for improving the HYDRO unit performances in achieving high vacuum conditions. They are made up of a flat type membrane blocking a series of holes located in prolongation of the discharge ports.

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date AB
	Page 5

AUTOMATIC DRAINING OFF VALVE

Such valve(s) is (are) installed on the SUCTION chamber(s). They are intended for preventing the HYDRO unit from being started up with an excessive amount of liquid in it, which condition could detrimentally affect the equipment performance and behavior in service.

As soon as the unit is shut down, the churn valve automatically opens, and the primary liquid medium is discharged.

Over a short period of time (2 to 3 min.) the pump is empty, and it may be started up again if desired, which operation will automatically cause the churn valve to close again.

REMARK :

These automatic churn valves don't allow to put HYDRO units "OUT OF FREEZING".

INSPECTION

Such an inspection should be carried out whenever the HYDRO unit is subjected to an overhauling or a thorough cleaning.

Such an inspection should be performed as regards the injection passageways, the condition of the directional control and impeller faces, and of the high vacuum churn valves.

It should be performed whenever the following malfunctions are observed :

- ◆ a decrease in gas or primary liquid flow density,
- ◆ a decrease in pump pressure.

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date KB
	Page 6

Aforesaid malfunctions involve :

- ♦ a decrease in efficiency,
- ♦ heat build-up conditions : the injection liquid flow density is no longer adequate to dissipate the generated within the unit as a result of the gas compression process.
- ♦ piping scaling hazards.

ROUTINE MAINTENANCE AND SERVICING

- ♦ Stuffing box reconditioning.

It may be performed with no need for dismantling the unit. Merely remove :
packing gland flange (544), split type packing gland (523), packing braids (527),
and lubricating ring (524).

- ♦ Reconditioning a mechanical packing. Refer to related instruction manual, enclosed.
- ♦ Directional controls and flanges.

When such components are inspected for the first time, the whole assembly consisting of the directional control and the flange, which are integral with each other, should be removed, and the directional control side facing the impeller should be inspected.

For chamber inspection purposes (suction chamber, discharge chamber, water entry) the directional control should be separated from the parent flange.

Clean, scrape degrease, if necessary :

- ♦ the suction and discharge ports,
- ♦ the primary liquid injection holes,
- ♦ for high degree scaling, follow instructions given in § 3.8.4.

Nature du document <p style="text-align: center;">TECHNICAL SPECIFICATION</p>	Réf. <p style="text-align: center;">AS/97-546/MTY/MP</p>
Titre <p style="text-align: center;">CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO</p>	Date <p style="text-align: center;">KB</p>
Page <p style="text-align: right;">7</p>	

Remove the gasket cement affording the necessary sealing between flange and directional control. Check the flat or cylindrical centering bearing areas as well as the O-rings for proper condition.

For cleaning such surfaces use a dry type super-solvent applied in the atomized condition, of trichlorethane or NU trichlorotene.

Blow free from dust and clean the outer parts.

Reassemble, and restore the sealing elements, i.e. : gasket cement seal, O-Rings, stuffing box.

♦ Check for proper condition :

- the bearing seals
- the automatic draining off churn valve
- the membranes the high vacuum valves are fitted with.

PRECAUTIONS IN PERFORMING MAINTENANCE OPERATIONS

The servicing of the lateral type HYDRO pumps is easily made and in a short time.

Care should be taken to thoroughly restore the sealing compounds, and not to damage the O-rings during the re-assembling process.

RE-ASSEMBLING PROCEDURE

Refer to the following drawings :

N° 372 087 - General arrangement drawing, longitudinal cutaway

N° 372 093 - Tapered roller bearing - Assembling and disassembling procedures.

Our units may be re-assembled without experiencing major difficulties, provided the sequence below is closely complied with, and precautions specified on this occasion are carefully observed.

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date KB
	Page 8

- ◆ When re-assembling, always use the sealing compounds or cements specified in section 3.5.1
- ◆ Secure the O-rings (514), (597), (598), in the related grooves, using for this purpose either grease or preferably a few spots of a suitable bonding material.
- ◆ Re-assemble the flanges (565), together with the related directional control (546) or (547). The directional control positioning mark with respect to the mating flange mark (stamped on the top side of such parts) should be complied with.

The centering operation is performed on the stuffing box hub. Coat the hub with a thin grease film by means of a brush. Where the directional control devices are made up of high premium materials, such as bronze, stainless steel, our recommendation is that this grease be replaced with molybdenum disulfide base grease, which will preferably be applied using a leather piece.

The necessary sealing action between flange and directional control should be achieved using a gasket cement of the HERMETIC-built ; HERMELEX type. For some specific applications, a cut-to-shape gasket should be used here. Compliance with specified initial thickness and material is mandatory.

Make sure that the suction and discharge chambers in the flanges are properly positioned in order to match their counterparts in the directional controls. Refer to operating sketch N° 372 088 : the larger port in the directional control (i.e. suction port) should be positioned on the flange chamber side opening into the suction flange.

Protect from potential damages the holes located at the directional control periphery (which holes are intended for accommodating the pulling out device) by means of graphite bearing grease.

The flange and directional control plate should be secured by means of washer (525) and screws (572).

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date AB
	Page 9

♦ Impeller assembling procedure :

- Fitting of the shaft linings (522).

The two linings are installed upon pushing the impeller onto the shaft.

The temperature to which the linings are heated up for shrink fitting purposes onto the shaft should not be such as to detrimentally affect the O-Rings (548), if any. 150°C is the maximum permissible temperature for "Perbunan" type sealing elements.

Where necessary, lubricate the recessed area machined into the impeller for O-Ring centering purposes, so as to make O-Ring installation easier.

Push the lining, in the as-expanded condition, onto the shaft, incorporating its O-Ring positioned as required, and hold it in place throughout the cooling down process at room temperature.

- Install by shrink fitting the spacer element (534) and the cylindrical roller bearing inner race (refer to section below).

Insert bushings (535), (571) and sealing elements (592).

♦ Installation of the antifriction bearings (refer to drawing N° 372 091).

- a) Installation of the cylindrical roller bearings (NU type, with two shoulders resting on outer race).

- Secure inner cap (581), into the driving side flange. If this cap is not of the one-piece type, arrange to prevent it from rotating. The outer race along with the roller shall be installed after flange installation onto the impeller.
- Installation of the bearing inner race onto the driving side shaft : insert ring (534), by shrink fitting, and thereafter the bearing inner race (heating up with piece part laying flat in a oil bath at a temperature of 120°C). Throughout the cooling down process, the bearing race should be maintained firmly supported on the spacer.

Nature du document <p style="text-align: center;">TECHNICAL SPECIFICATION</p>	Réf. <p style="text-align: center;">AS/97-546/MTY/MP</p>		
Titre <p style="text-align: center;">CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO</p>	<table style="width: 100%; border: none;"> <tr> <td style="width: 60%; border: none;"> Date <p style="text-align: center;"><i>KB</i></p> </td> <td style="width: 40%; border: none;"> Page <p style="text-align: center;">10</p> </td> </tr> </table>	Date <p style="text-align: center;"><i>KB</i></p>	Page <p style="text-align: center;">10</p>
Date <p style="text-align: center;"><i>KB</i></p>	Page <p style="text-align: center;">10</p>		

b) Installation of the tapered roller bearings

Separately install the tapered rollers (538), into housing (584). If these bearings are exchanged, the J1 axial clearance has to be defined again (drawing N° 372 091). Do not grease the bearings to do this adjustment.

The subsequent installation of this bearing into the flange and on the shaft is to be performed as specified in section 10.

Once the impeller is installed within the unit, and is properly seated on its antifriction bearings, then the bearing side clearance may be adjusted, as required, by means of the peel-off type shim steels (586) to the value specified on drawing N° 372 091.

- ◆ **Push the assembled impeller into the body, and center it laterally within the body.**
- ◆ **Install the flange and directional control plate assembly on the body side opposite to the drive side, without the tapered roller bearing housing, thereby making sure to comply with the location markings on the body. Lock in place the nuts of the assembling tie rods (506) (tightening should be performed gradually and in fives).**
- ◆ **Install the drive side flange and directional control plate assembly on the body and on the shaft, the bearing outer race being not installed. Lock in place the nuts of the assembling tie rods (506) (tightening should be performed gradually and in fives).**
- ◆ **Assemble the stuffing-box units : braids (527), lubricating ring (524), packing gland (523). The fastening nuts on packing gland flange (544), should be torqued down so that they can be screwed manually.**
- ◆ **Install the cylinder roller bearing outer race, fitted with its rollers. Install V-ring (592) and finally close with cover (582).**

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date KB Page 11

Now, two cases can arise :

- Reassembly of the pump without any exchange of the bearings opposite to drive side (axial clearance J1 already set). Refer to these instructions.
 - Reassembly of the pump after exchange of the bearings opposite to drive side (axial clearance J1 to be readjusted). See page 19 - Installation of the tapered roller bearings.
- ♦ Install bearing housing (584) into the related flange and onto the shaft, upon having adequately backed off the adjusting screws (577), (drawing N° 372 093). Install washer (588). Temporarily secure in position, the related outer ring by means of cap (585) along with a shim (586).
- ♦ Adjusting the impeller for proper side clearance (refer to drawing N° 372 091).
- By means of screws (577), and also acting on the screws used to secure the housing within the flange, shift the housing and the impeller until impeller is bottomed, on the right side, against the directional control plate.
 - Set a dial indicator at the end of the shaft, and set its pointer to the dial zero mark.
 - Shift the impeller and the housing in opposite direction, until impeller is bottomed against the other directional control plate.
 - Measure, by means of the dial indicator, the extent of the overall shifting. This value corresponds to the aggregate impeller clearance. Split this value on either side as specified in drawing N° 372 091.
 - Upon adjusting and adding shim stock as required, the tapered roller bearing housing should be locked in place with regard to the flange by means of the fastening screws.
 - Remove the box cover (585) adjust the axial clearance J1 of cylindrical roller bearings according to indications of drawing N° 372 091.

When the unit is in operation, the tapered roller bearing clearance as set at the time of installation will tend to zero, and due to the expansion which occurs in operation, the impeller will be satisfactorily centered between both directional control plates.

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date KB
	Page 12

- ◆ Re-install and connect the injection piping system and the automatic draining off churn valve assembly.

Re-install and connect the pulley or the coupling sleeve, and secure in place with the related cotter pin. Install the suction and discharge systems, where applicable.

CYCLICAL OVERHAULING

The purpose and intent of such overhauling operations is to check the unit as a whole for wearing behavior and to trace the causes for the wearing conditions possibly found, with a view of correcting or eliminating them to the greatest unit as the facility within which this unit is integrated. Such an overall inspection allows at the same time for scheduling in due time the spare and repair part procurement needs.

COMPONENT PART INSPECTION

Refer to drawings :

N° 372 087 General arrangement drawing, longitudinal cutaway, and N° 372 096. Spare part forecastings.

Upon completion of unit dismantling following the instruction and sequence outlined in section "Disassembling procedure", all component parts should be thoroughly cleaned and thereafter closely inspected.

- Body (501)

It may exhibits signs of erosion, corrosion or cavitation. An eroded condition is indicative of the fact that the injection liquid or the suctioned gas incorporate abrasive type matters. It may well happen that both media, i.e. liquid and gas, are involved here at the same time.

Evidence of corrosive attack reveals that either the injection liquid or the gas handled by the system incorporate matters having an adverse effect on the materials used for the manufacture of the involved HYDRO unit.

Cavitation will result either from an injection liquid flow density in excess of the recommended amount, or from an exceedingly high vacuum with respect to the type of unit involved, or even from excessive temperature.

Nature du document TECHNICAL SPECIFICATION	Ref. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date KB
	Page 13

- **Impeller (520)**

Just like as the body, the impeller may also disclose signs of erosion, corrosion or cavitation, which will result from the same reasons or sources as those outlined above.

Erosion and corrosion effects are most detrimental to the impeller faces, opposite the directional control plate faces, as they bring about an increase in clearance between these mating parts (= play).

- **Flanges (565) and directional control plates (546) and (547)**

The major detrimental effects result from erosion, which produces, into the metal, wear patterns and marks of varying amplitude and depth according to the particle size of the particulate matters present in either the injection liquid or the suctioned gas, and are further promoted by corrosive actions which are known to increase the operating clearance with the impeller, thus resulting in wearout promoting play.

The suction and discharge ports and compartments as well as the primary liquid injection ports should be closely inspected. In fact, deposits of matters which may not be abrasive or corrosive in nature, may build up on the inner walls of these compartments or openings and materially restrict their cross-sectional surface area, which condition would in turn result in a corresponding decrease in flow rate.

- **Shaft and bearings (521), (537), (538)**

Specific emphasis is placed upon the need of checking the wearing condition of the shaft linings, onto which the stuffing box packings are seated.

The antifriction bearings should first be carefully cleaned with petroleum, and thereafter inspected for possible mechanical damages or failures (rollers nicked or broken bearing, housing cracked, races nicked, etc.....) and their inner clearance should be measured towards evaluating if they need being replaced.

Nature du document TECHNICAL SPECIFICATION	Réf. AS/97-546/MTY/MP
Titre CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date KB
	Page 14

SIDE CLEARANCE BETWEEN IMPELLER AND DIRECTIONAL CONTROL PLATES

The clearance between these two mating component parts is a matter of prime concern for the HYDRO unit performance. When this clearance is in excess of fixed limits, the liquid packing ring which serves the purpose of affording the required sealing effect between the directional control plates and the impeller, does no longer develop as appropriate, which result in some recirculation of suctioned gas and, consequently, in a loss of flow density and degree of vacuum.

Such a clearance should be measured on either side of the impeller.

Clearance measuring procedure : with the unit in the assembled condition, open the service doors and using a set of inspection blocks, measure at a number of locations, the actual clearance between the impeller faces and the directional control plates.

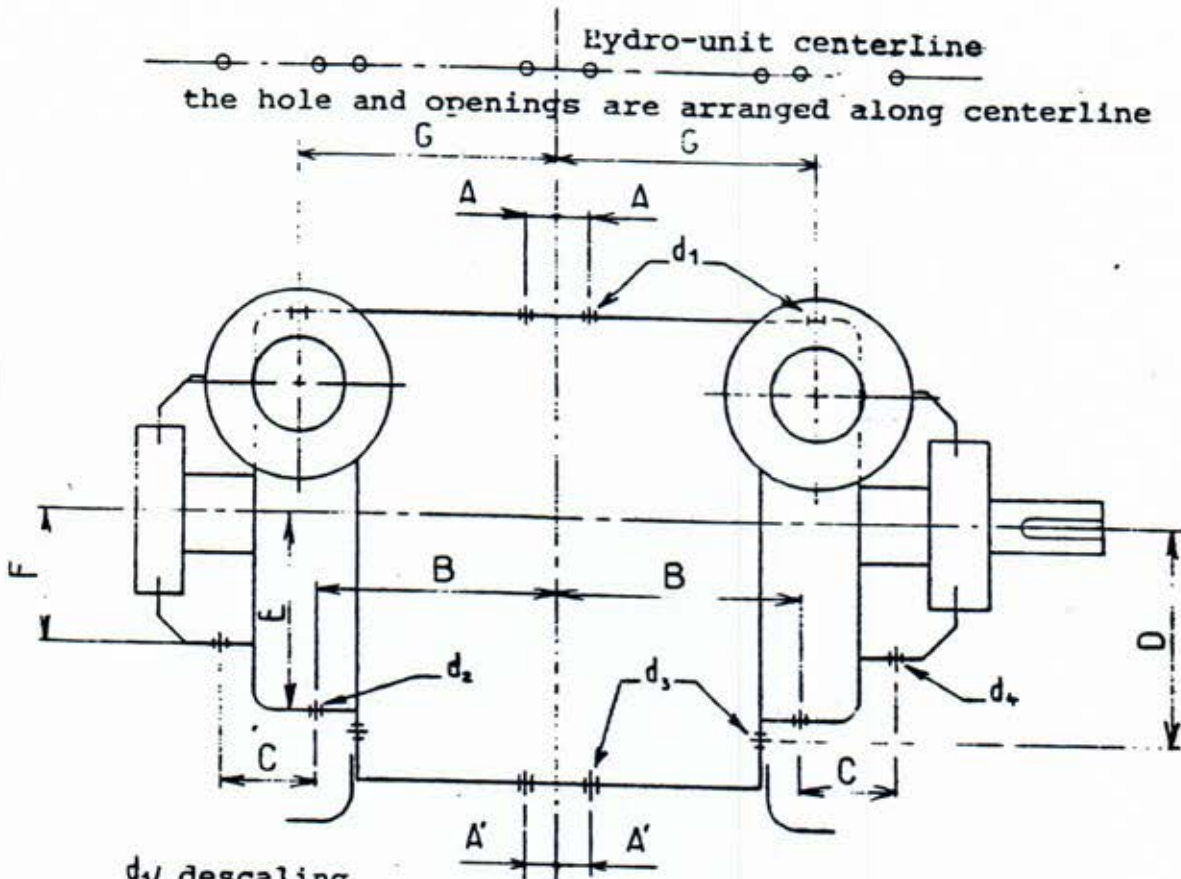
Nature du document	TECHNICAL SPECIFICATION	Réf AS/97-546/MTY/MP	
Titre	CORRECTIVE MAINTENANCE LIQUID RING VACUUM PUMP - HYDRO	Date <i>B</i>	Page 15

ANNEXE

DRAWINGS

- 372 086
- 372 091
- 372 093
- 372 094
- 372 096
- 372 087

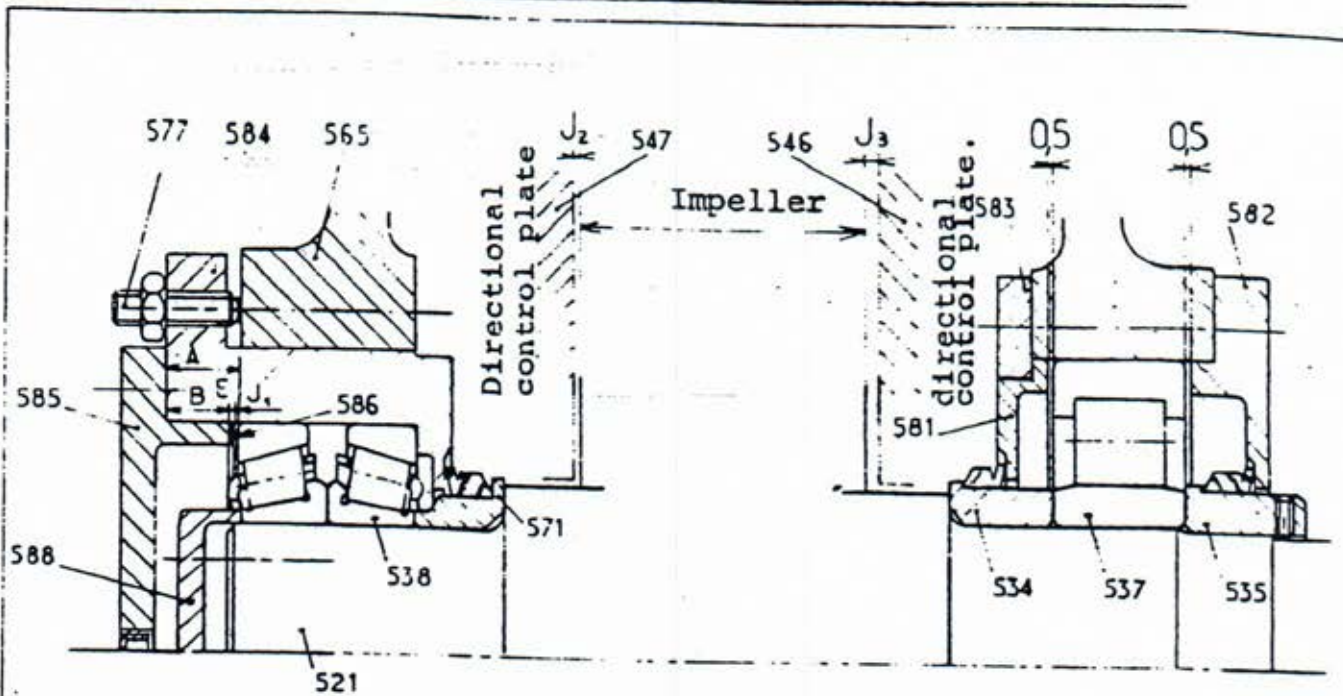
BODY AND FLANGE FLUSHING AND DRAINING OFF DEVICES



d₁/ descaling
 d₂, d₃/ drain off
 d₄/ discharge of drippings

UNIT TYPE	A	A'	B	C	D	E	F	G	Ø d ₃	Ø d ₁ , d ₂ , d ₄
15			197							
20			257	118	247	220	162	225	G3/8H	G1/2H
								287		
35	60		320	112	299	269	179		G1/2H	
50	60		383	135		330	220		G3/4H	
75	60		445	183		383	262		G3/4H	
110	60		617	128		472	292		G3/4H	
160	60		782	39		506	356		G3/4H	
250	60		893	140		690	406		G3/4H	

ANTIFRICTION BEARING INSTALLATION CLEARANCES AND IMPELLER SIDE CLEARANCE



- J₁: Installation axial clearance for tapered roller bearings (calculated to suit a temperature rise in operation of 20°C above the room temperature). Assessment of peel-off type shim stock thickness, item n° 586, : $E = A - B - J_1$
- J₂: Clearance between impeller and directional control plates
- J₃: $\frac{d}{3}$ housing side item 584
Opposite side

UNIT TYPE	J ₁
15	0,07
20	0,07
35	0,10
50	0,12
75	0,13
110	0,17
160	0,20
250	0,22

total clearance = $J_2 + J_3$

$J_2 = 1/3$ total clearance

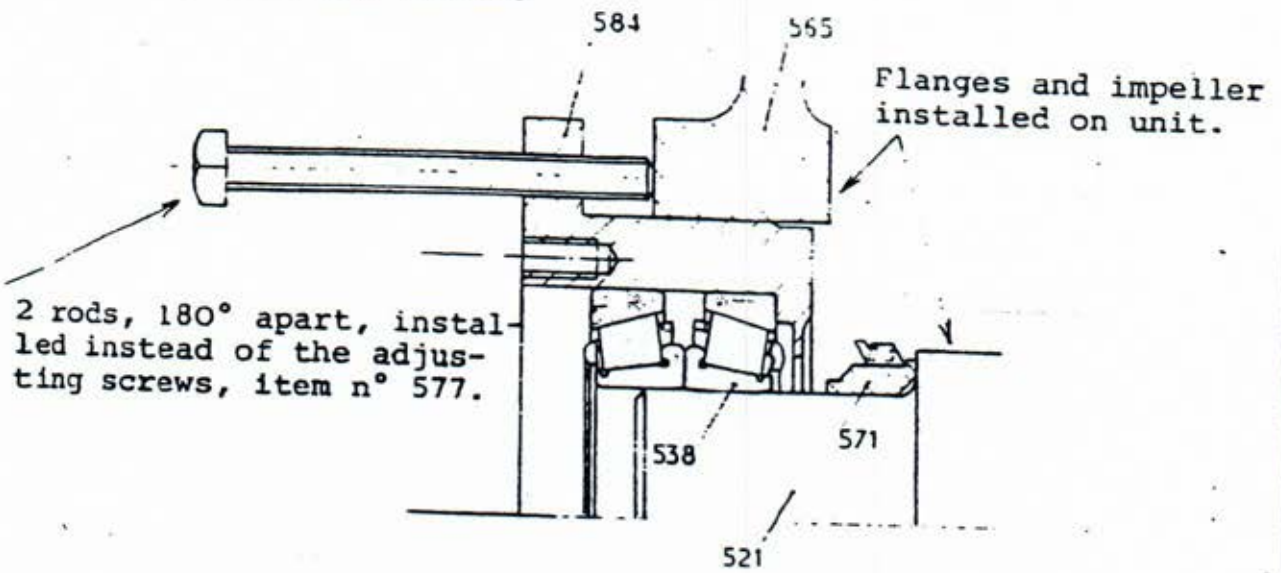
$J_3 = 2/3$ total clearance

• Heat expansion is proportional to temperature rise. Where the temperature is different from 20°C, alternate values should be calculated correspondingly.

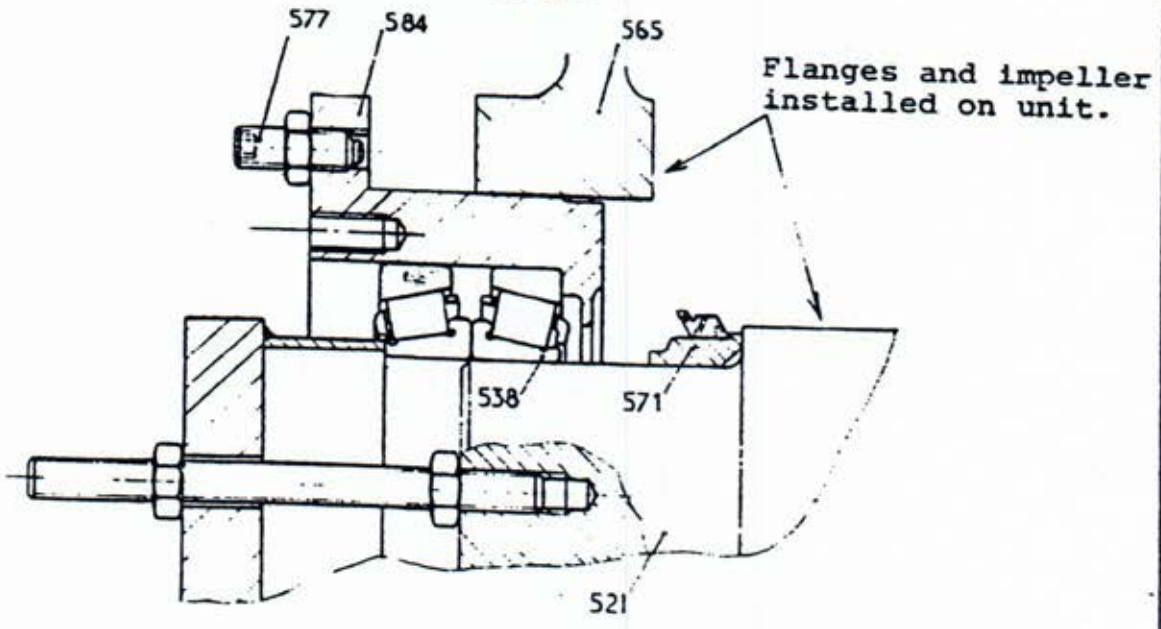
• Make sure that $J_1 < J_2 - J_3$

TAPERED ROLLER BEARING ASSEMBLING AND DISASSEMBLING PROCEDURES

Pulling out from housing

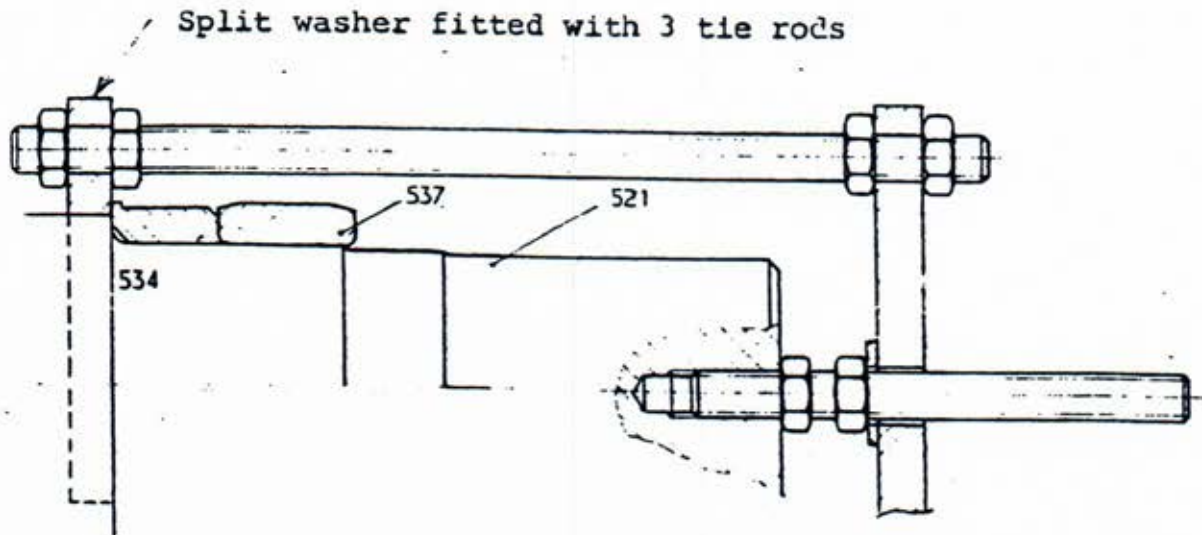


PRESSING OF BEARINGS ONTO SHAFT



DISASSEMBLING PROCEDURE FOR THE CYLINDRICAL ROLLER BEARING

INNER RACE PULLING OUT



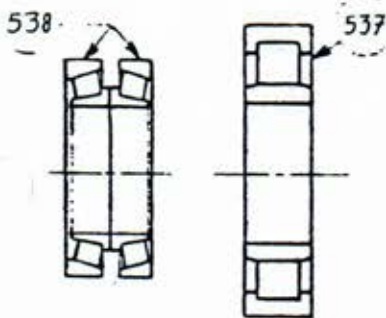
SPARE PARTS FORECASTINGS

REFER TO THE GENERAL ARRANGEMENT DRAWING, LONGITUDINAL CUTAWAY

FOR PUMP, THE FOLLOWING SPARE PARTS SHOULD BE PROVIDED FOR :

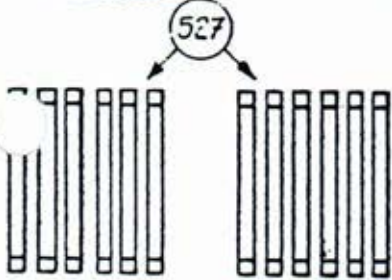
FOR STARTING-UP PURPOSES

1 set of bearings

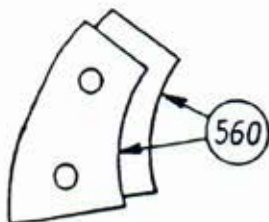


1 cylindrical roller bearing
2 tapered roller bearings

2 sets of braid material for stuffing box packings (or equivalent special packing material)



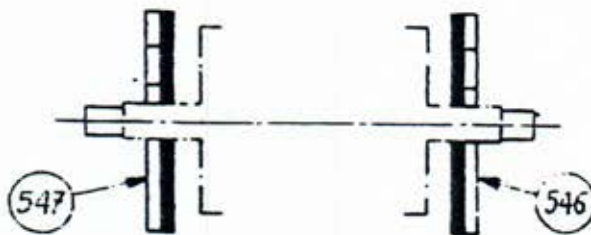
1 set of churn valve membranes (high vacuum churn valve)



FOR THE FIRST TWO YEARS OF OPERATION

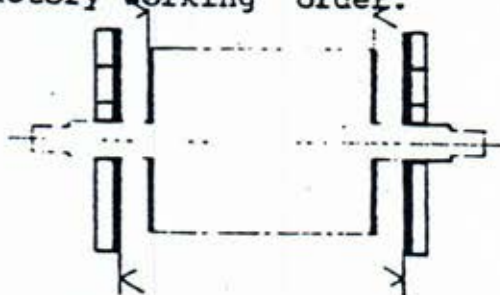
Provide for : first all spare parts required for starting-up purposes, and second, additionally :

1 set of directional control plates, with machining stock on face.



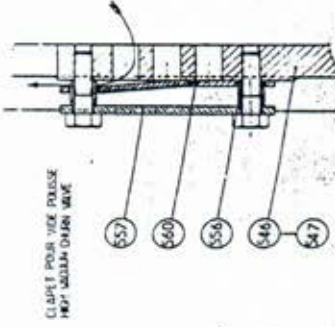
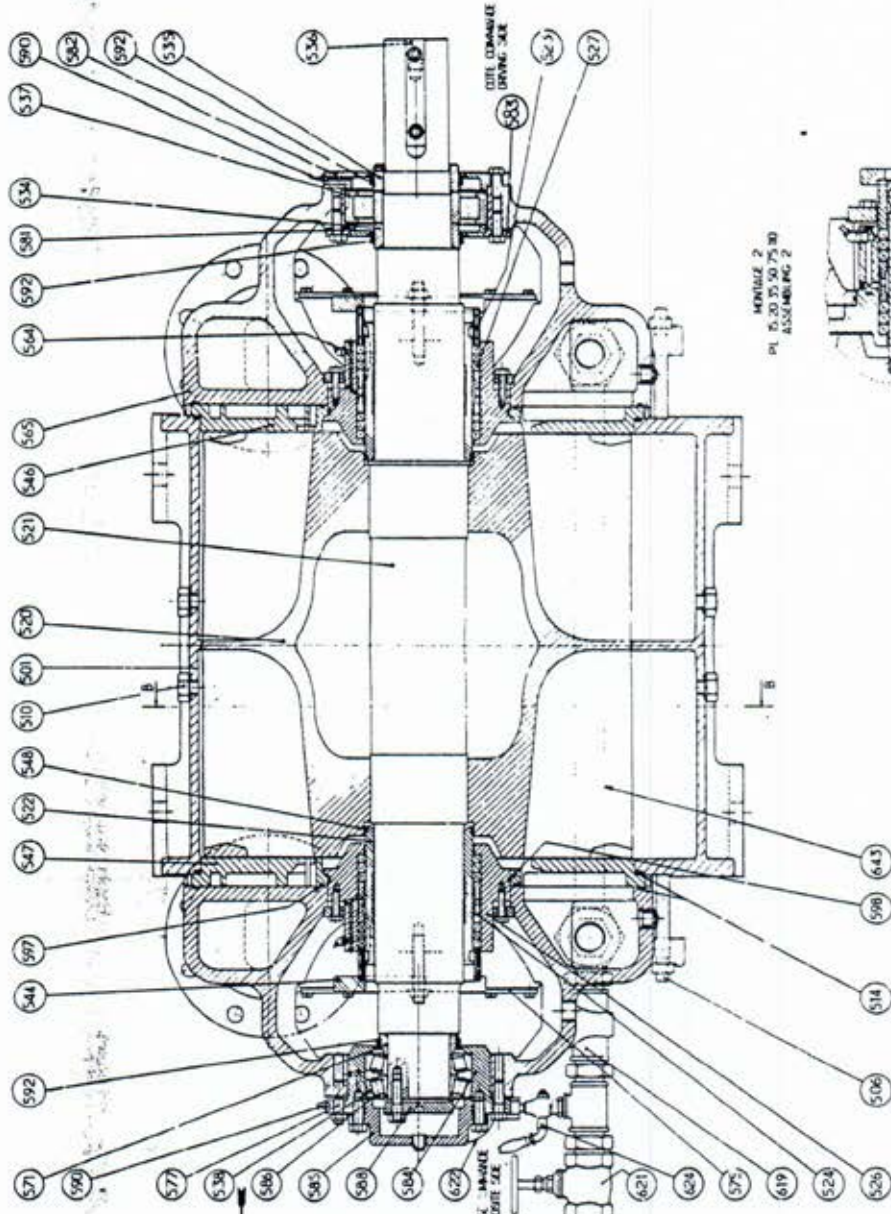
This allows for the following possibilities to be achieved by machining :

Impeller reworked + directional control plates in the new conditions = unit in satisfactory working order.

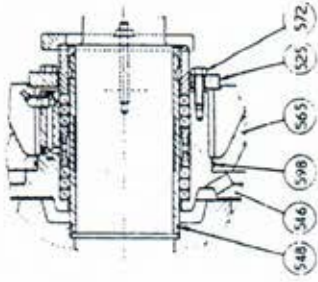


COUPE A A
LONGITUDINAL CUT AND V A

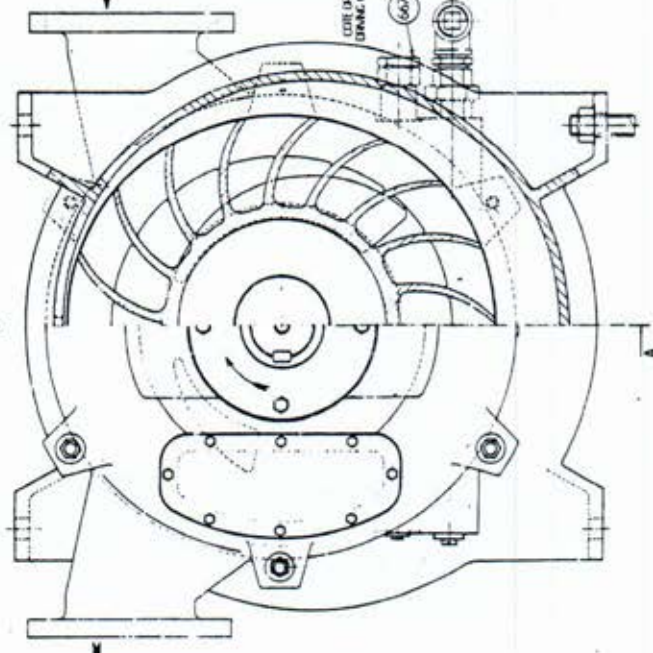
MONTAGE 1
PL 15 20 30 50 75 90
ASSEMBLING 1



MONTAGE 2
PL 15 20 30 50 75 90
ASSEMBLING 2



1/2 COUPE B B
1/2 OUT B B



HYDRO UNIT	1
PL. 5095	1
CONSOLE HYDRAULIQUE	1
APPAREILS HYDRO	1
SERIE PL. 75	1
ENSEMBLE COUPE LONGITUDINALE	1

MICROC RTE
2 6 AOUT 1980

EXEMPLE DE COUPE A A

Nature du document <i>Nature of document</i> <p style="text-align: center;">TECHNICAL SPECIFICATION</p>
Titre <i>Title</i> <p style="text-align: center;">TOOLS AND DEVICES</p> <p style="text-align: center;">LIQUID RING VACUUM PUMP</p> <p style="text-align: center;">HYDRO PL75</p>

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D	Date - Service <i>Date - Department</i>				
	Nom - Visa <i>Name - Visa</i>				
C	Date - Service <i>Date - Department</i>				
	Nom - Visa <i>Name - Visa</i>				
B	Date - Service <i>Date - Department</i>	29/04/98	29/04/98	29/04/98	+ Annexe Page 4
	Nom - Visa <i>Name - Visa</i>	C.MATHY	M.DEVINEAU	J.P.SURGET	
A	Date - Service <i>Date - Department</i>	17/09/97	17/09/97	17/09/97	
	Nom - Visa <i>Name - Visa</i>	C.MATHY	M.DEVINEAU	J.P.SURGET	
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Identification du client <i>Customer</i>			N° de commande ou de projet GEC ALSTHOM ACB <i>GEC ALSTHOM ACB contract of project Nr</i>		
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			AS/97-523/MTY/JD		

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Nature du document

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Ref: **AS/97-523/MTY/JD**

Titre

TOOLS AND DEVICES
LIQUID RING VACUUM PUMP HYDRO PL

Date

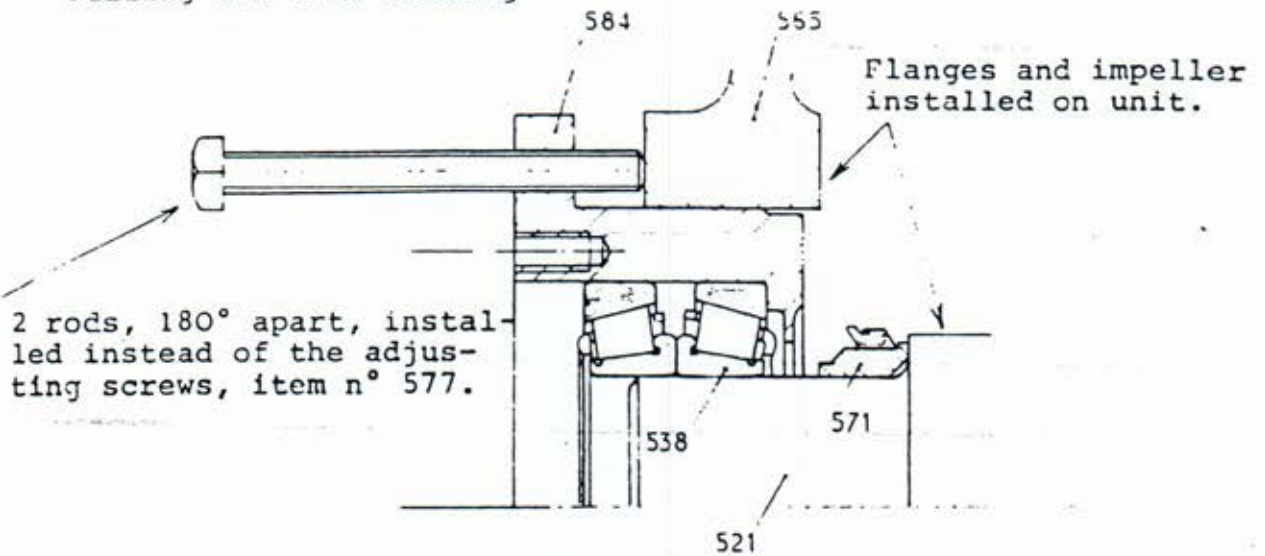
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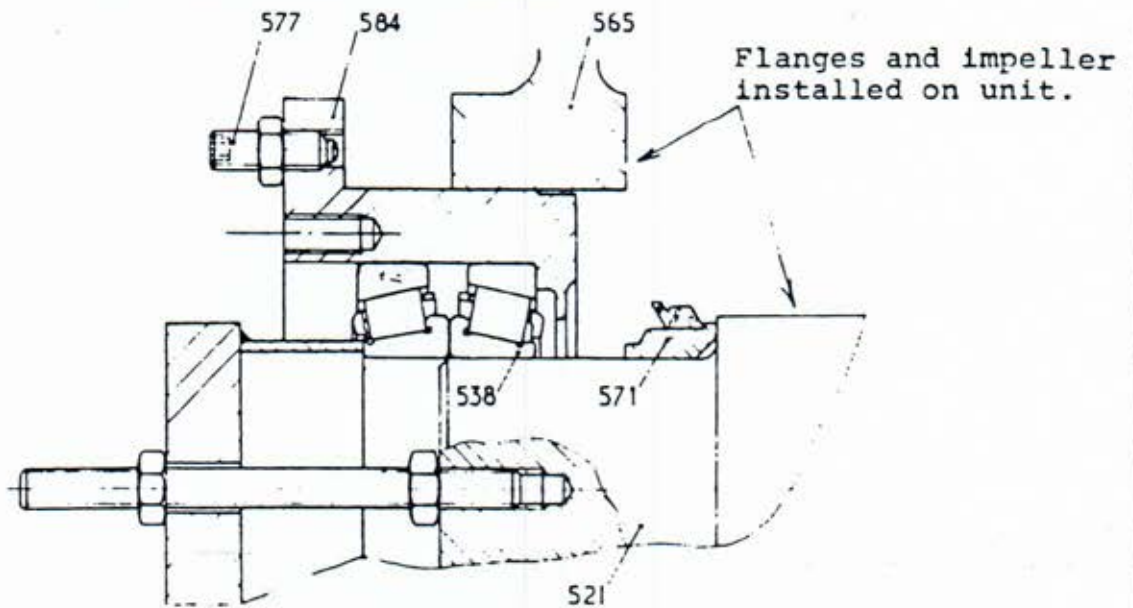
2/3

TAPERED ROLLER BEARING ASSEMBLING AND DISASSEMBLING PROCEDURES

Pulling out from housing



PRESSING OF BEARINGS ONTO SHAFT



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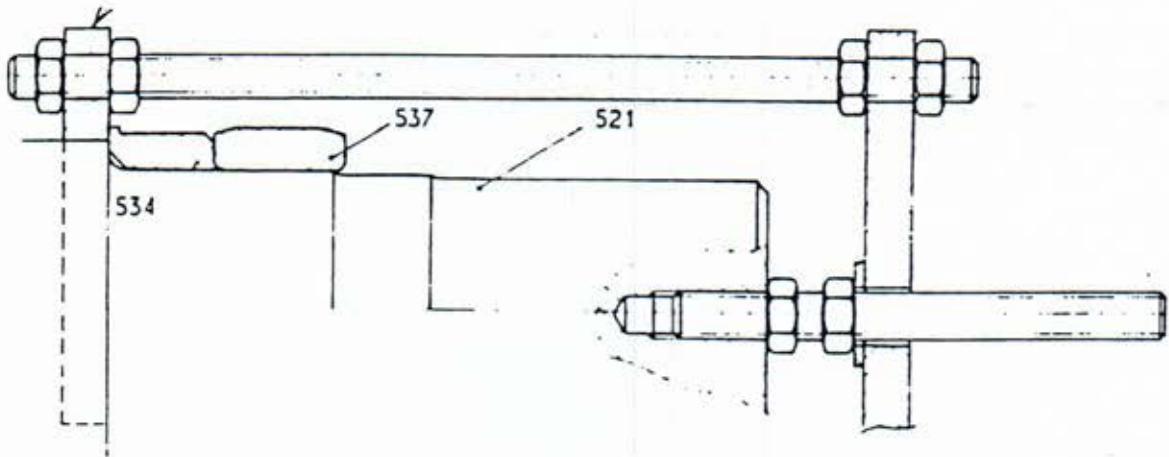
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3/3

DISASSEMBLING PROCEDURE FOR THE CYLINDRICAL ROLLER BEARING

INNER RACE PULLING OUT

Split washer fitted with 3 tie rods



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Titre	TOOLS AND DEVICES LIQUID RING VACUUM PUMP HYDRO PLK 75	Date <i>B</i>	Page 4

ANNEXE

DRAWING

↖ 372 087

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DIEMME

PISTON - DIAPHRAGM PUMP

TYPE DM PM 20 - 30

**USE AND MAINTENANCE
USO E INSTRUZIONE**

OPERATING MANUAL

ATTENTION

- CAREFULLY READ THE MANUAL BEFORE THE PLANT START-UP.
- THIS MANUAL MAKES INTEGRANT PART OF THE SELLING CONTRACT.
- EACH GUARANTEE AND RESPONSABILITY REGARDING DAMAGES TO PEOPLE OR THING FALLS OFF IN CASE OF NO OBSERVANCE OF THE INSTRUCTIONS THAT ARE HEREBY DESCRIBED.

TECHNICAL ASSISTANCE

DIEMME grants to its customers the maximum technical assistance either during the first START-UP and during all the machine life time.

The assistance is supplied in two different ways:

ON-LINE:

- placing one of its technicians at disposal by phone (phone n° ITALY-545-20611) and sending as soon as possible some data or drawings by fax (fax n° ITALY-545-30358).

ON-SITE

- sending one of its technicians at the customer after that a careful ON-LINE check of the problem should consider evident the need of a on-the-spot investigation in order to solve the problem.

DIEMME WILL INVOICE TO THE CUSTOMER THE TRIP, BOARD AND LODGING EXPENSES FOR EACH TECHNICAL INTERVENTION, EVEN UNDER WARRANTY.

IF IT SHOULD BE EVIDENT TO THE DIEMME'S TECHNICIANS THAT THE INTERVENTION WAS NOT STRICTLY NECESSARY OR THAT IT WAS CAUSED BY COMPONENTS NOT INCLUDED IN OUR SUPPLY, DIEMME WILL ALSO INVOICE TO THE CUSTOMER THE PERFORMANCES AS PER "ANIMA" RATES 10% discount.

Therefore DIEMME trusts in the maximum collaboration of the customers in order to optimize the interventions of its technicians and in order to allow in this way a quicker assistance in the most urgent situations.

NOTE : Except for specific agreements reported on the contract, the guarantee does not include the electrical parts, the wearing parts, the automatisms, the filtering cloths and anyhow each part that will present some damages due to the wrong use.

CONTENTS

Technical data	Page 3
List of construction materials	Page 4
Installation drawing	Page 4/A
Pump delivery curve	Page 4/B
A) DESCRIPTION	Page 5
A-1 Drive system	Page 5
A-2 Pumping system	Page 5
B) OPERATION	Page 6
B-1 Pumping	Page 6
B-2 Automatic adjustment	Page 6
B-3 Membrane leakage detection system	Page 7
C) INSTALLATION	Page 8
C-1 Suction conditions	Page 8
C-2 Delivery conditions	Page 8
C-3 Air make-up	Page 8
C-4 Installation on	Page 10
D) START-UP	Page 11
D-1 Preliminary precautions	Page 11
D-2 Oil filling	Page 11
D-3 Adjustments	Page 12
E) MAINTENANCE	Page 13
E-1 Stuffing box	Page 13
E-2 Membranes	Page 13
E-3 Suction and discharge valve	Page 15
E-4 Pump sleeve	Page 15
E-5 Valves adjustment	Page 15
E-6 Lubrication	Page 15
E-7 General	Page 16
F) PROBLEMS AND TROUBLE SHOOTING - SCHEME	Page 17
G) EXPLODED VIEWS	Page 19
H) SPARE PART LIST	Page 32

CONSTRUCTION MATERIALS

Diaphragm housing	nodular cast iron
Pump body	nodular cast iron
Diaphragms	Neoprene
Ball valves	high density polyethylene
Ball seats	Vulkollan
Gears	Special steel
Equalising tanks	carbon steel
Reducing unit housing	Cast iron

TECHNICAL DATA

Nominal delivery	m ³ /h
Operating pressure	12/15	bar
Piston diametre	200	mm.
Stroke	150	mm.
Frequency	58'	min. ⁻¹
Installed power	kW at 1450 rpm
Diaphragm diametre	500	mm.
Ball valve diametre	120	mm.
Weight of pump	1400	kg.

(TO BE COMPILED AT THE FUNCTIONAL TEST)

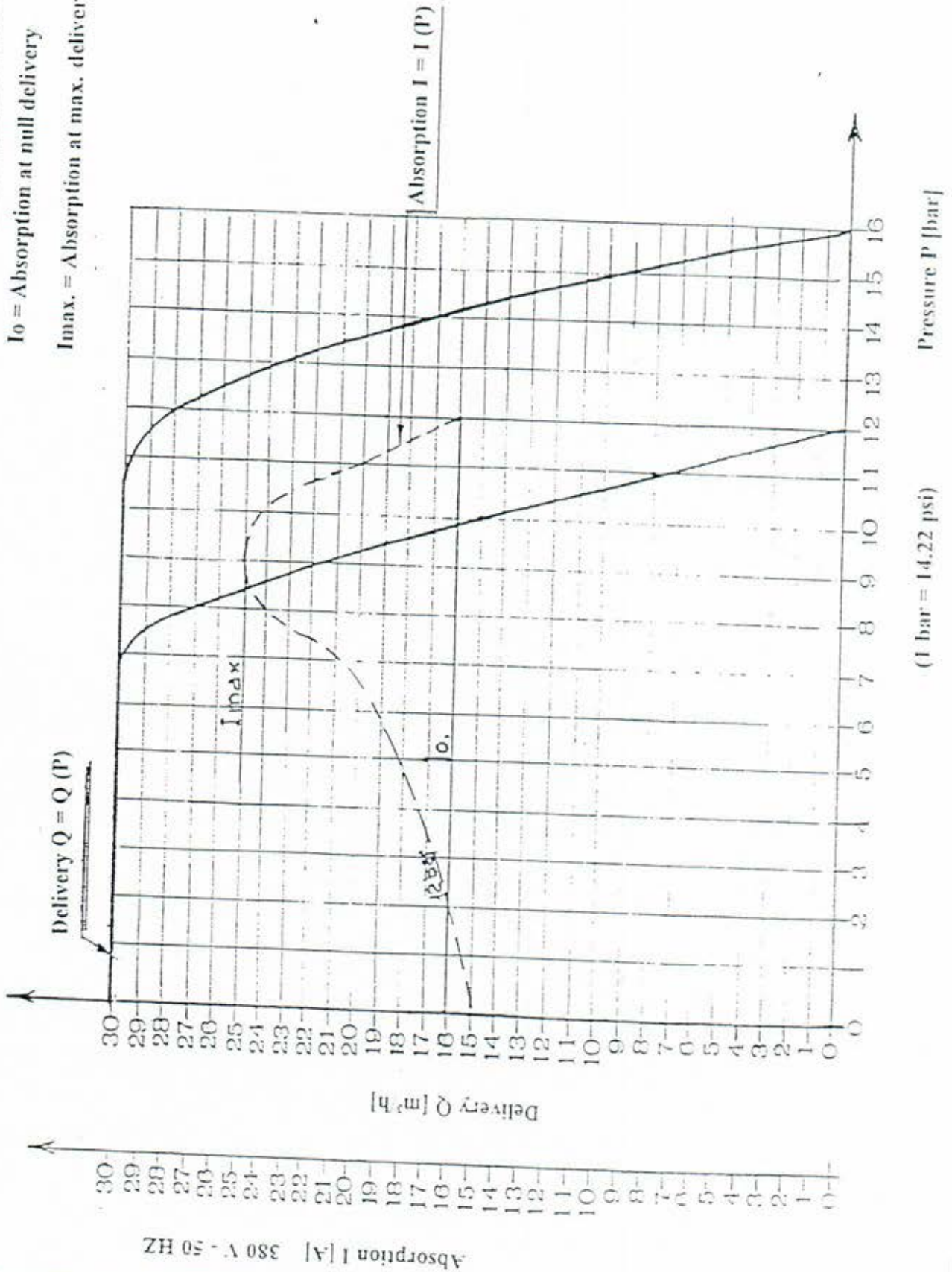
TITOLO

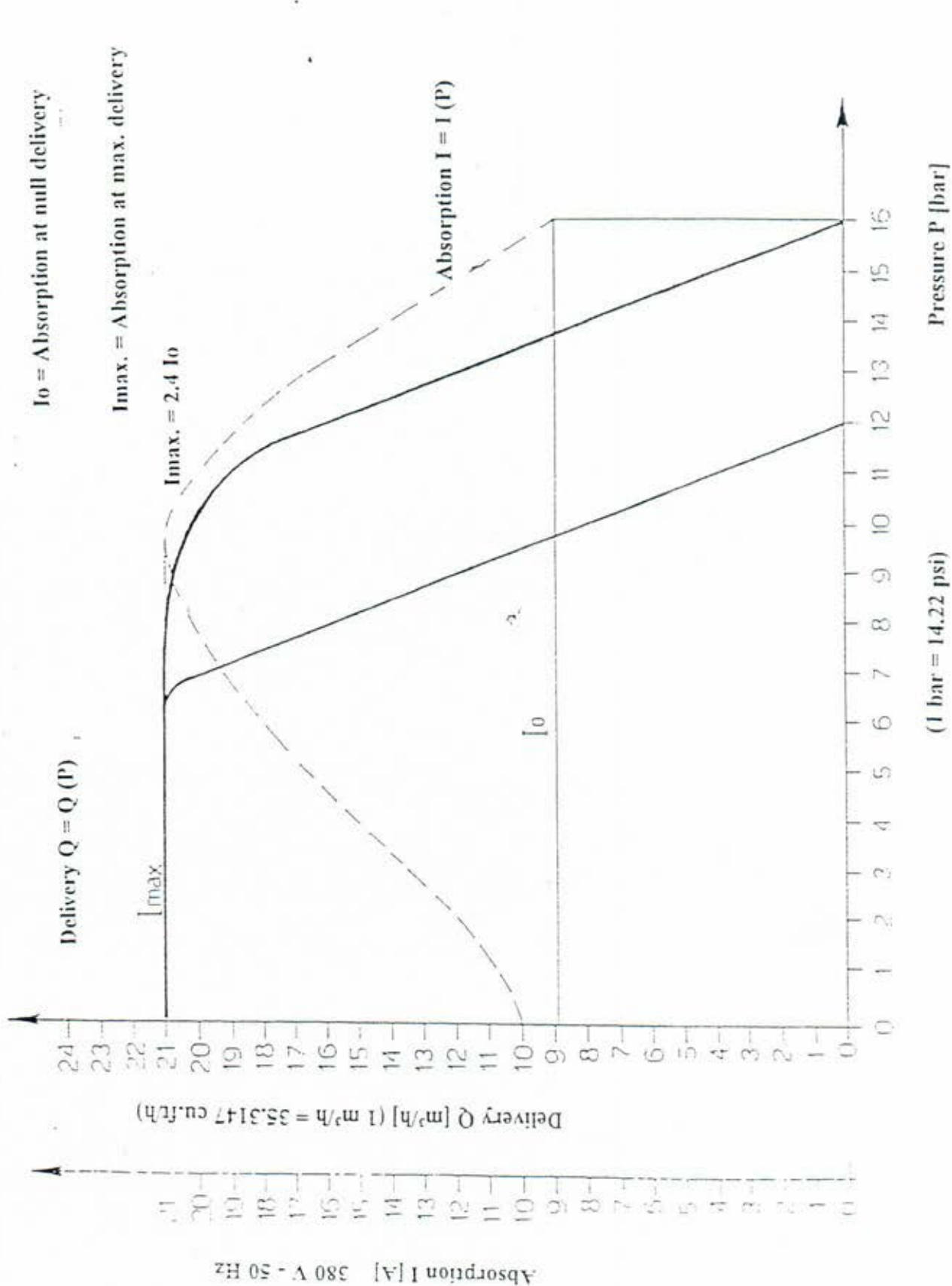
DMPM 20-30 membrane and piston pump! Characteristic curve

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I_0 = Absorption at null delivery
 I_{max} = Absorption at max. delivery





A) DESCRIPTION

The pump consists in a drive system and a pumping unit, all mounted on a metal groundplate.

A-1) DRIVE SYSTEM

The movement is given to the pumping piston through a crank mechanism, the crank of which is one body with the crown gear of the reducing unit.

In the reducing unit are placed the cylindrical guide of the crank mechanism crosshead.

The power is given by an electric motor which transmits movement to the gear couple of the reducing unit, through a transmission with trapezoidal belts.

A-2) PUMPING SYSTEM

The pumping part of the pump consists in a body within which the piston runs, and two membrane housings.

The piston causes the oil to push on the membranes, which, at every single piston stroke, swell as much as is required to contain the oil moved by the piston (equal to the pump bore).

The membrane separates the pump into two different parts called primary and secondary side (see fig. 1).

The primary side is in contact with the fluid to be pumped and includes, besides the part of the header wetted by the fluid itself, the ball valves, the seats, the intake and delivery pipes and the intake and delivery compensating vessels.

The secondary side includes all parts wetted by the oil, namely: the pump cylinder, the oil tank, the back-flow valve and the whole adjusting system.

TITOLO

TESTA DI POMPAGGIO
PUMPING HEAD

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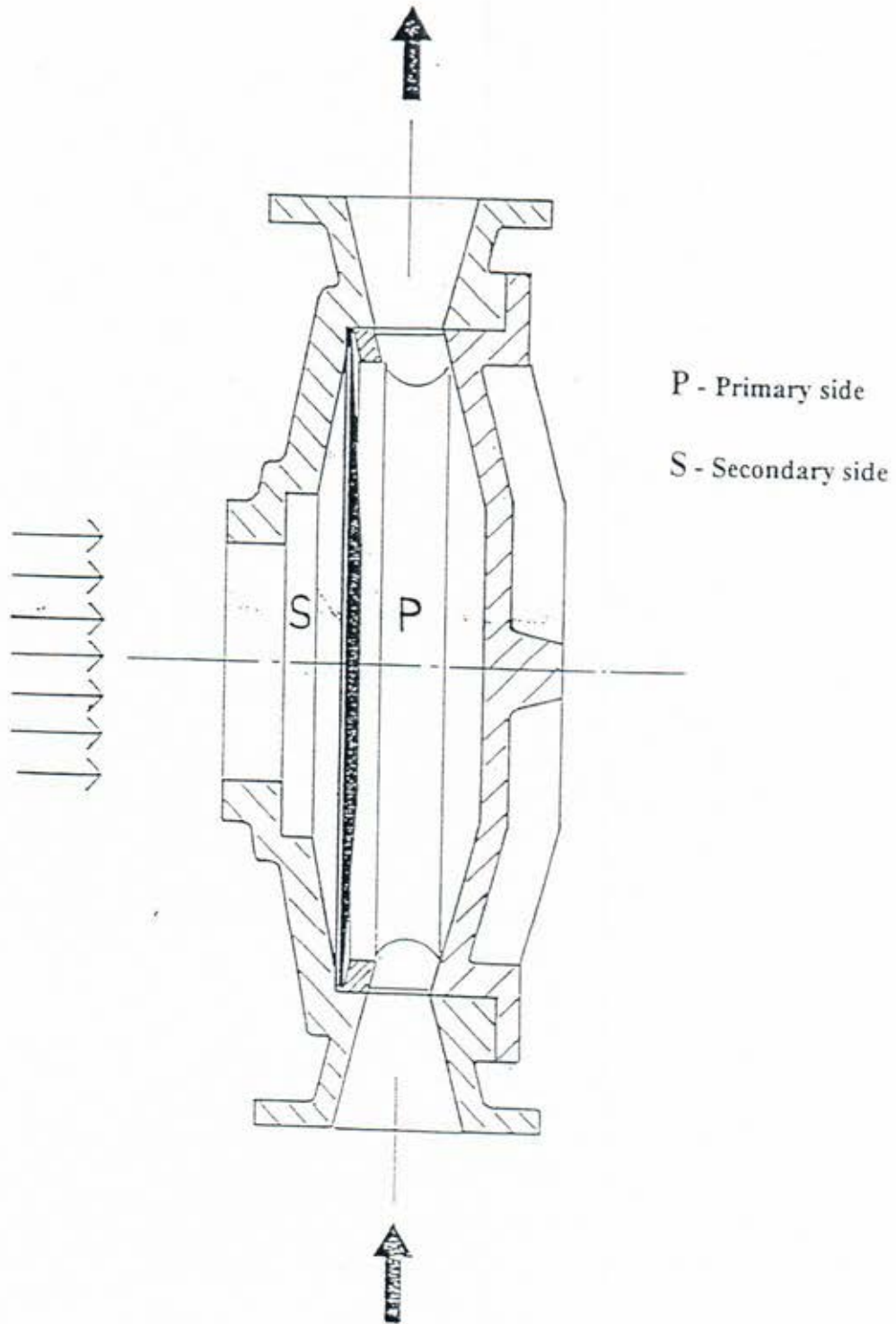


FIG. 1

page 1.11 S/A

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Mod. 16/F

B) OPERATION

B-1) PUMPING

The oil transfers the mechanical energy (given by the motor to the piston), to the membranes.

This energy, that is able to carry out membrane deformation, is transformed by the membranes into hydraulic energy to be transferred to the liquid to be pumped.

The piston/membrane pump is a volumetric pump which carried out the pumping cycle by creating and destroying volumes (equal to the pump capacity).

In the suction phase the membrane moves towards the secondary side thus causing the pressure drop on the primary side, which is necessary for suction valve opening, which lets the fluid flow into the header (this takes place once on every pump side).

The liquid that has been sucked, is brought to the delivery during the following pressure phase.

During this phase the diaphragm swells towards the primary side and pushes the liquid beyond the delivery valve.

In the secondary side is located a system suitable to top up the oil that goes lost due to the inevitable seal imperfections.

In case of overpressures, the overflow valve discharges part of the liquid into the tank.

This system is then capable of continuously adjusting the delivery versus pressure, thus following the characteristic curve as shown above.

B-2) AUTOMATIC ADJUSTMENT DURING FILTER-PRESS FEED

The pressure chosen for filtration shall be set on the back-flow valve in the oil circuit.

Just around filter-press complete filling (that is to say, at a pressure close to the one set on the valve) the back-flow valve starts discharging.

Some of the liquid will be removed from between the piston and the membrane, hence lower membrane deformation and lower pump capacity.

As some liquid is drawn from the circuit, depending on counter-pressure, the pump delivery will gradually be reduced until it will be null at the moment when the pressure in the filter-press is equal to the one set on the valve.

When the delivery pressure goes below the set one, some of the liquid will be flown out from the tank by means of the compensating system (at every suction phase) until the pump delivery volume is balanced with the set pressure.

B-3) MEMBRANE LEAKAGE DETECTION SYSTEM

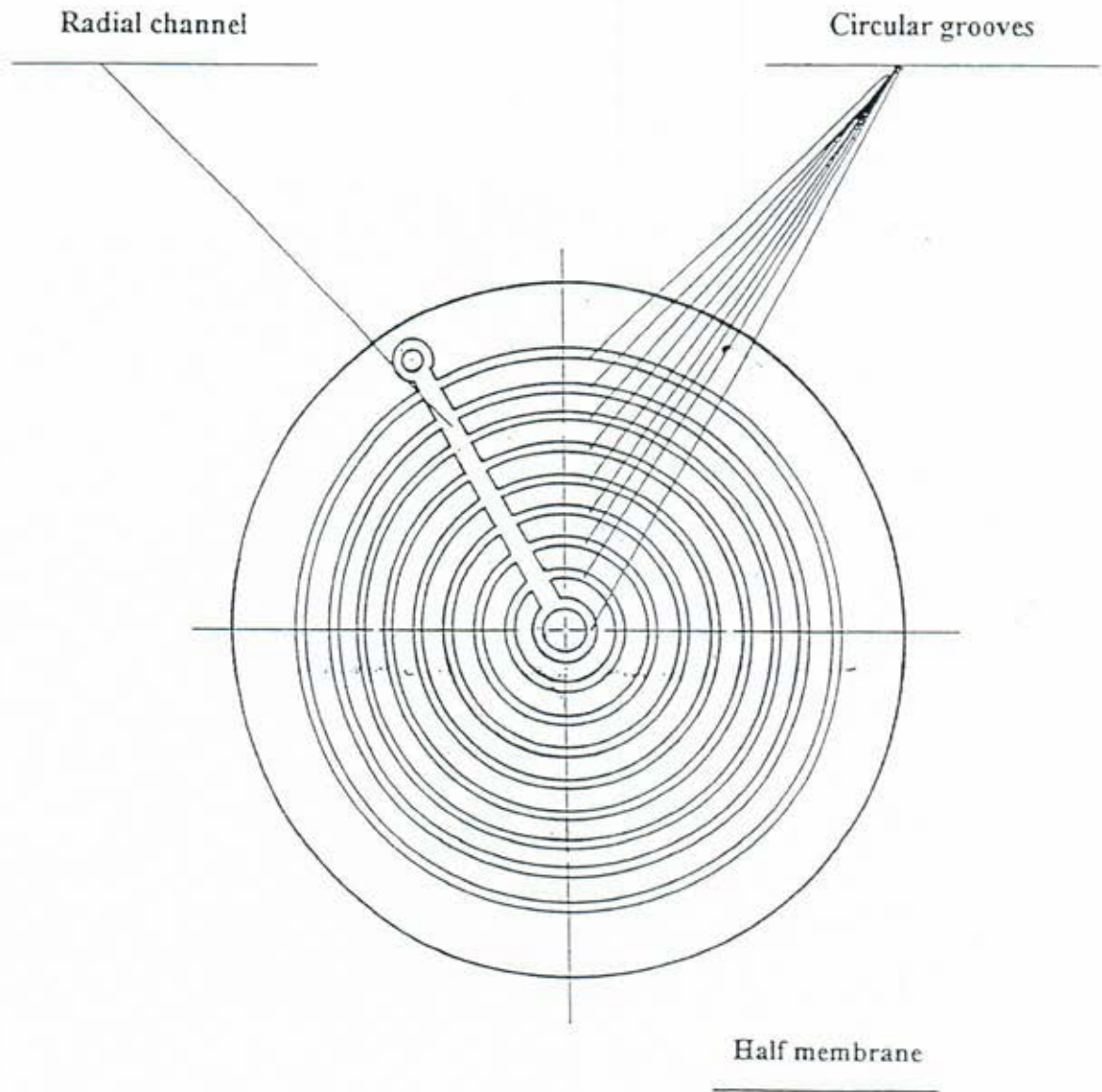
The pumping diaphragm is composed in two halves, stuck together by means of a special glue.

The surface of one of the two halves (the surface on which the other semi-membrane shall be glued) shows semi-circular grooves, connected to each other by means of a radial channel (fig. 2).

The radial channel is in connection with a small tube which conveys any leakage outside of the pump where the leakage detection will be signalled by means of an electric signal.

Should one of the two diaphragms break, the liquid, which pushed on the membrane with the same pressure, is conveyed outside along the above described channels.

The leakage detection system is of vital importance since it makes it possible to act on the pump before the fluid to be pumped enters the secondary side and damages the pump.



JEDM - Mod. 16/F

FIG 2

page 1.14
7/A

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C) INSTALLATION

C-1) SUCTION CONDITIONS

The suction pipe shall be as short as possible (of course according to the requirements of the plant) and have a larger section than the nominal valve diameter; moreover 90 bendings shall be avoided and only wide radius bendings employed.

The suction height depends on viscosity, specific gravity and temperature of the liquid, and on the stroke frequency.

During the suction phase the liquid is subjected to accelerations and decelerations which causes vibration of ducts.

In order to keep vibrations within acceptable limits, the speed of the liquid should be limited by suitably choosing the pipe diameter; moreover the presence of a compensating vessel in the suction side is useful.

Should hot liquids be sucked, the suction shall be done in such a way as to prevent any danger of cavitation.

When the liquid is sucked from a tank, the sucking mouth shall be on the bottom and, to prevent emptying, it is possible to insert in the pipe a check valve at its end.

C-2) DELIVERY CONDITIONS

Two compensating vessel are placed on the delivery pipe in order to equalize pressure peaks.

It is advisable to avoid sharp angles in pipes and it is also advisable to place before the filter-press a compensating vessel to balance the feed to the press and avoids over-pressures which might damage the press itself.

C-3) AIR MAKE-UP

The compensating vessel are efficient if the air cushion is sufficient; it has a tendency to decrease with time.

This decrease is caused by progressive "emulsion" of the air with the liquid to be pumped.

It is therefore necessary to bring back the lost air in order to keep the pressure vessel efficient.

Air refilling can be done manually at the end of filtration: actually when the pipes are discharged all the liquid in the pipes is emptied through a valve and undergoes an acceleration which caused a depression inside the pressure vessel.

There are anyway such situations in which it is not possible and one is obliged to a continuous air-refill by means of an external air compressor (or with the network of the service air).

To this purpose, the pump is normally equipped with a system of self-operation two ways solenoid valve with a flow meter and a nonreturn valve.

The electrovalve must be activated from the electric control panel together with the main motor (see table "AIR FILLING DEVICE").

The air consumption can be adjusted (seeing at the flow meter) at $20 \div 25 \text{ nl/1'}$ at $1.5 \div 2 \text{ bar}$, acting on the speed adjuster directly mounted on the flow-meter (see the same table).

AIR REFILLING

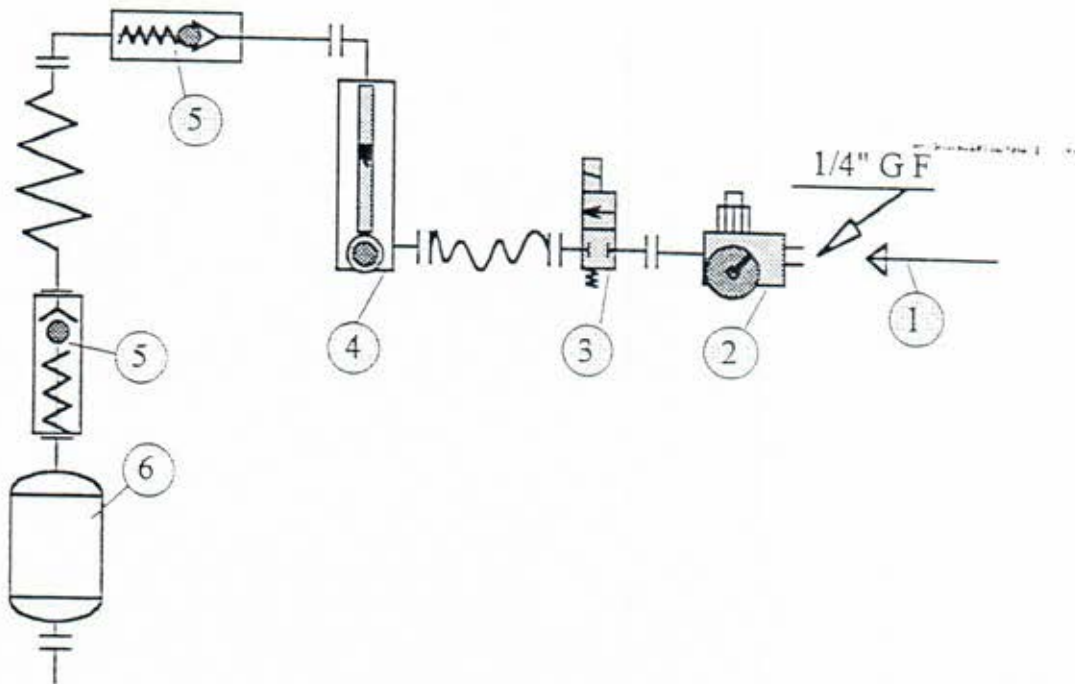
The air refilling device is mounted near the suction valve on the right side on front of the pump.

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AIR REFILLING DEVICE DM-PM 20/30 PUMP



DESCRIPTION

Pos.	Description	Code
1	Network service air	-----
2	Pressureadjuster with pressure gauge	19090000060
3	2 way electrovalve	19050000090
4	Flow-meter with speed adjuster	07350001000
5	Nonreturn valve	18110100080
6	Suction vessel of DM-PM pump	-----

Air consumption 20 - 25 nl/1' at 1,5 - 2 bar

file REINTEGRO ING.DOC

C-4) PLACEMENT OF PUMP ON THE CONCRETE BASE

The base shall be made of reinforced concrete; refer for dimensions to the enclosed installation plan.

The pump is placed together with the drive unit on its ground plate; it shall be placed on the foundation and fastened to it, without causing undue stress.

At this point it is necessary to put the belts in tension by adjusting the motor slide.

The pump is now ready for operation.

D) START-UP

D-1) PRELIMINARY PRECAUTIONS

Make sure that the pump is clean, without dust on the secondary side, to prevent damage to the chromium plated sleeve, which might cause bad operation of the pump.

D-2) OIL FILLING

Unscrew completely the rods for permitting filling from the re-fill valves, then start filling the tank with oil; all air vent plugs on the membrane housings must be previously removed (see fig. 3).

The oil level will rapidly decrease as it flows through the re-fill valve to the pump body.

When the level is getting constant, this means that the pump cylinder is mostly filled with oil.

At this point turn manually the pulley of the reducing unit so that the pump makes a few strokes and lets air out from the air vents on the membrane housings.

The oil level will now go down in the tank which will have to be re-filled.

After that install the rods back, tightening them well in place.

After about 10 minutes of operation the rod of the re-fill valve of the pushing side (1) shall be slightly loosened in order to let air out, if any.

After filling the oil level in the tank should be 1/4 of the total height.

The suitable oil will be a hydraulic oil with a viscosity of 2.5-3°E, and the quantity to be introduced is around 50 litres or a emulsionable oil at 5% (see lubricating card).

(1) Standing at the back of the pump, with the piston forward, the pushing side is the right one.

TITOLO

ALIMENTAZIONE OLIO OIL FILLING

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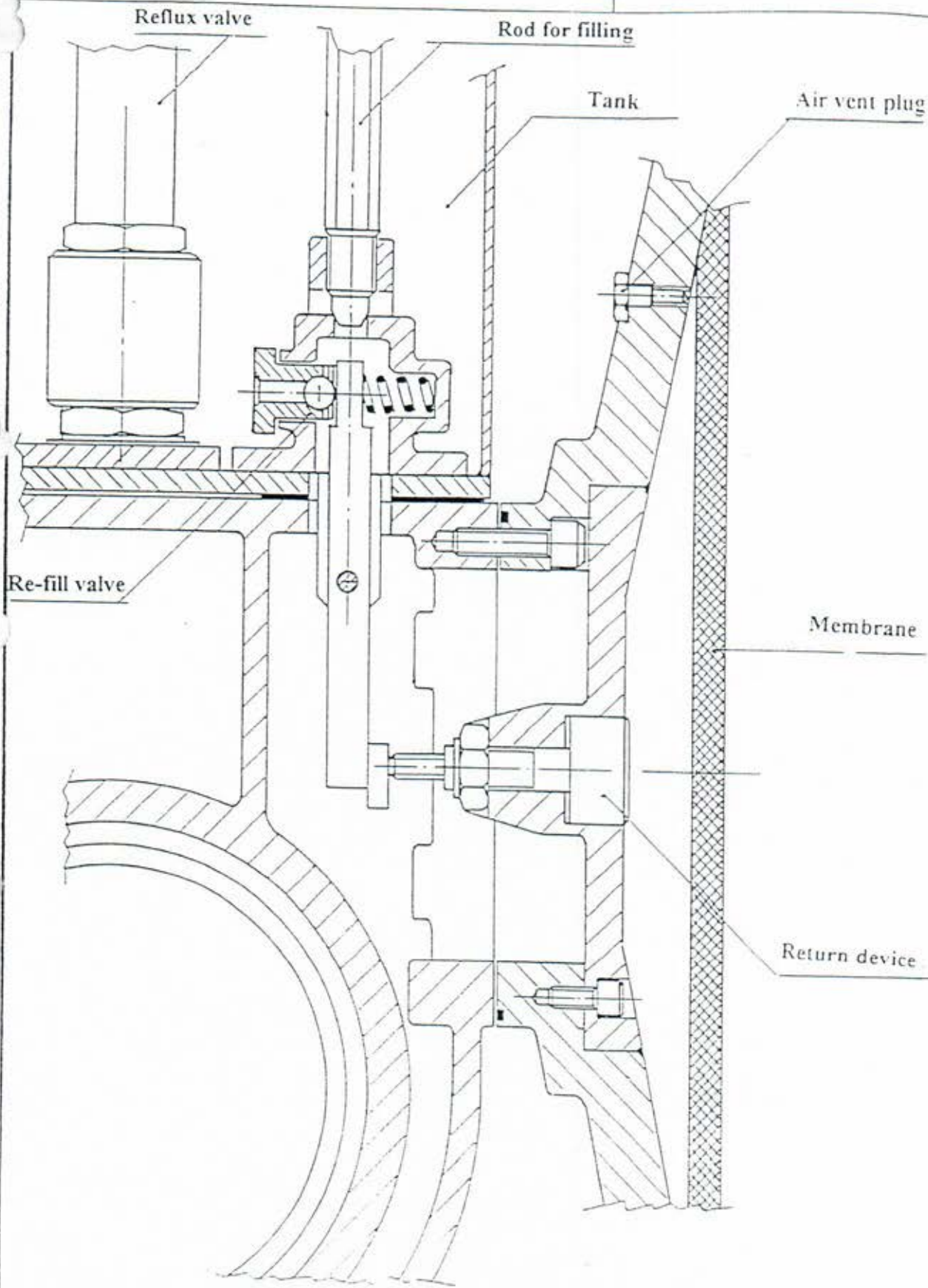


FIG. 3

OFDM - Mod. 16/F

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D-3) ADJUSTMENTS (see exploded view table "C")

All adjustments necessary for good operation are carried out at FILTRI DIEMME's.

We engage no responsibility for any tampering.

Reflow valve

The calibrated pressure of the valve can be read on the pressure gauges placed on top of the pressure vessels for compensation of the delivery.

At this pressure the valve starts discharging all the oil from the cylinder to the tank with consequent annulment of the pump delivery according to the curve.

The calibration of the valve in place can be done by using a key, acting on the square placed on the valve head, and reading increases or decreases on the pressure gauges.

It must be noted that the pressure read on the pressure gauges should not exceed 16 bar, for which pressure the pump has been designed (Note: 16 bar - 227 psi).

Return device

The cap placed on the secondary side of the membrane header must have a clearance of abt. 2 mm. (5/64") (see fig. 4).

Adjustment can be done, after removing the fastening screw, by acting on the threaded rod which controls the lever of the re-fill valve.

This adjustment is done whenever the device shows clearances caused by wear of its components.

REGOLAZIONE VALVOLA RIFLUSSO
ADJUSTMENT OF THE REFLUX VALVE

DIEMME

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48022 LUGO (RAVENNA) ITALIA

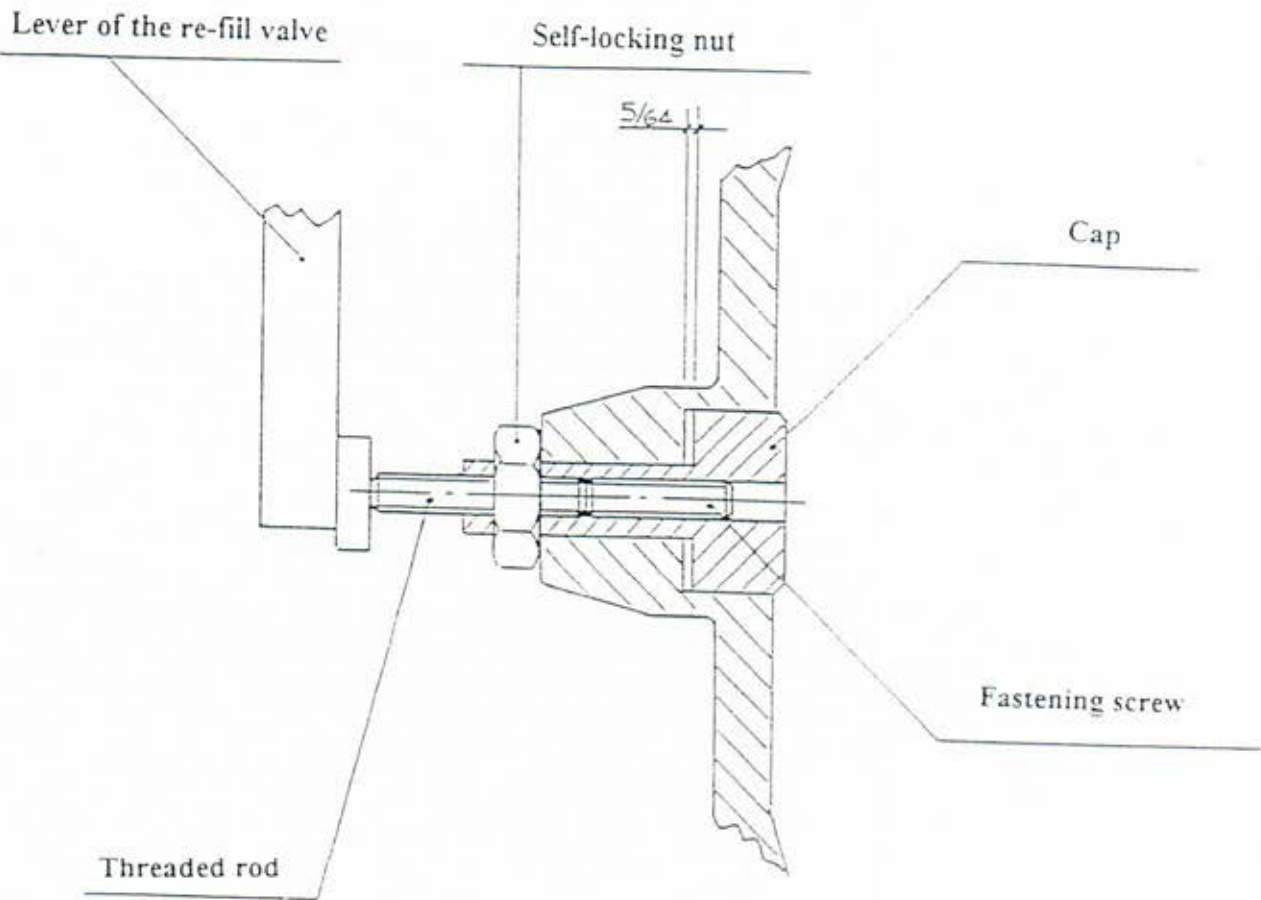


FIG. 4

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EDM - Mod. 16UF

E) MAINTENANCE

E-1) STUFFING BOX (see exploded view table "F")

It is normal for the stuffing box to leak slightly during operation but should the leakage become greater it will be necessary to adjust it through the suitable ring nut.

E-2) MEMBRANES (see exploded view table "E")

Should the pump membrane break, you will have leakages of liquid from the side discharge channel in the two pumping headers (in some cases an electrical device stops the pump automatically).

In case of leakage the membrane should be immediately replaced.

The pump must be emptied both on the primary and secondary side; on the secondary side the oil can be let-out by unscrewing the drain plugs placed below the pump pressure body, whereas on the primary side the liquid can be removed by removing the inspection plug of the suction valve.

To replace the membrane it is necessary to remove the header cover, unscrewing the 8 closing screws, and insert n. 4 screws in the threatened holes of the cap.

Screwing alternatively this 4 screw you will have an automatic removal of the cover out of the header.

Attention: the pump header weights about 80 kg., so a suitable lifting device will be necessary (we do not supply it).

At this point, after removing the cap of the membrane housing, the membrane can be replaced; make sure that the small pipe for oil leakage detection be exactly placed in its seat.

Reassemble the header, screwing in the due way the 8 closing screws and using, if possible, a "dinamometric" key set at about 140+150 Nm.

In case of substitution of the screws they must be class 10.9.

Start again the pump according to chapter D.

For the assembly of the seal-gasket part. 34 of the exploded view "I", see at the special instructions above.

Instruction for assembling the pump rod seal

DMPM 20-30

(IGR - WTF seals)

Used on stems of hydraulic, pneumatic cylinders and revolving distributors, these seals offer excellent performances within following limits:

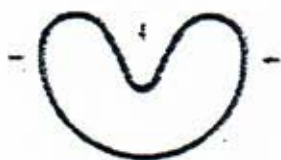
Pressures: da 0 a 800 bar

Temperatures: da -40°C a +125°C

Speed: Alternate movement 15 m/s max.
Helical and oscillatory movement 5 m/s max.
Revolving movement 2 m/s max.

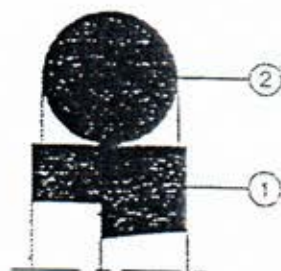
ASSEMBLING

After checking that dimensions, roughness and bevels are the defined ones and after introducing the O-Ring in the seat assemble the P.T.F.E. ring deforming it as stated in picture 3.
To allow the gasket to get back its original shape, after having pressed the folded part as stated in picture 4, we suggest the help of a sizing sleeve of plastic material.



Fluids: Mineral hydraulic oils, water-oil and glycoles-water emulsion.
Note: For applications with temperatures lower or higher than those stated above, of inflammable synthetic fluids, steam etc. the I/GR seals are supplied with O-Rings made of special elastomers.

STRUCTURE

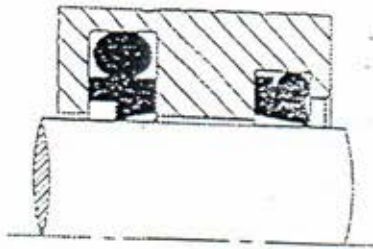


1. P.T.F.E. dynamic seal ring
2. O-Ring with function of expansion and static seal.



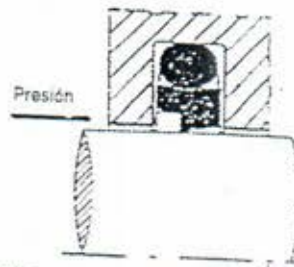
To avoid damages to the seal during assembling we recommend that the seal does not get in touch with sharp edges and threaded parts.
A slight lubrication makes the assembling of the

APPLICATION EXAMPLE



Seal on stem of hydraulic cylinder.
The dust-scraper is type WTF.

parts easier.



I/GR seals with "B" profile will have to be oriented toward the fluid in pressure as stated in picture 5.

E-3) SUCTION AND DELIVERY VALVE (exploded view - table "A" and "B")

In this case the only elements subject to wear are the ball and its seat.

Ball replacement is quite easy and can be done by removing the inspection cap, whereas to replace the valve it is necessary to dismantle the valve (it is therefore necessary to remove also the delivery pipe or suction pipe).

When the valve is reassembled, it is advisable to replace the seals which are likely to be damaged during this operation.

E-4) PUMP SLEEVE (exploded view table "I")

This element, in which the piston slides, is made of chromium plated steel and ensures best wear resistance.

Should it be necessary to replace it anyway, act as follows:

- empty pump body;
- remove front cap;
- by turning the pulley, bring the piston to the TOP DEAD CENTER and dismantle it;
- move the rod to the BOTTOM DEAD CENTER;
- unscrew the fastening screws of the sleeve, remove it.

Reassemble in the opposite order.

E-5) ADJUSTING VALVES AND OIL TANK (table "H")

Removal of these elements should always take place after releasing pressure.

This can be done by slowly opening the reflux valve until pressure is null; at this point the oil can be drained from the tank by using the suitable hole.

The reflux valve can be dismantled together with the whole pipe, including the check valves, by just unscrewing the flange screws.

By loosening the valve fastening screws, the re-fill valves can be removed and also the tank which is now free.

E-6) LUBRICATION

Gear box

The crown gear in the reducing unit is in oil bath and well lubricated, and at every turn also the union between the link pin and the big end of the connecting rod get lubricated.

The pinion and the sleeve in which the crosshead runs are shock lubricated by the oil driven by the gear rotation.

Lubrication shall be done with SAE 90 gear oil.

LUBRICATION SCHEDULE

PART	CHECK every (hours)	REPLACEMENT every (hours)
Gear box	50	500 (first time) - 3000
Stuffing box	200	3000
Pump	10	Add only in case of membrane failure

LUBRICANT

PART	TYPE	VISCOSITY	VOLUME LT-GAL	MANUF.	BRAND	MIN. °C	TEMP. °F
Gear box	Oil	SAE 90	18-4.25	ESSO BP Total	Spartan EP 150 ENERGOL GR-XP 150 Carter Epi 100	-30	-22
Stuf. box	Grease	STD	50-13.25	BP	BP grease		
Pump	- Water +5% cutting oil - Hydr. oil	2.9° Engl. at 50°C	50-13.25	Any Total Esso	Any Azolla-32 Teresso-43	-2 -15 -15	+28 +5 +5

E-7) GENERAL

After about two months' operation check the fastening screws of the big end of the connecting rod.

Adjustment of the trapezoidal belts shall be done after two months from the first start-up.

Control for the membrane leakage detector shall be done several times per day and as soon as a leakage is detected the pump shall be immediately stopped.

F) PROBLEMS AND CORRECTION

THE PUMP DOES NOT SUCK

- Check tightness on the suction pipe.
- In case, fill the pump and prime it.
- Drain the pump cylinder.
- Make sure that the ball valve seal is efficient.
- Make sure that the ducts are not clogged and if required wash them.

THE PUMP DOES NOT REACH THE OPERATING PRESSURE

- Check calibration of the reflux valve.
- Check efficiency of reflux valve seals.
- Check efficiency of check valves.
- Check seal of re-fill valves.
- Check stuffing box.
- Check gaskets between oil tank and pump body.

THE PUMP WORKS IN ALTERNATION WITH PRESSURE PEAKS

- Feed air to the pressure vessels (*).
- If the liquid to be pumped is too thick, dilute it
- Reduce the temperature of the liquid.
- Check valve tightness.

CERTIFICATO DI QUALIFICAZIONE PER VALVOLA DI SICUREZZA

CARRARO - SERIE 'CS'

Tipo CS 31/H Matricola

Attacchi: Entrata DN 1 1/2 NPT

Uscita DN 2 1/2 NPT

Entrata Valvola Diametro D 26,5 mm

Area A 5,51 cmq

Alzata h 6,8 mm

Coefficiente K = 0,38

Campo di taratura (a contropressione atmosferica)
 da 15,5 a 17,21 BAR

Massima temperatura di impiego 232 °C

Sovrapressione 3 + 10 % della pressione di taratura

Scarto di chiusura 2 + 6 % della pressione di taratura

Il coefficiente di efflusso K è stato determinato mediante prove effettuate alla presenza dei tecnici della ISPESI come da lettera di qualificazione della Direzione Centrale Tecnica della ISPESI prot. 7810 15/12/83. Le condizioni di esercizio per calcolare la capacità di scarico nelle condizioni di piena portata, secondo le specifiche della raccolta E, edizione 1979, sono le seguenti:

Fluido: OLIO

Pressione di taratura: 16 BAR

Temperatura di esercizio: 20 °C

Sovrapressione: 10 %

Pressione massima in condizione di efflusso della piena portata: p1 18,6 BAR ASS.

Contropressione max. p2 1

Differenziale di calcolo P1-P2 = dp 17,6

Peso specifico (alla temp. T) γ 1

che, introdotte nella formula:

$$q = \frac{(0,9 \cdot K) \cdot \sqrt{d_p \cdot \gamma \cdot 1000 \cdot \Delta - 100}}{0,621}$$

(per dp in bar)

~~$$oppure q = \frac{(0,9 \cdot K) \cdot \sqrt{d_p \cdot \gamma \cdot 1000 \cdot \Delta - 100}}{0,621}$$~~

~~(per dp in at)~~

danno la capacità di Kg/h 3987,1 pari a

Materiali come segnati sul retro; detti materiali sono idonei per fluidi e condizioni di esercizio sopra indicati. Le caratteristiche costruttive della valvola soddisfano le prescrizioni di cui al punto 2 della specifica E.1.D.2. La valvola è stata assoggettata con buon esito a controllo finale di costruzione e di funzionamento a prova idraulica lato ingresso valvola alla pressione di 60 BAR e lato uscita valvola alla pressione di 18 BAR.

CARRARO S.R.L.

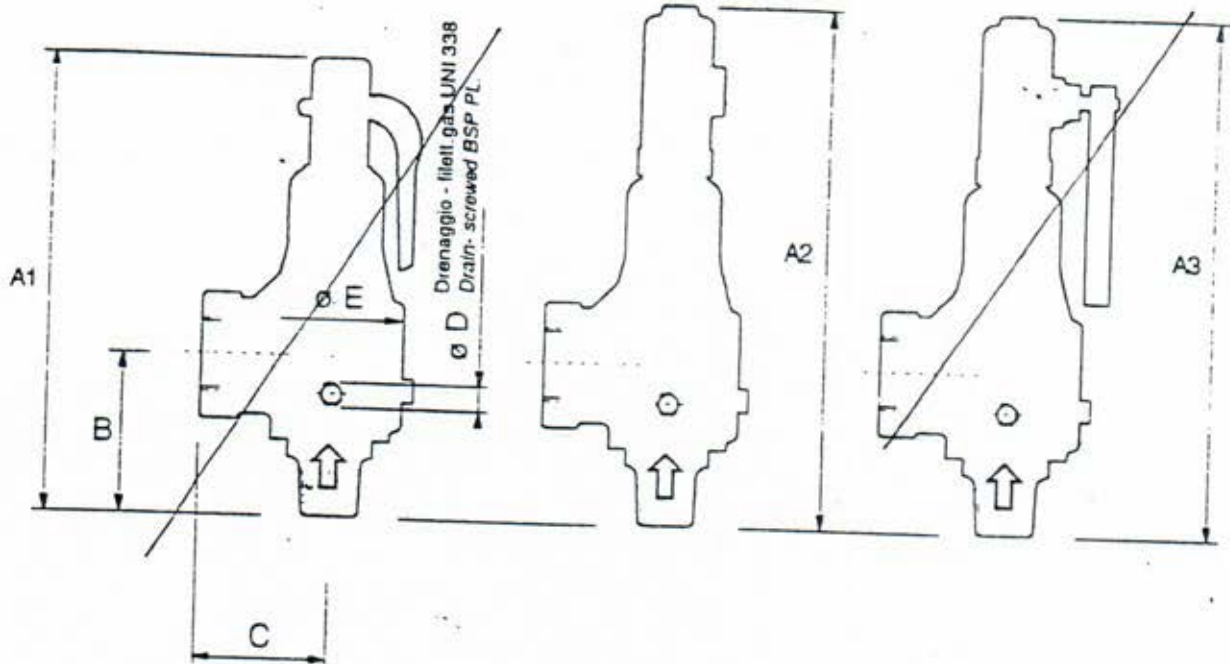
[Handwritten Signature]

Valvola di sicurezza tipo / Safety valve type: "CS 30" - "CS 31"

TIPO / TYPE CS30

TIPO / TYPE CS31
SENZA LEVA / WITHOUT LEVER

TIPO / TYPE CS31
CON LEVA / WITH LEVER



ATTACCHI FILETTATI - SCREWED ENDS	
Entrata / Inlet	Uscita / Outlet
NPT MASCHIO / MALE	NPT FEMMINA / FEMALE
<input type="checkbox"/>	<input type="checkbox"/>

Ø Attacchi / Connections Ø		A1	A2	A3	B	C	øD	øE	Orifici standard previsti Provided stand. orifices	Altri orifici realizzabili Other feasible orifices
Entrata / Inlet	Uscita / Outlet									
1/2"	1"	230	240	240	72	62	1/8"	62	<input type="checkbox"/> D	
3/4"	1"	230	240	240	72	62	1/8"	62	<input type="checkbox"/> E	<input type="checkbox"/> D
1"	1.1/2"	280	300	300	90	75	1/4"	84	<input type="checkbox"/> F	<input type="checkbox"/> D <input type="checkbox"/> E
1"	2"	280	300	300	90	75	1/4"	84		<input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F
1.1/4"	1.1/2"	280	300	300	90	75	1/4"	84	<input type="checkbox"/> G	<input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F
1.1/2"	2.1/2"	380	400	400	130	100	1/4"	114	<input type="checkbox"/> H	<input type="checkbox"/> F <input type="checkbox"/> G <input type="checkbox"/> J
2"	2.1/2"	380	400	400	130	100	1/4"	114	<input type="checkbox"/> J	<input type="checkbox"/> G <input type="checkbox"/> H
										<input type="checkbox"/>

La CARRARO si riserva il diritto di modificare in qualsiasi momento e senza preavviso, le caratteristiche dei prodotti qui illustrati. CARRARO reserves the right to modify the characteristics of here described products at any time and without notice.



CARRARO S.R.L.
VALVOLE E STRUMENTAZIONE

20090 SEGRATE (MI) - VIA E. FERMI 22
TELEX 321142
TEL. (02) 269912.1 - FAX (02) 2692.2452

Rev.1 - 23/10/96

DIS. 93064.PM4

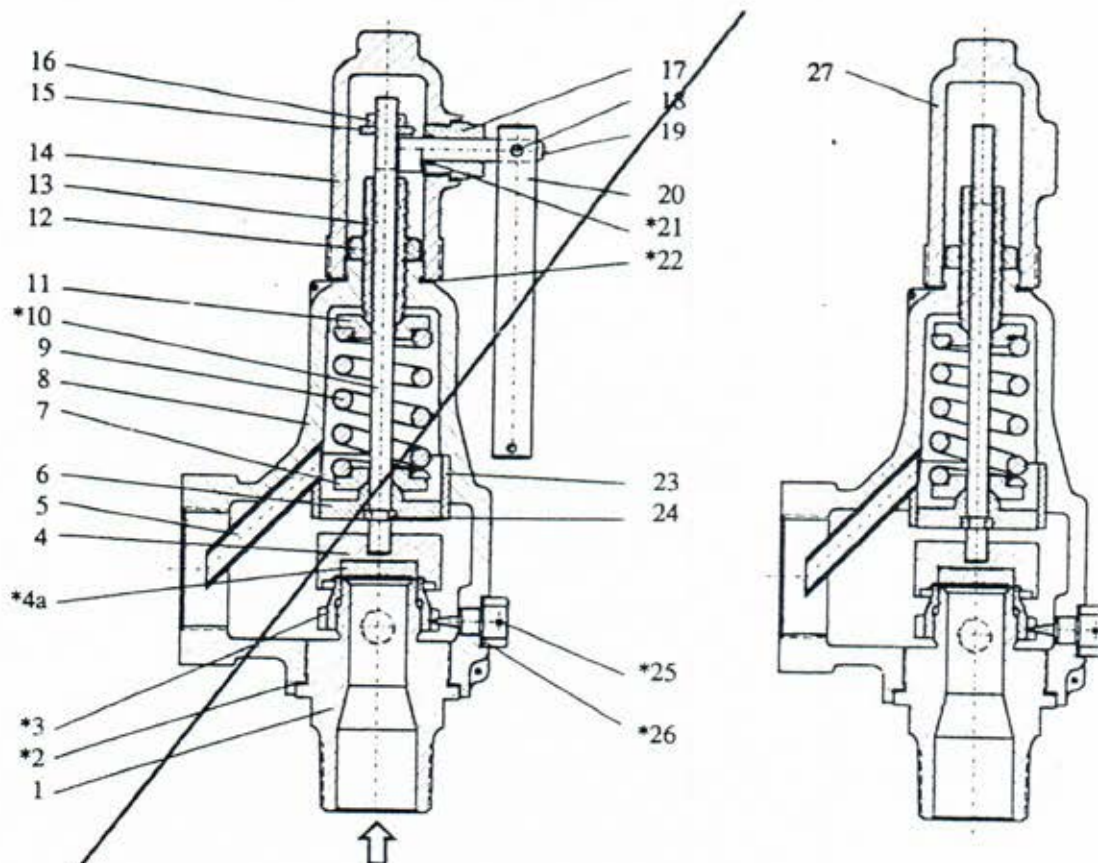
Emesso:

[Signature]

Approv.

[Signature]

Valvola tipo: / Valve type: " CS 31 " (attacchi filettati / Screwed ends)



Valvola tipo CS 31 (Con leva)
CS 31 type valve (With lever)

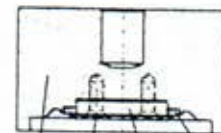
Valvola tipo CS 31 (Senza leva)
CS 31 type valve (Without lever)

**TAPPI A TENUTA ELASTICA
RESILIENT TIGHTNESS DISC**



*28 *29 *30

Per orifici tipo:
For orifice type:
" D - E - F "



*31 *32 *33 *34

Per orifici tipo:
For orifice type:
" G - H - J "

1 - Corpo-Sede / Nozzle-body	*10 - Asta / Stem	18 - Perno leva / Lever pin	*26 - Guarnizione / Gasket
*2 - Guarnizione / Gasket	11 - Piattello superiore / Upper washer	19 - Albero comando / Control shaft	27 - Cappello / Cap
*3 - Anello regol. / Adjusting ring	12 - Controdado / Lock nut	20 - Leva / Lever	*28 - Tappo / Disc
4 - Portatappo / Holder	13 - Vite di taratura / Compression screw	*21 - Guarnizione / Gasket	*29 - Vite guarniz. / Gasket screw
*4a - Tappo / Disc	14 - Cappello / Cap	*22 - Guarnizione / Gasket	*30 - Guarnizione / Gasket
5 - Tubo eiettore / Eductor tube	15 - Dado per asta / Stem nut	23 - Guida / Guide	*31 - Tappo / Disc
6 - Pistone / Piston	16 - Dado / Nut	24 - Anello per asta / Stem ring	*32 - Vite / Screw
7 - Piattello infer. / Lower washer	17 - Manicotto / Sleeve	*25 - Vite anello regolazione / Adjusting ring pin	*33 - Piattello guarnizione / Gasket plate
8 - Incastellatura / Bonnet			*34 - Guarnizione / Gasket
9 - Molla / Spring			

* RICAMBI CONSIGLIATI / RECOMMENDED SPARE PARTS

N.B.: I gruppi di part. (28, 29, 30) e (31, 32, 33, 34) sono fornibili in unico set.
Note: Part units (28, 29, 30) and (31, 32, 33, 34) are supplied in one set only.

La CARRARO si riserva il diritto di modificare in qualsiasi momento e senza preavviso, le caratteristiche dei prodotti qui illustrati.
CARRARO reserves the right to modify the characteristics of here described products at any time and without notice.



CARRARO S.R.L.
VALVOLE E STRUMENTAZIONE

20090 SEGRATE (MI) - VIA E. FERMI 22
TELEX 321142
TEL. (02) 269912.1 - FAX (02) 2692.2452

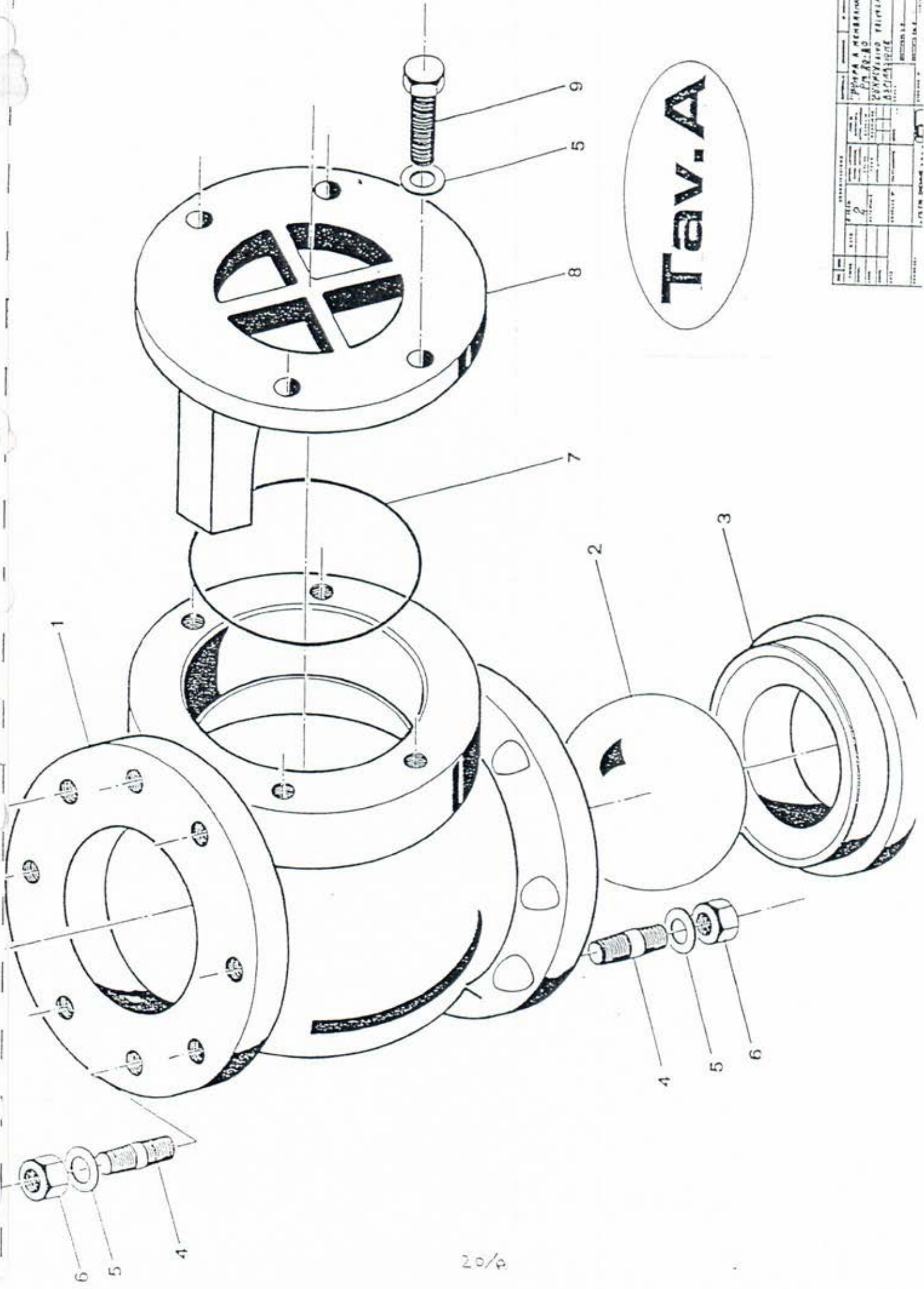
Rev. 1 - 11/05/98 DIS. 93101.PM4
Emesso: *[Signature]* Approvato: *[Signature]*

LOWERED EFFICIENCY

- . Check the return device and the cone seal of the rod.
- . Check tightness of stuffing box.
- . Check oil level in tank.
- . Check oil leakage detector.

(* If air refill is done through a small valve with calibrated mouth placed on the suction part, the calibrated hole can be increased in order to increase the quantity of air sucked in.

G) TABLES OF EXPLODED VIEWS



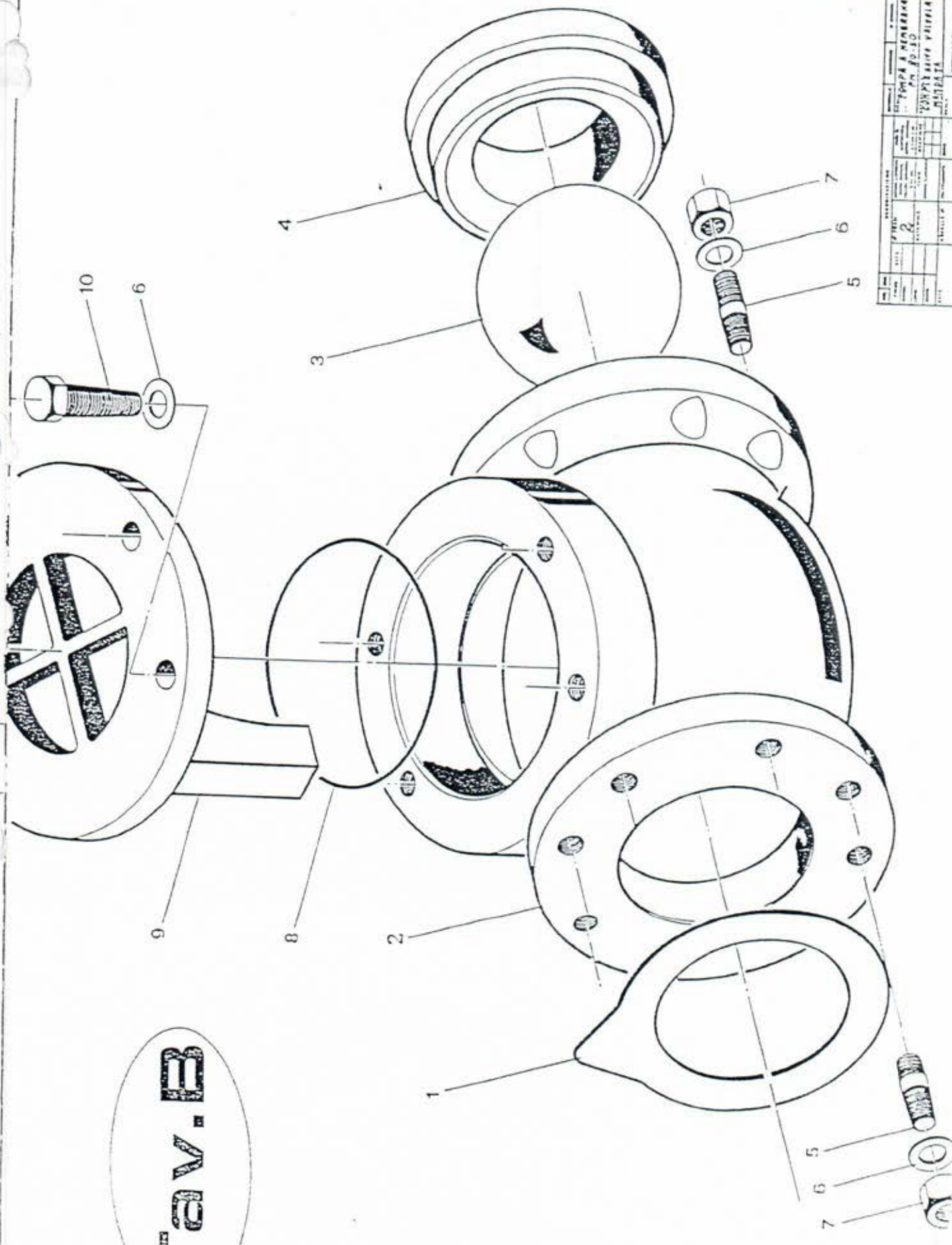
TAV.A MEMBERSHIP FORM NO. 10 UNIVERSAL ITALIA ASSOCIATION	
NAME	
ADDRESS	
CITY	
COUNTRY	
TELEPHONE	
POSTAL CODE	
PROFESSION	
DATE	
ISSUE NO.	
ISSUE DATE	

20/a

TABLE A - SUCTION VALVE

POS.	DESCRIPTION	CODE
1	Valve body	BBG00100G00
2	Ball Ø 120	0922V012000
3	Valve seat	BBG00300A00
4	Stud bolt M 16 x 40 UNI 5911-66	1013010A443
5	Washer DN 16 UNI 6592-69	10310100016
6	Hex. nut M 16 UNI 5588-65	1022010A216
7	O-Ring 4587	1101V314880
8	Inspection plug	BBG00200G00
9	Screw M 16 x 40 UNI 5739	1001010A443

TAV. B



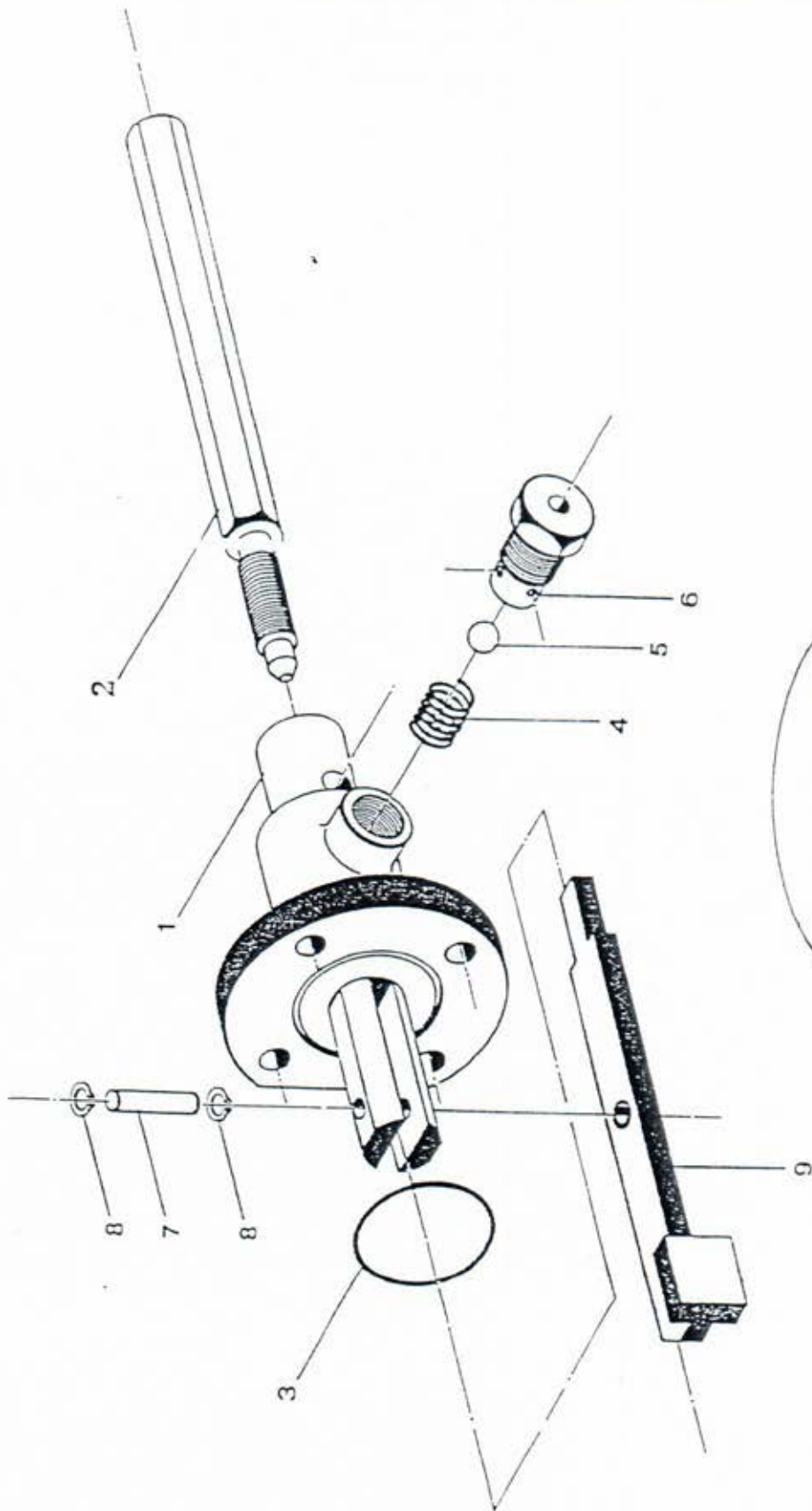
PRODOTTORE	INDUSTRIE S.P.A.
MODELLO	2
DESCRIZIONE	COMPRESSORE VAPORI
DATA	1954
PRODOTTORE	INDUSTRIE S.P.A.
MODELLO	2
DESCRIZIONE	COMPRESSORE VAPORI
DATA	1954

21/5

TABLE B - DELIVERY VALVE

POS.	DESCRIPTION	CODE
1	Flat gasket (tongue type) DN 100	1140W10L100
2	Valve body	BBG00100G00
3	Ball Ø 120	0922V012000
4	Valve seat	BBG00300A00
5	Stud bolt M 16 x 40 UNI 5911-66	1013010A443
6	Washer DN 16 UNI 6592-69	10310100016
7	Hex. nut M 16 UNI 5588-65	1022010A216
8	O-Ring 4587	1101V314880
9	Inspection plug	BBG00200G00
10	Screw M 16 x 40 UNI 5739	1001010A443

DISEGNO N. 1 DATA A MEMORIA 27.10.30 AUTORE ALBERTO		VERIFICA DATA AUTORE	
N. 1 DATA A MEMORIA 27.10.30 AUTORE ALBERTO	VERIFICA DATA AUTORE	N. 1 DATA A MEMORIA 27.10.30 AUTORE ALBERTO	VERIFICA DATA AUTORE

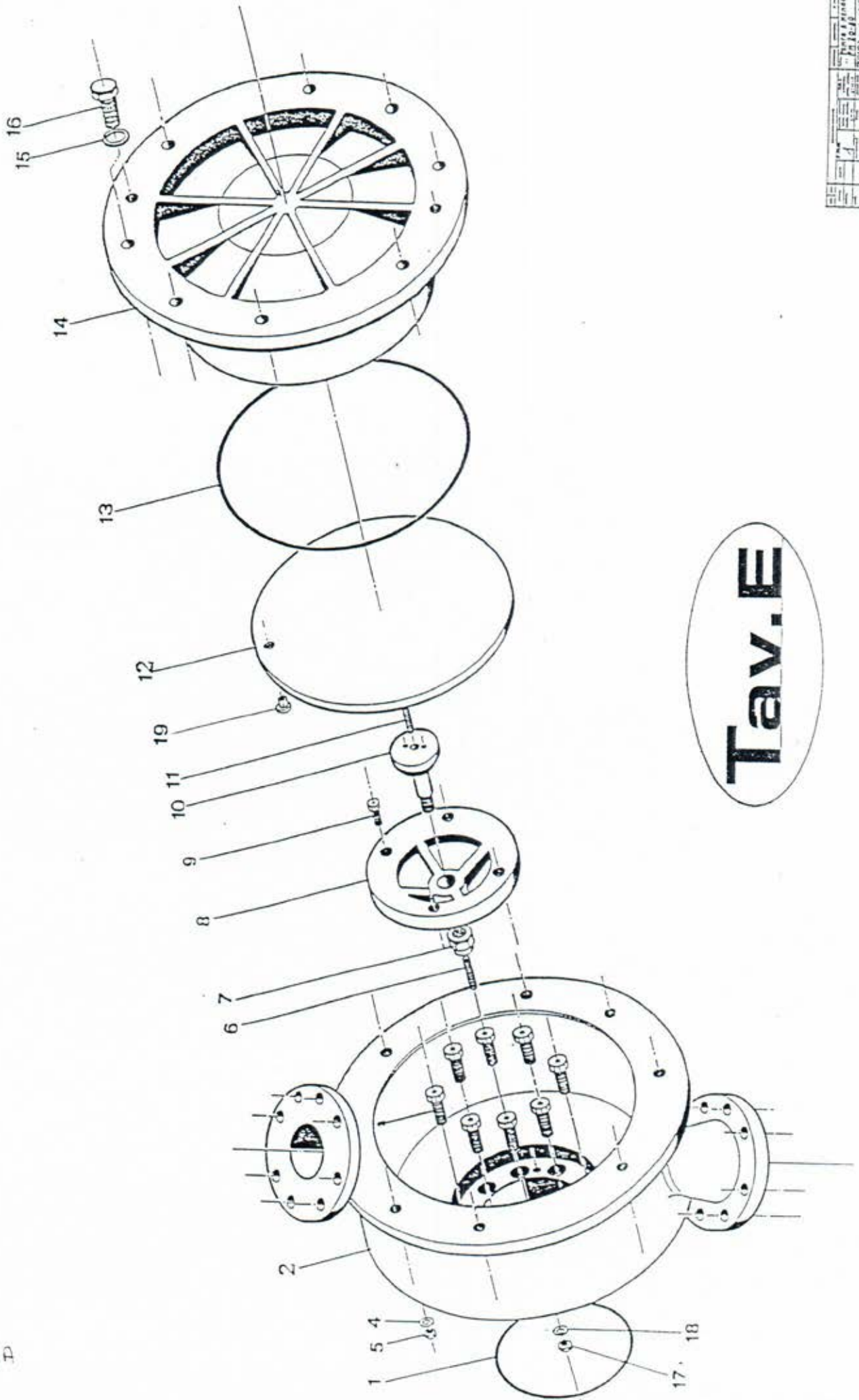


Tav. C

22/A

TABLE C - MAKE-UP VALVE ASSEMBLY

POS.	DESCRIPTION	CODE
1	Oil make-up valve body	BBE10100G00
2	Oil level stem	BBE10200F00
3	O-Ring 3250	1101V206317
4	Spring for make-up valve	0901Z255000
5	Ball Ø 15	0922F001500
6	Ball seat plug	BBE10300F00
7	Make-up valve stem pin	BBE10700F00
8	Elastic "Seeger" ring 8 UNI 7435-75	105002E0008
9	Oil make-up stem	BBE10500F00



Tav. E

Dizayn qurultay		Tayinuv qurultay	
№	№	№	№
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
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19	19	19	19

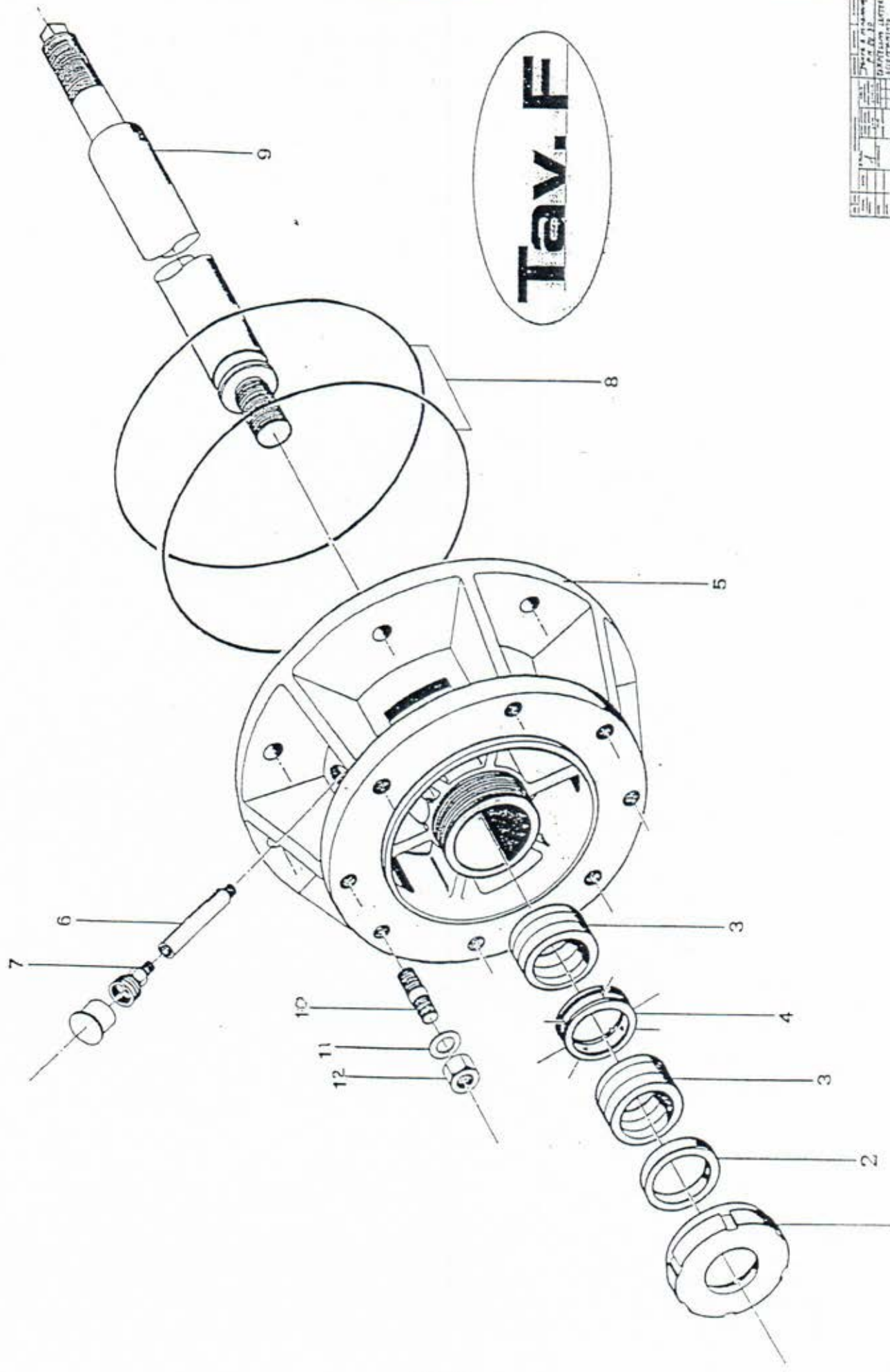
23/A

TABLE E - MEMBRANE ASSEMBLY

POS.	DESCRIPTION	CODE
1	O-Ring 4925	1101V323450
2	Membrane casing	BBD00100G00
3	Screw M 16 x 50 UNI 5931-67	1002010A447
4	Copper gasket Ø 1/4"	1139L010008
5	Plug 1/4" gas	1311110A080
6	Threaded dowel M 10 x 40 UNI 5923-67	1010010A051
7	Self-locking nut M 24	1022010A324
8	Membrane ring	BBD00400G00
9	Screw M 10 x 25 UNI 5931-67	1002010A205
10	Make-up valve adjusting pin	BBD00500T00
11	Threaded dowel M 10 x 50 UNI 5923-67	1010010A053
12	Membrane	11550380000
13	DOWTY O-Ring 388	1101V548140
14	Membrane housing lid	BBD00200G00
15	Elastic washer DN 22 UNI 1751	10320100022
16	Screw M 22 x 50 UNI 5739	1001010A661
17	Plug 3/8" gas	1311110A120
18	Copper gasket Ø 3/8"	1139L010012
19	Leakage Conveyor	BBD00303B00

Project No.	1000000000
Part Name	Pressure Gauge
Part No.	1000000000
Quantity	1
Material	Steel
Manufacturer	Garrett
Drawing Office	Garrett
Scale	1:1
Date	10/10/52
Drawn by	J. H. ...
Checked by	J. H. ...
Approved by	J. H. ...

TAV. F



24/5

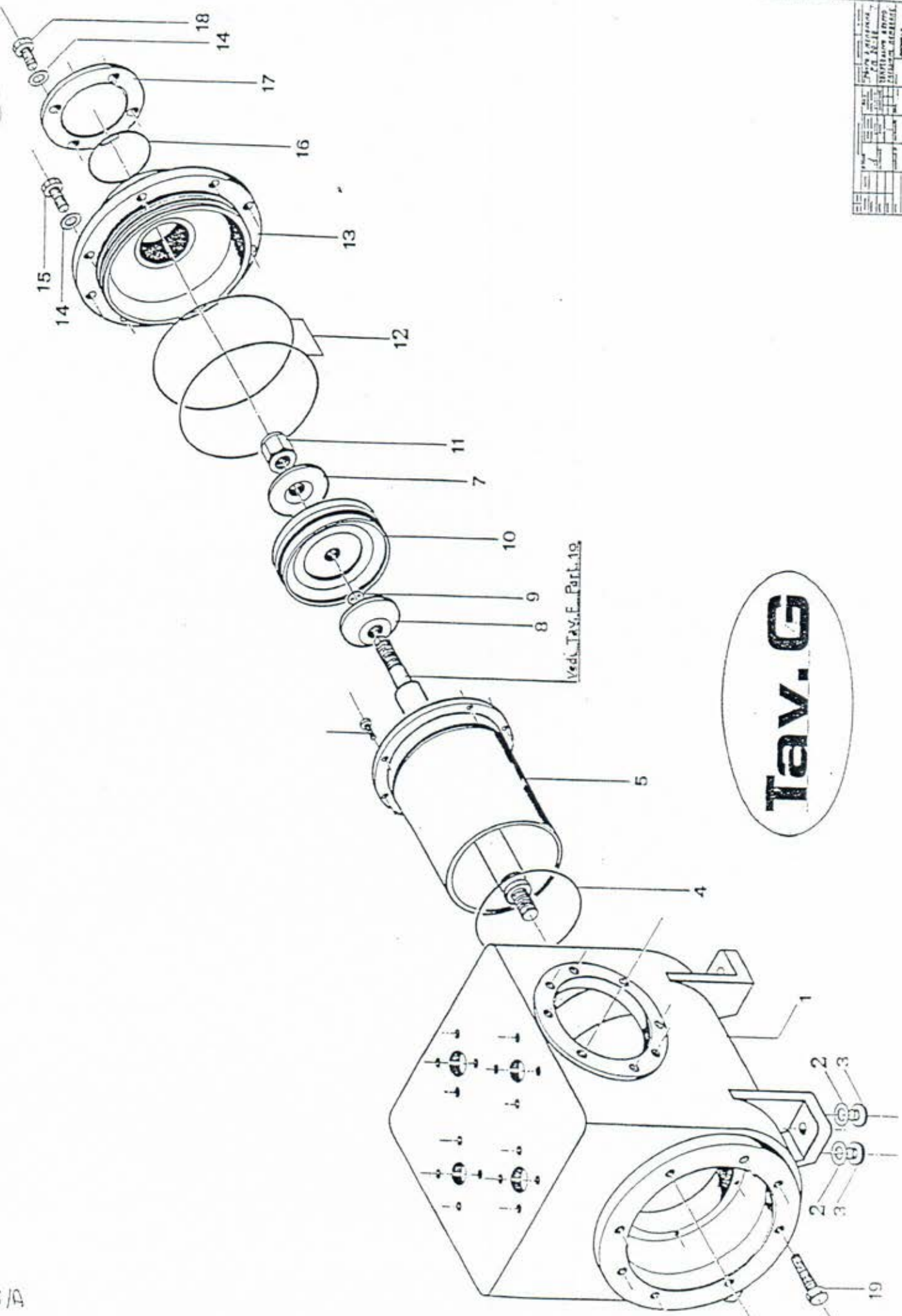
TABLE F - COUPLING SLEEVE ASSEMBLY

POS.	DESCRIPTION	CODE
1	Stuffing box ring nut	BBB00500B00
2	Stuffing box ring	BBB00600F00
3	Gasket CH 225196	1125V065150
4	Stuffing box ring	BBB00400F00
5	Coupling sleeve	BBB00100G00
6	Staufer greaser column	BBB00300B00
7	Greaser 1/4" gas	09110204082
8	O-Ring 275	1101V326629
9	Piston rod	BBC00400F00
10	Stud bolt M 16 x 40 UNI 5911-66	1013010A443
12	Washer DN 16 UNI 6592-69	10310100016
13	Hex. nut M 16 UNI 5588-65	1021010A216

Part Name	Part No.	QTY	Notes

TAV.G

Medi_Tav.G_Part.19



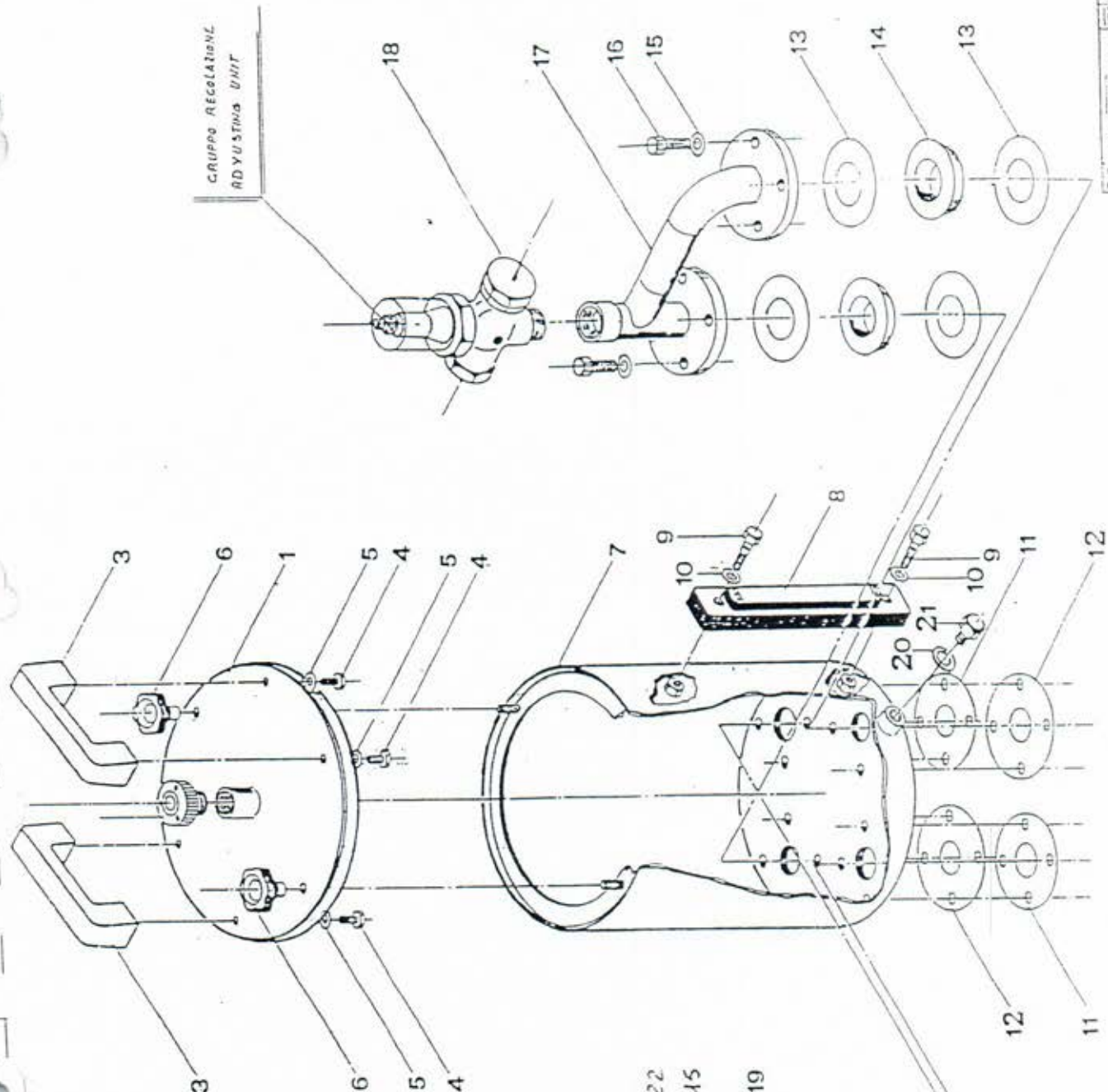
25/A

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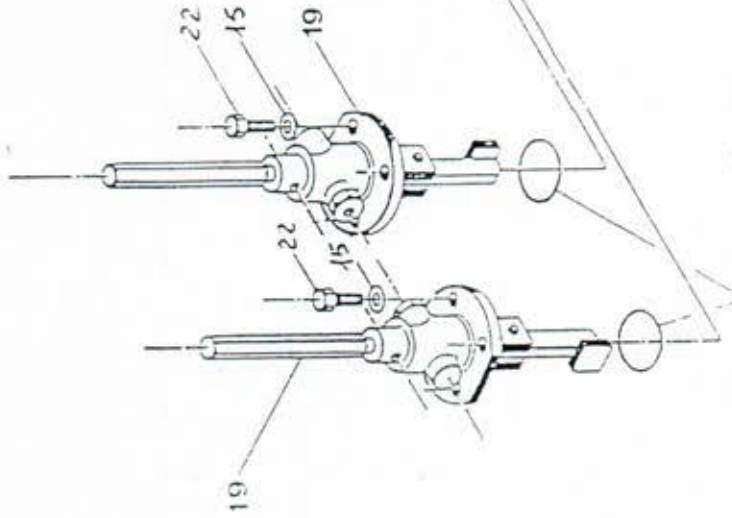
TABLE G - MEMBRANE PRESSURE ASSEMBLY

POS.	DESCRIPTION	CODE
1	Membrane pressure body	BBC00100G00
2	Copper gasket Ø 1/2"	1139L010016
3	Plugs 1/2" gas	1311110A0160
4	O-Ring 173 Dowty	1101V221558
5	Pump sleeve	BBC00500F00
6	Screw M 8 x 25 uni 5931-67	1001010A137
7	Piston thrust washer with threads	BBC00600E00
8	Piston washer without threads	BBC00700F00
9	O-Ring 4118	1101V302975
10	Double piston Ø 200 - 15440	1128V200000
11	Self-locking nut M 30 x 2	1022010C330
12	O-Ring 275 Dowty	1101V326629
13	Front lid	BBC00200G00
14	Washer DN 16 UNI 6592-69	10310100016
15	Screw M 16 x 40 UNI 5739	1001010A443
16	O-Ring 4462	1101V311710
17	Closing flange	BBC00300F00
18	Screw M 16 x 35 UNI 5739	1001010A441
19	Screw M 16 x 40 UNI 5739	1001010A443

GRUPPO REGOLAZIONE
ADJUSTING UNIT



Tav. H



Vedi Tav. C Part. 3

PRODOTTORE	INDUSTRIE S. GIOVANNI
MODELLO	1000
REVISIONE	1
DATA	1955
PRODOTTORE	INDUSTRIE S. GIOVANNI
MODELLO	1000
REVISIONE	1
DATA	1955

26/A

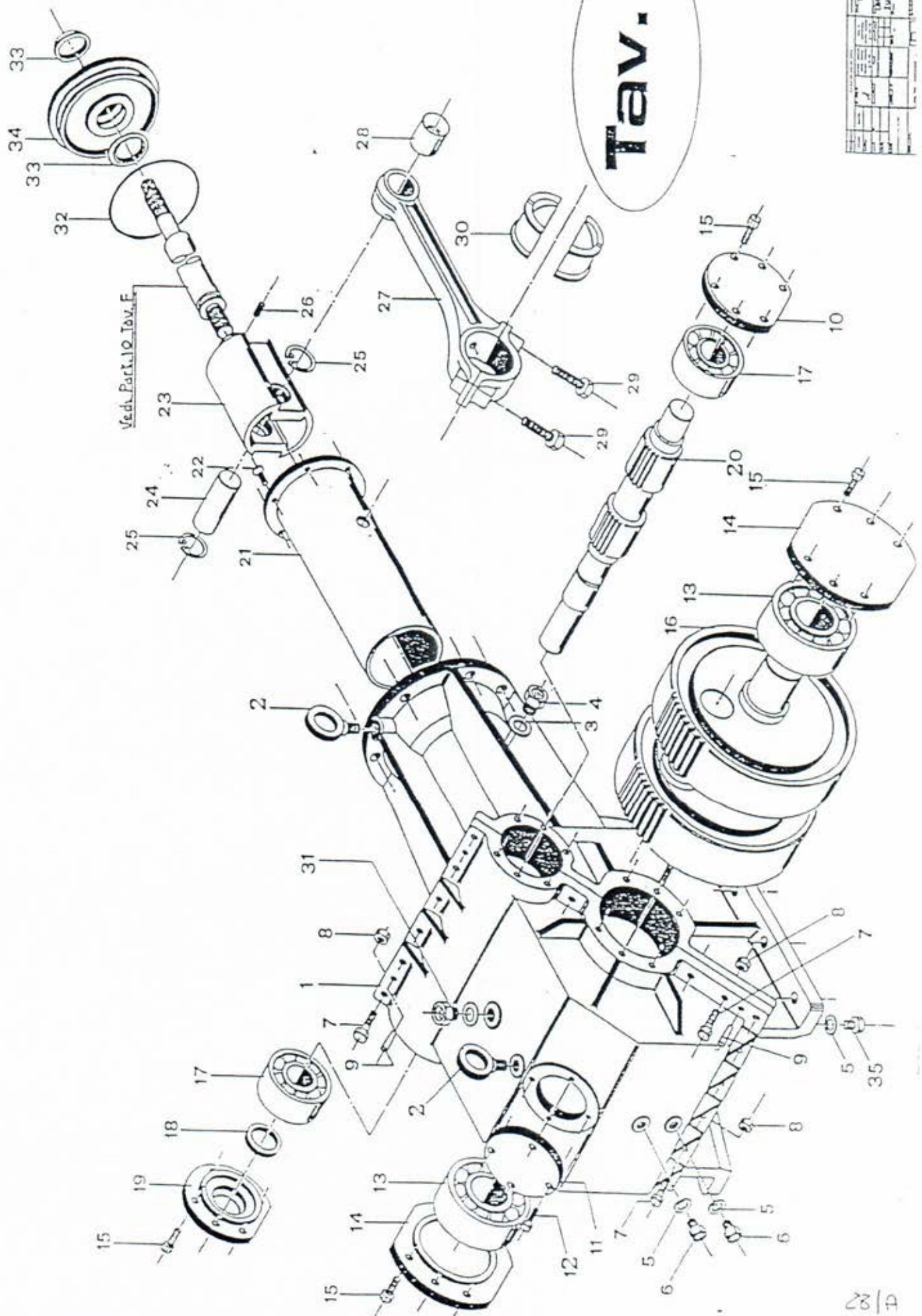
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TABLE H - OIL MAKE-UP TANK

POS.	DESCRIPTION	CODE
1	Tank cover	BBF00200F00
2	Plug ELESA SF 60	18550100280
3	Handles ATAL M-T 132 M8	0950N100030
4	Screw M 8 x 16 UNI 5739	1002010A133
5	Washer DN 8 UNI 6592-69	10310100008
6	Knobs D = 50 M 8 F.	0952N205081
7	Oil recycling tank	BBF00100F00
8	Oil window	18551000800
9	Hollw screw M 10 x 40 UNI 5931	1002010A212
10	Flat washer DN 10 UNI 6592	10310100010
11	Adjusting valve gasket	BBF00400M00
12	Nonreturn valve gasket	BBF00500M00
13	Gasket DN 40	1140W160040
14	Nonreturn valve DN 40	23C7A3W0340
15	Washer DN 12	10310100012
16	Screw M 12 x 70 UNI 5931	1002010A304
17	Max. pressure valve pipe	BBE00100F00
18	Oil flow-back valve 1½"	23E0B0C0340
19	Make-up valve	See Table C
20	Copper gasket Ø 1/2"	1139L010016
21	Plug Ø 1/2" gas	1311110A160
22	Screw M 12 x 40 UNI 5931	1002010A290

№ документа	№ документа	№ документа	№ документа	№ документа
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

Tav. 1



28/A

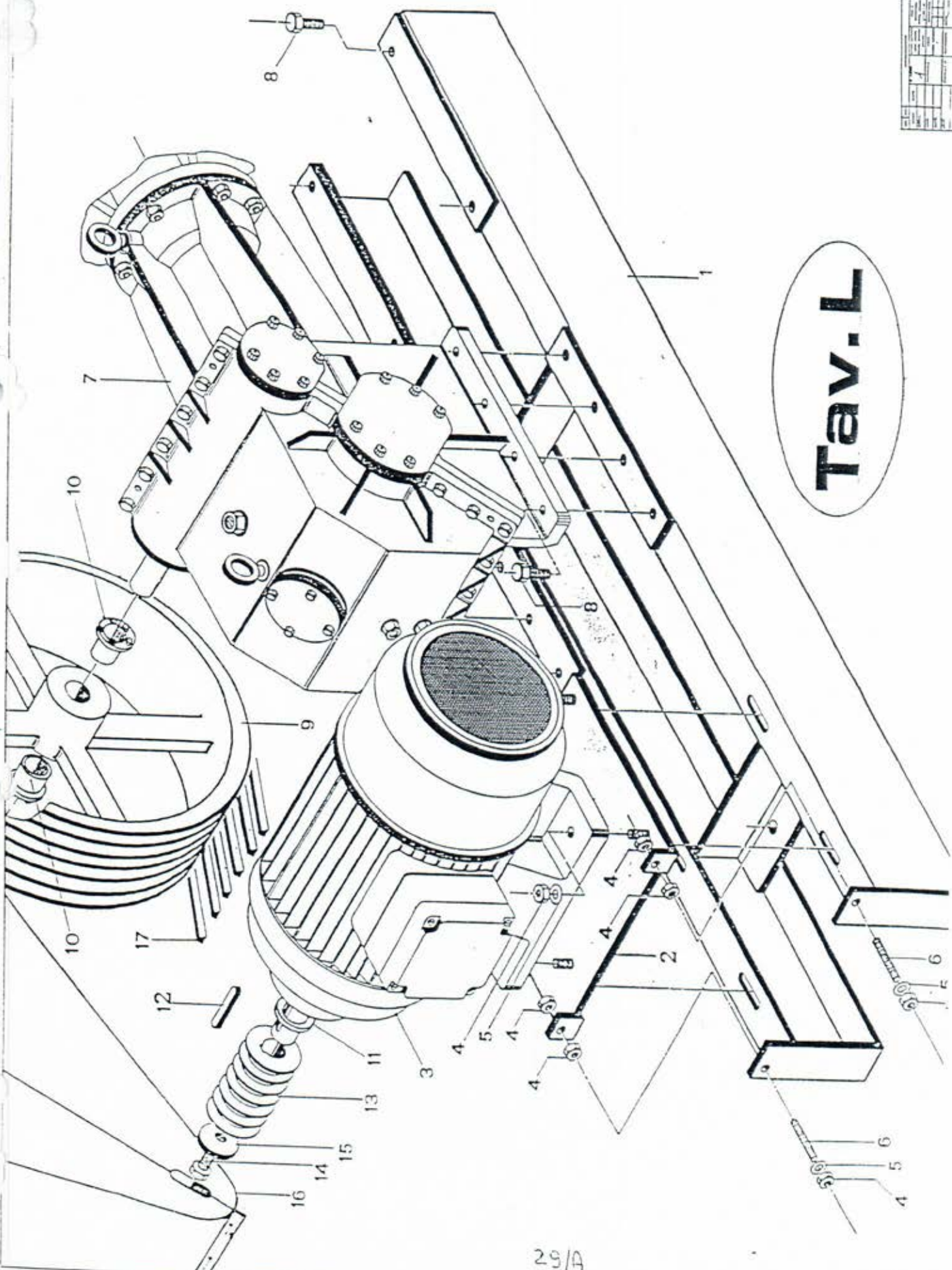
1:50

TABLE I - REDUCING UNIT

POS.	DESCRIPTION	CODE
1	Reducing unit casing	BBA00100G00
2	Eyebolts M 16 UNI 2947	
3	Copper gasket Ø 3/4"	1139L010024
4	Plug 3/4" gas	1311110A0240
5	Copper gasket Ø 1/2"	1139L010016
6	Oil level plug 1/2" gas	18550200160
7	Screw M 10 x 40 UNI 5931	1002010A212
8	Nut M 10 UNI 5588-65	1021010A210
9	Tapered pin 8 x 60 UNI 7286	1052033C060
10	Pinion cap	BBA00500G00
11	Inspection plug	BBA00700G00
12	Screw M 8 x 25 UNI 5931-67	1002010A137
13	Roller bearing NJ 2314 EC	08207070510
14	Crowngear cap	BBA00400G00
15	Screw M 10 x 35 UNI 5931-67	102010A210
16	Gooseneck with crowngears	BBA00200F00
17	Roller bearing NJ 2310 EC	08207050400
18	Gasket DPSM 50658	1109V050158
19	Pulley side pinion cap	BBA00600G00
20	Pinion	BBA00300F00
21	Reducing unit sleeve	BBA00800F00

22	Screw M 6 x 20 UNI 5933	1004010A094
POS.	DESCRIPTION	CODE
23	Guide piston	BBA00900B00
24	Connecting rod pin	BBA01000F00
25	Seeger elastic ring 44 UNI 7435-75	105002I0044
26	Dowel M 10 x 20 UNI 5923-67	1010010A045
27	Connecting rod	BBA01300F00
28	Bushing (included in the connecting rod)	
29	Screw M 20 x 1.5 L = 90 UNI 5712	1001020C610
30	Connecting rod bushing	BBA01100B00
31	Oil plug 3/4"	18550100240
32	o-rING 4675	1101W050146
33	Seal gasket I/GR 0500 (two pieces)	1109W050146
34	Gasket bearing flange	BBB00200G01
35	Plug 1/2" gas	1311110A160

№ документа	29/A
Исполнитель	И.С.С.
Проверенный	
Утвержденный	
Дата	
Лист	1
Всего листов	1
№ детали	
№ материала	
№ чертежа	
№ сборки	
№ изделия	
№ завода	
№ цеха	
№ участка	
№ станка	
№ инструмента	
№ приспособления	
№ оснастки	
№ штампа	
№ пробы	
№ отливки	
№ заготовки	
№ детали	
№ сборки	
№ изделия	

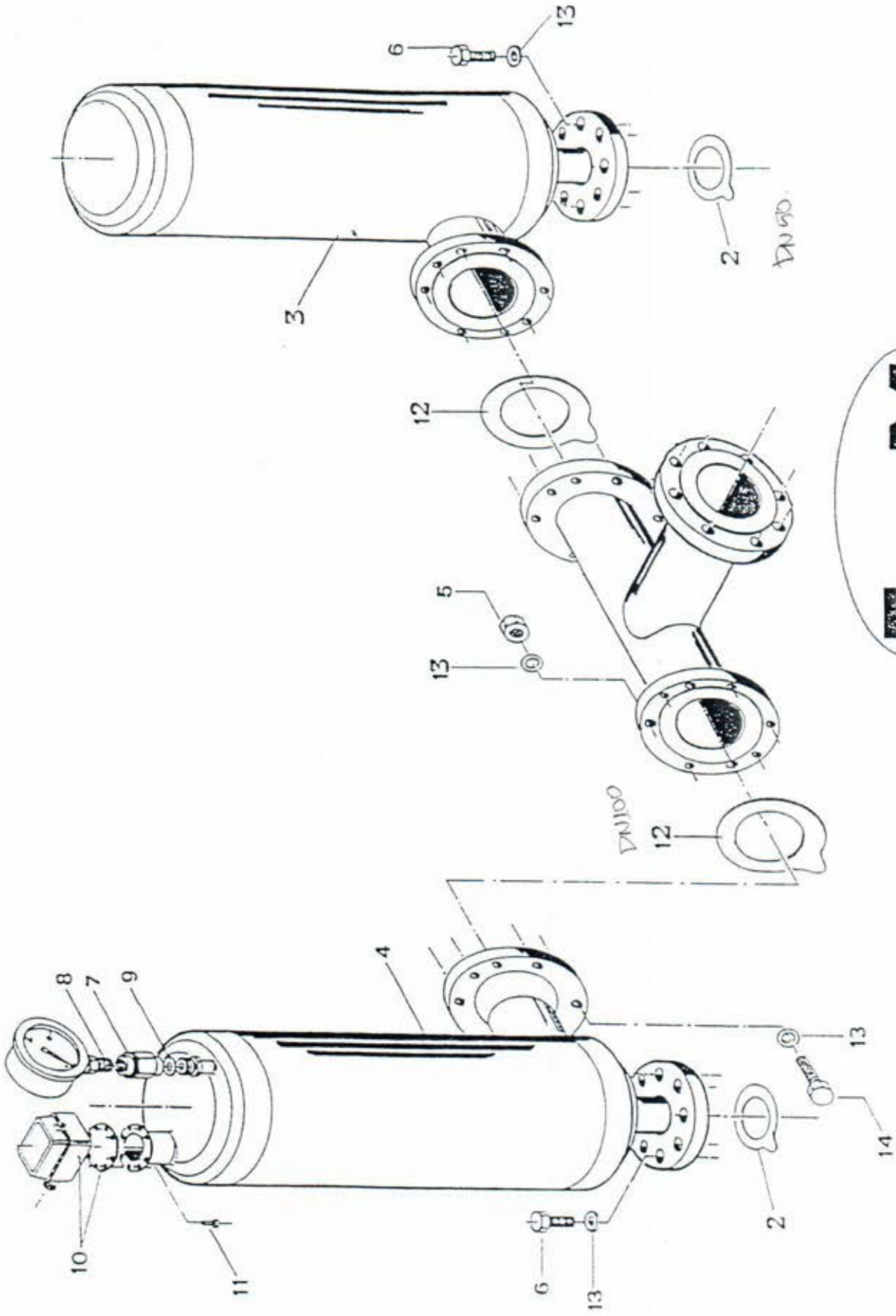


Tav. L

TABLE L - ELECTRIC MOTOR - REDUCING UNIT ASSEMBLY

POS.	DESCRIPTION	CODE
1	Upper basement	BBL00100F00
2	Motor bearing plate (DMPM30) (DMPM20)	BBH10100F00 BBH10200F00
3	Electric motor (DMPM 30 - HP 25) (DMPM 20 - HP 20)	2524162300A 2524161300A
4	Hex. nut M 12 UNI 5588-65	1021010A212
5	Washer DN 12 UNI 6592-69	10310100012
6	Threaded bar M 12 L = 330	115010A0212
7	Reducing unit PH 20-30 (TABLE I)	BBA00000A00
8	Screw M 16 x 35 UNI 5739	1001010A441
9	Reducing unit pulley	BBH00100G00
10	Key D = 45 x 75 (1006)	08350004500
11	Motor pulley washer	BBH00502F00
12	Motor shaft key (included in the electric motor)	
13	Motor pulley (DMPM30) (DMPM20)	BBH00200G00 BBH00300G00
14	Screw M 16 x 30 UNI 5739	1001010A439
15	Motor pulley tab washer	BBH00601F00
16	Casing	BBH20100F00
17	Trapezoidal belts type B 95	08040170950

№ документа	ИЗМ.	№	Дата
1			
2			
3			
4			
5			
6			
7			
8			
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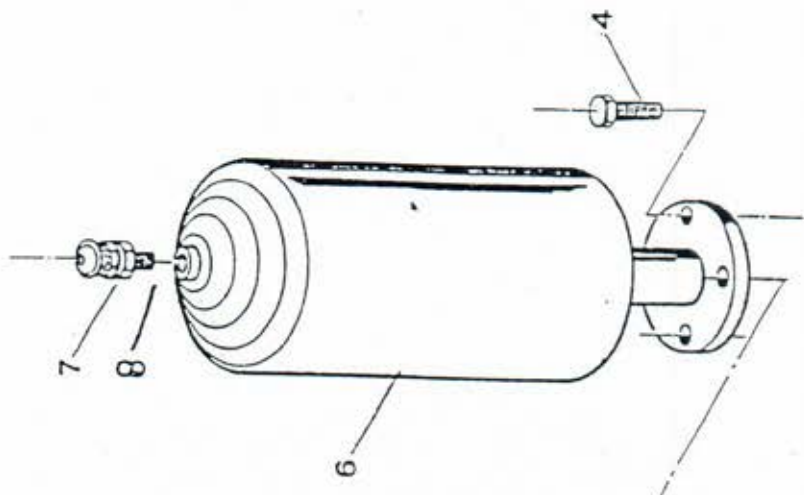


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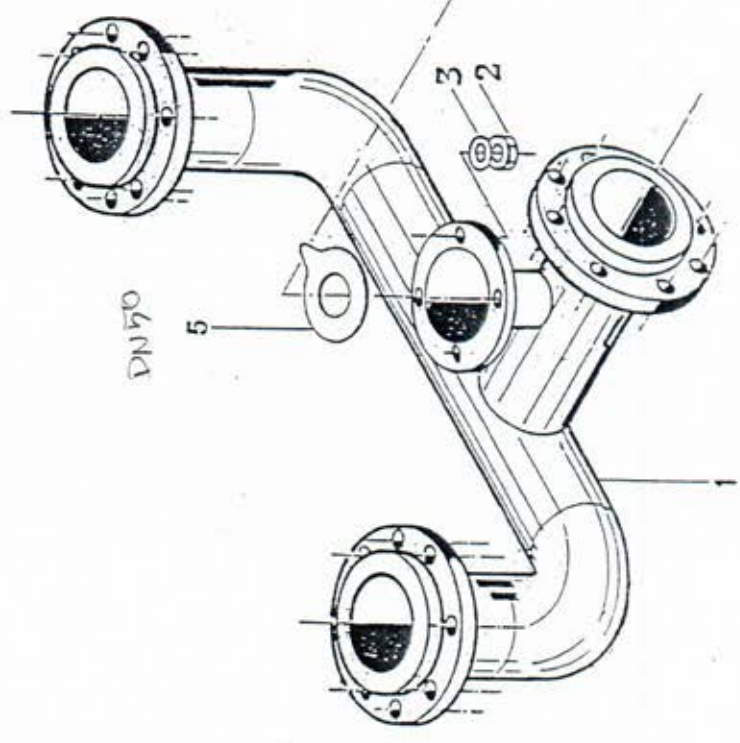
TABLE M - DELIVERY PIPE ASSEMBLY

POS.	DESCRIPTION	CODE
1	Delivery pipeline	BBI00100F00
2	Plane gasket DN 100	1140W10L100
3	Right compensating vessel	ACI50000F00
4	Left compensating vessel	ACI50000F10
5	Nut M 16	1021010A216
6	TE screw M 16 x 60 UNI 5737	1001010A452
7	Pressure gauge supporting hose	ACA00300I00
8	Pressure gauge 0-25 bar	0702A00256G
9	Gasket 10X19X1	1139L020010
10	Pressure switch CS7/20	47032041000
11	Screw M 4 x 20	10010I0A020
12	Plane gasket DN 100	1140W10L100
13	Washer Ø16	10310100016
14	Screw M 16 x 90 UNI 5737	1001010A464

№ документа	311А
Исполнение	01
№ чертежа	1
№ документа	311А
Исполнение	01
№ чертежа	1



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311А

1.56

TABLE N - SUCTION PIPE ASSEMBLY

POS.	DESCRIPTION	CODE
1	Suction pipe	BBI10000F00
2	Nut M 16	1021010A216
3	Washer DN 16	1031010010
4	Screw TE M 16 x 60 UNI 5931-67	1001010A452
5	Flat gasket with tongue DN 50	1140W10L050
6	Suction pressure vessel	ACI30000F00
7	Straight connection 1/4" M for Rilsan pipe diam. 6-8	151L0208080
8	Nonreturn valve	23C1I3C1080

LAVRION - 550 MW

1 x 309 E COMBINED CYCLE POWER PLANT

SPARE PARTS LIST
FOR WASTE WATER TREATMENT PLANT

- Contractual spare parts L1
- First emergency spare parts
(all parts required during assembly and commissioning) L2

(B)

SPARE PARTS LIST
FOR WASTE WATER TREATMENT PLANT

CONTRACTUAL SPARE PARTS (L1)

- (1) The Supplier shall give a detailed analysis with the respective unit prices
- (2) In the term "piping" are included pipes, fittings, expansion joints, hangers supports, anchors, relevant bolts, etc...
- (3) See attached list (See pages B.0 - 140, 141, 149, 152)

M.

Project: ...
 Drawing: ...

Page: 20
 Date: 03.3.98
 Rev.:

Item No	Description	Quantity	NEU	Des x Unit	Conv. Des x Unit
11.3	For each valve Gasket between body/bonnet (min. two of each type) Gasket between stem and bonnet Ring gasket (min. two of each type)	1			
11.4	Maintenance and equipment maintenance Boxes of packing for stem Maintenance accessories Packing for valves	1			
11.5	For each type manual globe valve and gate valve to be installed Complete globe valves Packing Complete gate valves Packing	1			
12.	CONTROL VALVES For each valve Packing	1			

[Handwritten signature]

Item	Description	Quantity	Unit	Cost	Remarks
IV.	ELECTRICAL EQUIPMENT FOR THE D.C. AND THE BALANCE OF THE BLOCK				
1.	Measurements				
1.1	Sensors and transmitters (battery and analog)				
1.2	Analyzers				
2.	Control systems				
3.	Power supply systems				
4.	Communication systems				
4.1	Control systems				
4.2	Power supply systems				
4.3	Communication systems				
5.	Other equipment				

JV 30



**TERMOKIMIK
CORPORATION**

IMPIANTI E PROCEDIMENTI
INDUSTRIALI SPA

SPARE PARTS LIST

Following is a preliminary list of proposed SPARE PARTS.
Detailed Spare Parts Lists will be submitted during detail engineering.

Commissioning Spare Parts

Our supply will include the following commissioning spare parts:

1) Centrifugal pumps and air blowers:

1 set of gaskets for each type of pump and blower fitted in the plant.

2) Metering pumps:

1 set of gaskets for each type of metering pump fitted in the plant.

3) Valves:

1 diaphragm for each size of diaphragm valves fitted in the plant
1 seal seat for each size of butterfly valves fitted in the plant
1 set of gaskets and O-rings for each type of actuator fitted in the plant
2 solenoid valves

4) Instrumentation:

1 spare pressure gauge for each type of pressure gauge fitted in the plant.
1 spare level switch for each type of level switch fitted in the plant.
1 sight glass for each flow meter fitted in the plant.
2 limit switches

5) Vessels:

1 sight glass for each type
20 bottom strainers for each type
1 set of gaskets for manholes and sight glass.

6) Control Panel:

1% of the total quantity and type of relays, switches, signalling lamps and pushbuttons fitted in the panel.