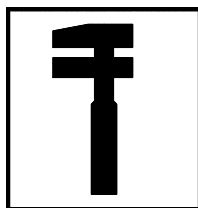


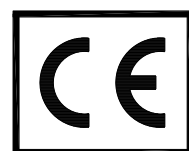
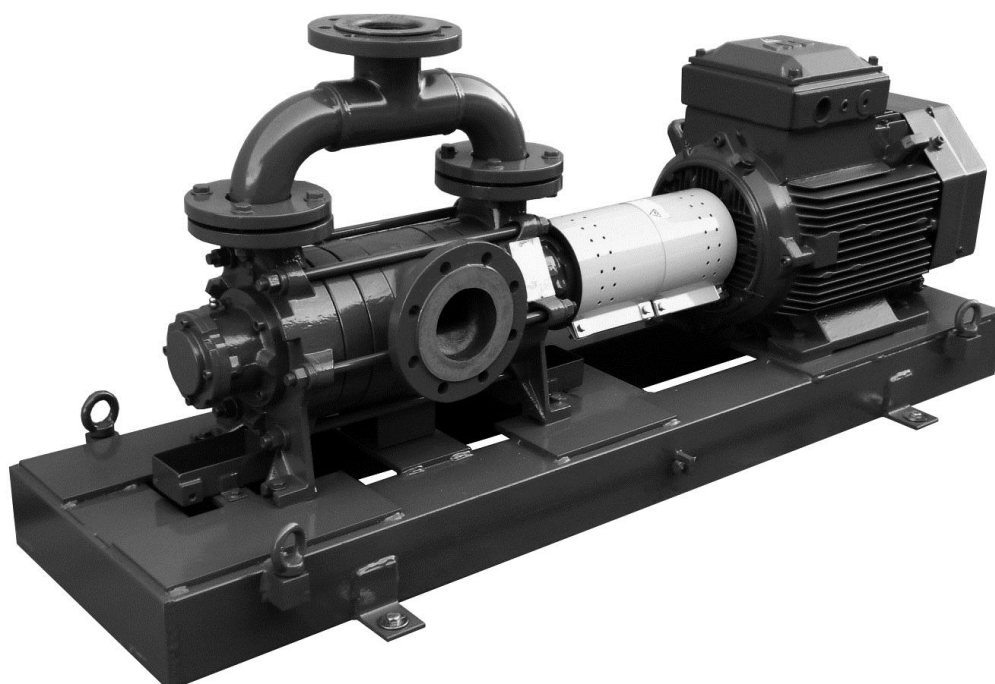
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(Rev. 2.0_10-2010)



DISASSEMBLY AND ASSEMBLY INSTRUCTIONS FOR SELF-PRIMING MULTISTAGE CENTRIFUGAL PUMPS

TBH & BT 1000/2-C



INTRODUCTION

These instructions are for the maintenance personnel for maintenance and repair of self-priming multistage pumps series TBH & BT 1000/2-C.

Disassembly and assembly procedures should be carried out by qualified personnel. Prior to working on the pumps the maintenance person should be fully knowledgeable of the material outlined in this manual. Instructions relating to safety of operation, installation and maintenance will be found in the "OPERATING MANUAL FOR CENTRIFUGAL PUMPS" which is usually supplied with the pump or it can be requested from your POMPETRAVAINI representative.

Proper attire is necessary prior to beginning any work on the pumps. Therefore, for your safety, always wear safety hat, eyeglasses, gloves, shoes etc. and be sure to have proper tools necessary for the work to be done.

Do not force or subject pump or any of its components to sudden shocks or violent impact. Do not damage with markings or scratches the mechanical seal surface areas, the engagement surfaces and sealing areas. Do not damage gaskets, and O-Rings. Do not leave in the pump foreign matter such as screws, nuts, bolts, washers, rags, etc.

When requesting spare parts or technical information for the pump, always quote the pump model number and serial number which is printed on the pump nameplate: therefore it is recommended not to remove the pump nameplate or, in case this action will be necessary, write the serial number on the pump (for example on the flange).

Should additional information be required, please do not hesitate to contact POMPETRAVAINI or the closest representative. Should there be any difficulties in repairing the pump, it is recommended to send the pump for repair to POMPETRAVAINI or the local authorised representative.

POMPETRAVAINI will not and cannot be responsible for work done on the pump by the customer or non-authorised personnel.

NOTE: Pump parts are identified by item numbers (VDMA). Item numbers can be found in the parts list under chapter 10 and cross-referenced with the sectional drawing under chapter 11.

All drawings given in these instructions are only schematics and not certified.

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The liquids and gas handled by the pumps and also their parts could be potentially dangerous for persons and environment: provide their eventual disposal in conformity with the laws into force and a proper environment management.



The present manual is not assigned for pumps subjected to the ATEX 94/9/CE directive. In case the pump is assigned in environments subjected to the application ATEX 99/92/CE directive or in case the pump is provided with a nameplate indicating the ATEX stamp, it is strictly forbidden proceed to start up the pumps but necessary to consult POMPETRAVAINI for clarifications.

For pumps subjected to the ATEX 94/9/CE directive it is available a dedicated integrative manual.

In preparing this manual, every possible effort has been made to help the customer and operator with the proper installation and operation of the pump. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.

1 – PREPARATION PRIOR TO PUMP DISASSEMBLY

In the event pump repair is necessary, it is important to be familiar with work to be carried out. See also “Operating Manual for Centrifugal Pumps”.



FOLLOW THE SAFETY PRECAUTIONS LISTED IN CHAPTER 2 OF ABOVE MANUAL.

Prior to working on the pump it is important to:

- wear safety attire (hat, glasses, gloves, shoes, etc.)
- disconnect electrical power and, if required, disconnect electrical cable from motor terminal box
- close valves at pump suction and discharge side
- allow pump to cool down if it has been handling hot liquids
- follow safety precautions if hazardous fluids have been handled by the pump
- drain pump casing of any handled liquid through the draining connections and, if required, rinse the pump with neutral liquid.

If it is necessary to remove pump and motor from installation, proceed as follows:

- remove flange bolts from pump suction and discharge connections
- remove the coupling guard
- remove the spacer coupling, if applicable
- if it is required to remove the motor, remove bolts from the motor feet or (in case of monoblock design) from the motor flange, then remove the motor
- remove bolts from the pump feet
- remove the pump from the baseplate.

2 – DISASSEMBLY FOR BEARINGS AND/OR MECHANICAL SEALS REPLACEMENT

The pumps are designed to allow replacement of ball bearings, sleeve bearings and mechanical seals without total pump disassembly. Therefore it is possible to leave the pump in place without disconnecting the piping or removing the pump from the installation.

Disassembly should follow the steps as outlined for the specific type of pump design.

NOTE: Adopt extra care to prevent damaging of mechanical seal faces and seal components during disassembly.

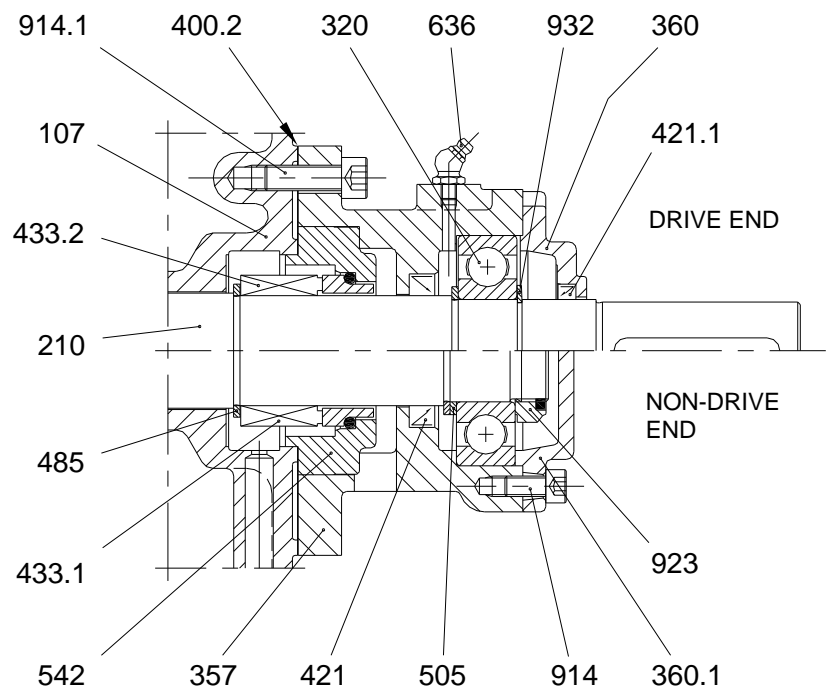


Fig.1 - Sectional drawing mechanical seal and bearing housing

(See fig. 1 for reference to item numbers).
NOTE: this pump has free floating impellers VDMA 230 therefore the replacement of bearings VDMA 320 and mechanical seals VDMA 433.1 or 433.2 can be done one site at a time

Remove bolts VDMA 914, bearing cover VDMA 360 or 360.1, shaft snap ring VDMA 932 or shaft nut VDMA 923, bolts VDMA 914.1, bearing housing VDMA 357 with insert VDMA 542 (with help of gear puller), ball bearing VDMA 320, spacer(s) VDMA 505, remove the radial seal ring VDMA 421 and finally the mechanical seal VDMA 433.1 or 433.2.

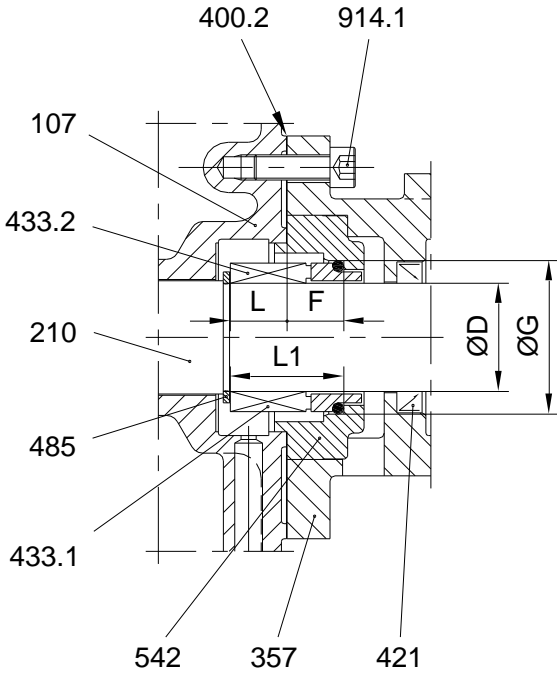
NOTE: To remove macahnical seals that are located on pump shaft by means of set screws, manifold VDMA 147 and discharge casing VDMA 107 with fitting VDMA 731.3 must be removed as well.

Inspect all removed components, obtain original new components such as bearings, mechanical seals, gaskets, etc.
To install mechaniacal seals and or bearings follow instructions in chapters 3 and 4.

3 – MECHANICAL SEALS ASSEMBLY

NOTE: Standard pumps are fitted with mechanical seals unified to DIN 24960/K standard having short working length “L1”. For dimensions of non-unified mechanical seals, contact POMPETRAVAINI or the closest representative.

Check following dimensions prior to fitting mechanical seals VDMA 433.1 and 433.2:
Dimensions “G” and “F” on seal insert VDMA 542, diameter “D” on shaft VDMA 210, dimension “L” from casing VDMA 107 to spacer VDMA 485. Dimensions should be as given by fig. 2 and table 1.
If corrections must be made to retain the given seal working length “L1” (=“L + F”), any adjustments must be made through spacer VDMA 485 or (where possible) on the shaft VDMA 210.



Tab. 1 – MECHANICAL SEAL DIMENSIONS

PUMP SERIES	Ø D h6	F	Ø G H8	L	L1 ±0,5
TBH & BT 1000/2	43	22.5	61	22.5	45

Fig. 2 - Typical mechanical seal with locating dimensions for either pump end (Drive and Non-Drive)

3.1 - FITTING SEAL STATIONARY PART IN BEARING HOUSING

Fig. 3

The seating area for the seal stationary part and its edges should be perfectly clean and free of tool or machining markings. Lightly wet the seating area and the O-Ring for the seal stationary part using water, soapy fluid, Vaseline, etc., avoid the use of oils. Press the seal stationary part (with O-Ring in place) in the seal housing seating area with the help of a plug having the face protected with a soft material such as plastic or paperboard. Applied force should be vertical to the axis of the part. A harbour press or the shaft of a drill press can be used for this operation, see fig. 3.

3.2 - FITTING SEAL ROTATING PART OVER THE SHAFT

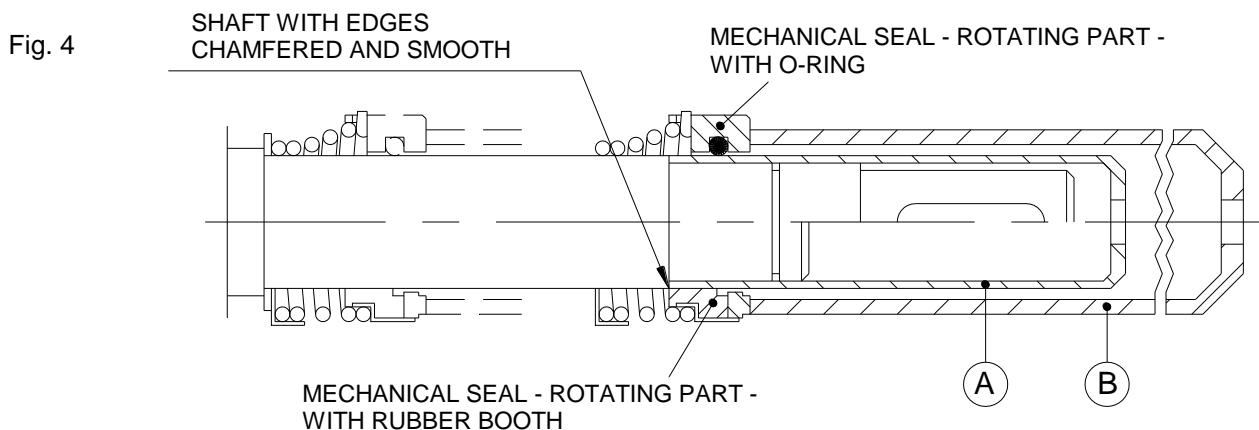
The mechanical seal areas over the pump shaft should be clean, smooth and without sharp edges.

Polish such areas with an extra fine emery cloth prior to applying lubricating fluids such as water, soapy fluid or Vaseline (do not use oils).

Slide seal retainer VDMA 485 over the shaft, slide the total seal rotating part over a conical guiding sleeve "A" or similar tool to help fit the seal over the shaft (see fig. 4), sleeve should also be lubricated with the above mentioned fluids.

The seal rotating part can then be pushed over the shaft by hand or using a sleeve "B" till it rests against the retainer VDMA 585.

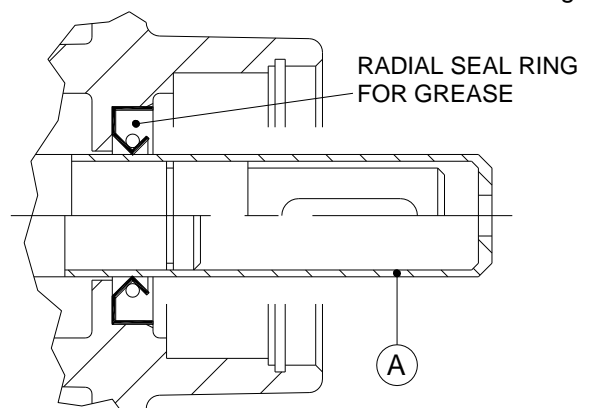
NOTE: Mechanical seals with conical single springs are designed for a single rotational direction, therefore they must be fitted on pump side which has the proper direction or rotation.



If mechanical seal is the type to be locked on the shaft by means of set screws, first locate the seal on the shaft then install pump discharge casing VDMA 107, tighten fitting VDMA 731.3, attach manifold VDMA 147.

Install bearing housing VDMA 357 complete of radial seal ring VDMA 421 (see fig. 5), seal seat VDMA 542 (where applicable), seal stationary part VDMA 433.1 or 433.2 and gasket VDMA 400.2. Bolts VDMA 914.1 should be tightened to pump casing VDMA 107.

NOTE: Bearing housing draining opening should be at bottom (6 o'clock location).

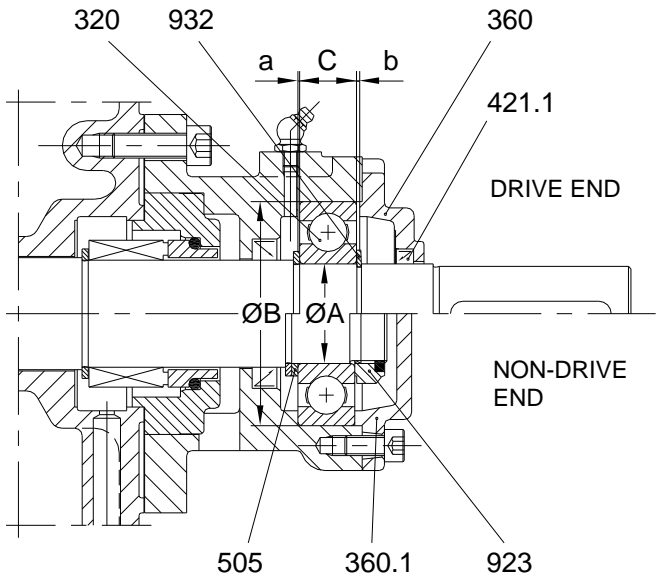


4 - BEARING ASSEMBLY

Bearings can only be fitted after the mechanical seals are in place and the bearing housings are secured per chapter 3

(See fig. 6 for parts identification).
Insert on shaft the previously removed spacer ring VDMA 505, push bearing VDMA 320 over the shaft (see tab. 2 for dimensions), for drive end side install Seeger ring VDMA 932, for the non-drive end side install shaft nut VDMA 923, install bearings covers VDMA 360 or 360.1 and secure with bolts VDMA 914.

Fig. 6
"STANDARD" bearing design



Tab. 2
BEARING DIMENSIONS

PUMP SERIES	a	b	BEARING DIMENSIONS				GREASE QUANTITY FOR BALL BEARING in grams
			Ø A	Ø B	C	BALL BEARING TYPE	
TBH & BT 1000	1	1	40	90	23	6308	20

5 - PUMP DISASSEMBLY

Complete pump disassembly becomes necessary if, for example, there is an excessive wear of impellers which would prevent the pump from performing as expected or if the shaft is excessively damaged in the seal areas causing leakage of the pumped liquid.

Replacing or machining the worn out parts will be a question of economics and/or time available to complete the repair. In this chapter a pump without bearing housing and/or sleeve bearing housing and without mechanical seals will be considered (see fig. 7). Disassembly and assembly of these components have been addressed in chapters 2, 3, & 4.

NOTE: Where the mechanic is not familiar with the pump, it is advisable to draw a reference line along the pump. Mark each part with its location, rotation and assembly sequence; however the main components are already marked at the external upper part with reference logs to provide the proper position (see chapter 8). From the suction casing VDMA 106 those Suction and Discharge Elements going toward the NON-DRIVE-END are called right hand, those going toward the DRIVE END are called left hand.

Disassembly work should be carried out with proper tools and using suitable disassembly sequence to prevent further damage to the pump parts.

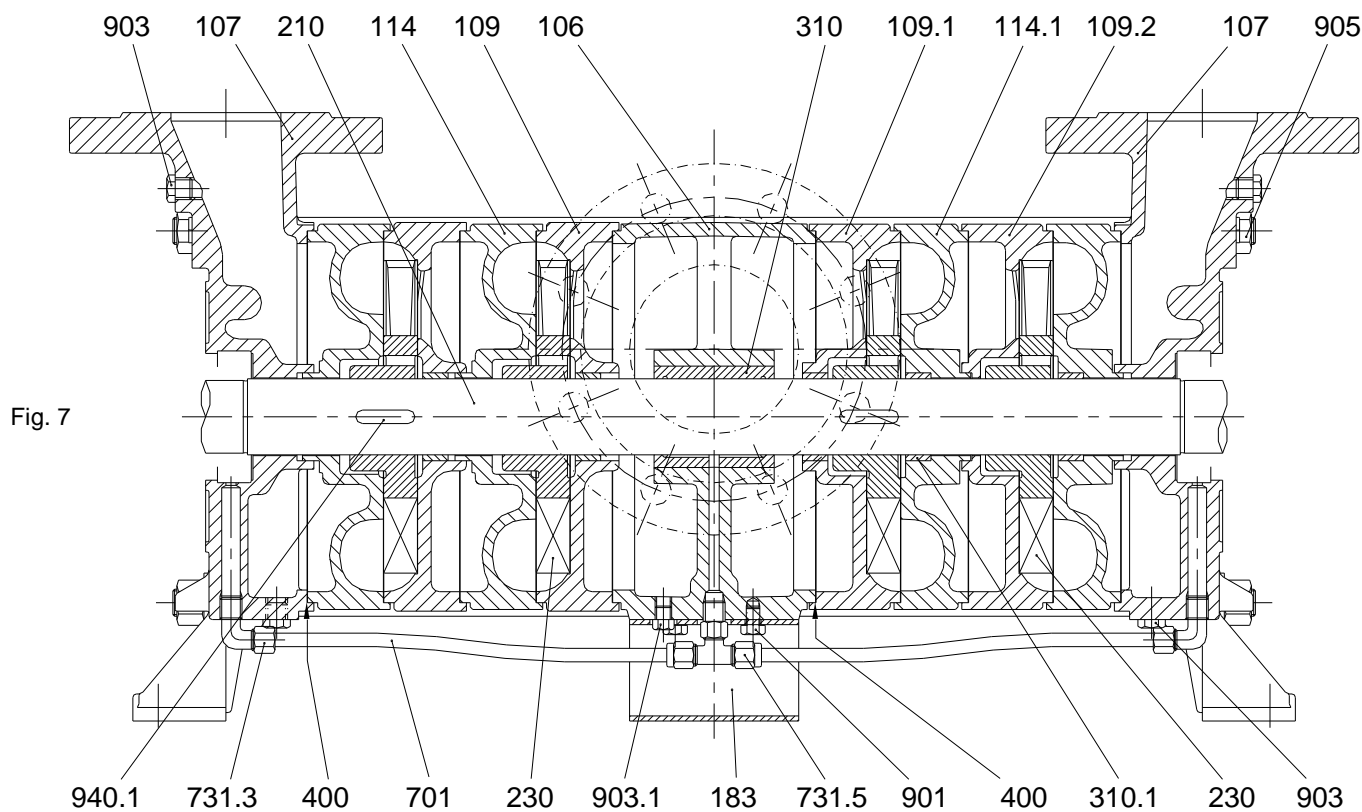


Fig. 7

First remove bolts VDMA 901.8 then remove manifold VDMA 147, tie-bolts VDMA 905 and tubing VDMA 701. Remove discharge casing VDMA 107, the left hand discharge and suction elements VDMA 114.1, 109.2 & 109.1. Then remove suction casing VDMA 106, the right hand suction & discharge elements VDMA 109 and 114, the other discharge casing VDMA 107.

6 - MACHINING AND REVISION OF PUMP PARTS

Machining of internal parts is usually required to remove grooves and/or deformation of working surfaces hence to rebuild the proper internal clearances. Material removal from the surfaces should be minimal and only to reset the proper clearances. Impeller VDMA 230 can be machined on both faces 3 and 4 (if required), max material removed each face not to exceed approximately 0,3 mm (see tab. 4 for nominal dimension "A" for impellers).

The surfaces 1, 2, 5, & 6 of the intermediate plates VDMA 109 and 114 (see fig. 8) can also be machined max. 0,3 mm each.

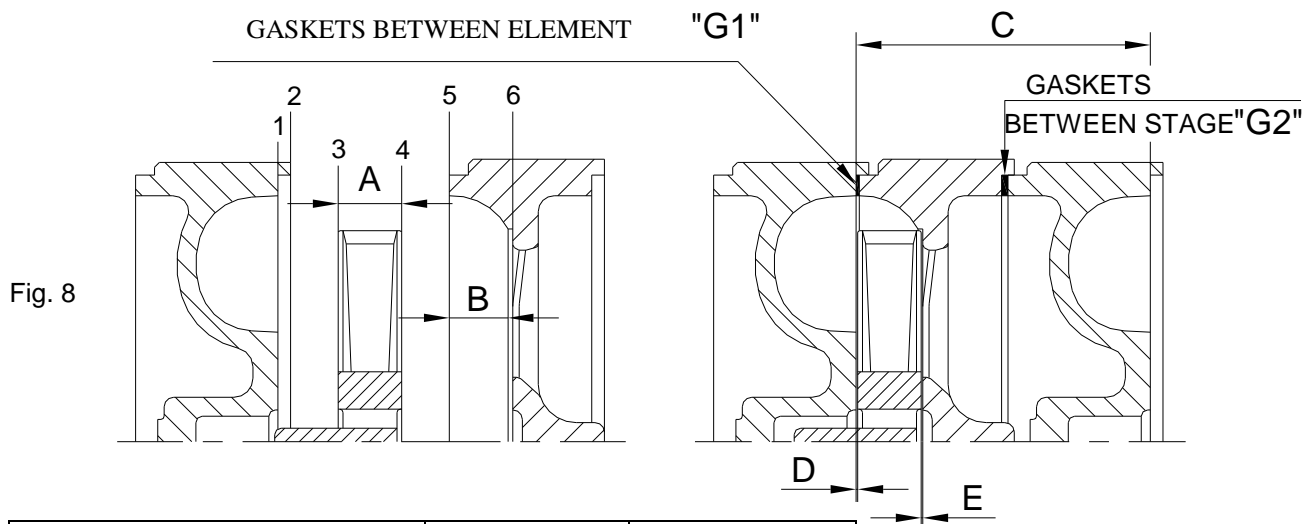


Fig. 8

CONSTRUCTION		GH – RA	A3
GASKETS "G1"		n° 1 x 0.1 mm	n° 1 x 0.25 mm
GASKETS "G2"			
PUMP SERIES		TBH & BT 1000	
TOTAL CLEARANCE (mm) "D + E"	MIN.	0.07	0.022
	MAX.	0.13	0.028

Tab. 3

CONSTRUCTION	GH - RA - A3
PUMP SERIES	TBH & BT 1000
"C" in mm	90.2
"A" nominal in mm	20

Tab. 4

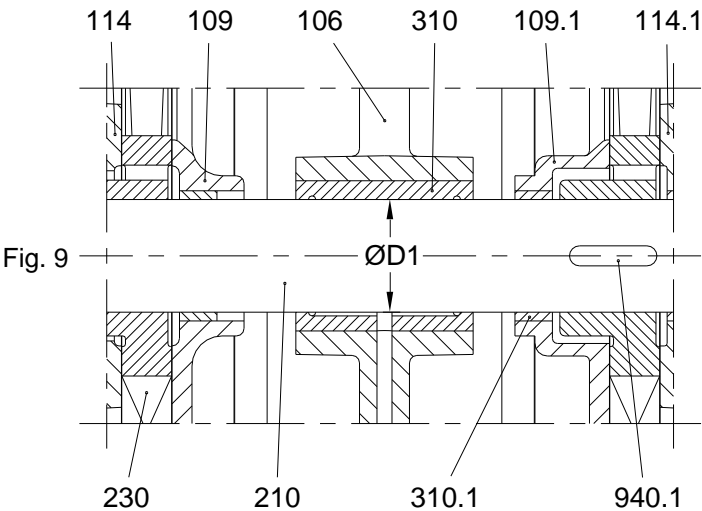
Machining of faces 1-5-6 must be such that total clearance “D + E” given in tab 3 is maintained. Total clearance “D + E” is obtained by subtracting dimension “A” from dimension “B” and then adding thickness of gasket “G1”.

NOTE: Impellers are free floating on the pump shaft, impellers will find their centre by hydraulic forces once the pump is started therefore clearances “D” and “E” will become of equal value.

Machining of pump parts will result in a decrease of total pump length. If the total decrease of pump length is more than 1 mm pump there may be problems in reassembling the pump, therefore each pump stage must keep dimension “C” value per tab. 4.

Dimension “C” can be corrected by increasing the thickness of gasket for clearance “G2” or adding more gaskets as shown in fig. 8.

CAUTION: Machining of the components will result in a decrease of pump performance, decrease is relative to the decrease of impeller nominal dimension “A”.



Tab. 5
INSIDE DIAMETER OF BUSHINGS VDMA 310 & 310.1
AS FITTED IN SUCTION CASING AND ELEMENTS
(see fig. 9)

PUMP SERIES	Ø D1	MATERIAL
TBH & BT 1000	45 B9 +0.242 +0.180	Bronze & Carbon

7 - PUMP ASSEMBLY

Inspect every pump component making certain that they are in good condition. If the parts are in acceptable condition, proceed with cleaning procedure using suitable cleaning products. Those parts that are reusable but require machining should be reworked as discussed in chapter 6.

When mixing new original parts with used and re-machined parts, make sure that the dimensions of the later are compatible with those from the original parts. For recommended spare parts see chapter 9.

For mechanical seals assembly see chapter 3. See sections in chapter 11 for identification of the item numbers.

NOTE: Assembly sequence given below assumes that the pump is completely disassembled.

- 1 - Place the pump shaft VDMA 210 in a bench vice vertically and with the drive side downward. Insert on the shaft the seal retaining ring VDMA 485. Lubricate shaft and seal rotating part VDMA 433.1 with compatible liquid then insert rotating part of mechanical seal over the shaft. If mechanical seals are with conical springs designed for one specific rotation, the seal to be mounted here is the one for C.C.W. or left hand shaft rotation. Where applicable, press fit seal seat holder VDMA 542 in the bearing housing VDMA 357. Insert radial seal ring VDMA 421 in bearing housing VDMA 357. Lubricate (with suitable fluid) the mechanical seal O-Ring and press fit the stationary part into the bearing housing VDMA 357 or seal seat holder VDMA 542.
- 2 - Clean the 2 mechanical seal faces. Insert over the shaft the bearing housing and keep compressed the mechanical seal spring.
- 3 - Insert spacer VDMA 505 over the shaft. Fit the bearing VDMA 320 on the shaft until it bottoms against the shaft shoulder, block the bearing with shaft nut VDMA 923. Place the bearing cover VDMA 360.1 on the bearing housing and lock it in place with bolts VDMA 914. Remove shaft from vice.
- 4 - Place gasket VDMA 400.2 on the bearing housing then slide shaft and bearing housing assembly in the discharge casing VDMA 107, then tighten the assembly to the casing with bolts VDMA 914.1. Make sure the draining opening of the bearing housing is located at the bottom in same direction of pump feet.
- 5 - Place the assembly in the vertical position resting on bearing cover VDMA 360.1 and the pump casing flange toward you. Place the gasket “G2” VDMA 400 on the discharge casing keeping it in place with a few drops of compatible oil (see tab. 3 and 4 for gasket thickness and clearances).

- 6 – Place discharge right element VDMA 114 on discharge casing VDMA 107 as indicated in the assembly schematic and based on the pumps number of stages (see chapter 8).

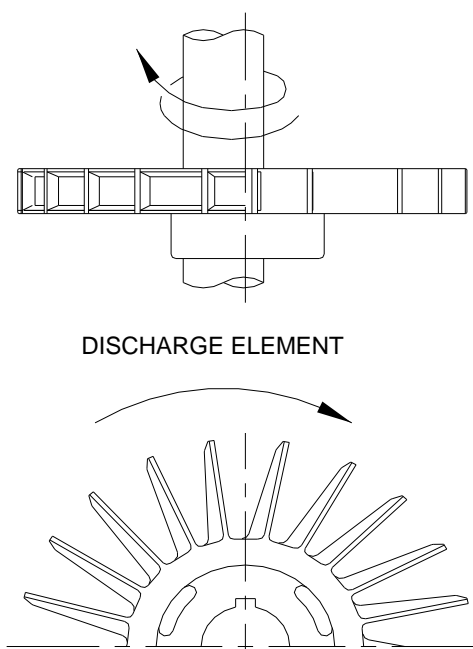
NOTE: This schematic allocates the rotation of stage sets (suction/discharge elements) depending on the number of pump stages, keeping in mind that every stage set, made by one suction and discharge plate plus the impeller, must be placed with the elements matching marking grooves lined up with each other.

Fit on the shaft the key VDMA 940.1 for the first impeller VDMA 230. Slide the impeller on the shaft with the impeller hub pointing down so that flat part of the blades is facing the pump rotation, in other words the impeller blades must “bite” into the liquid when rotating, see fig. 10.

NOTE: The key VDMA 940.1 must fit perfectly in the impeller key-way but the impeller must be allowed to freely slide over the shaft.

Place gasket “G1” VDMA 400 on the right discharge plate VDMA 114, then add the right suction plate VDMA 109 with the 2 reference grooves lined up.

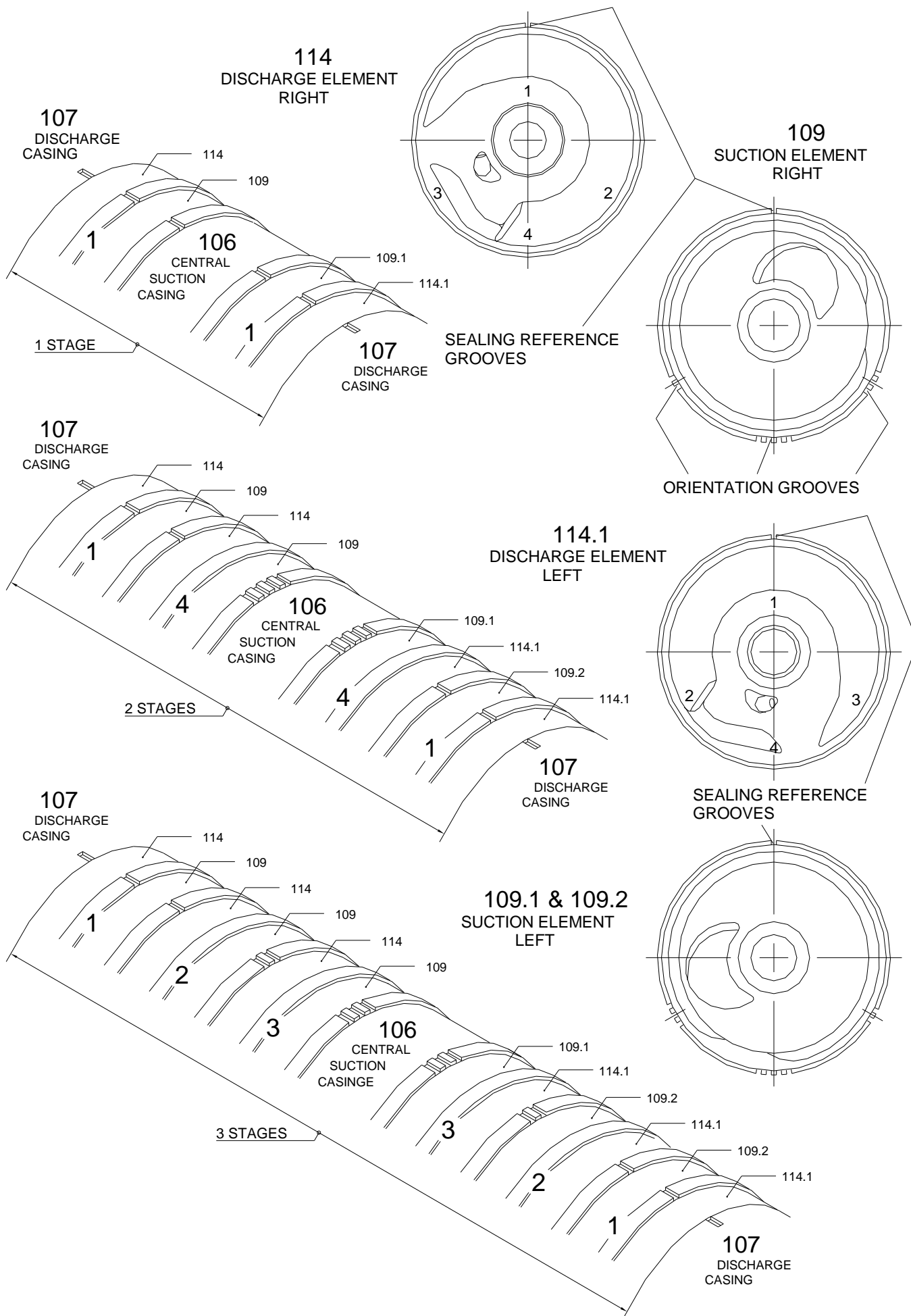
- 7 - At this point the steps from point 6 will be repeated as many times as the number of stages to be built. Carefully place the orientation of the suction and discharge plates as illustrated in the schematics of chapter 8.
- 8 - Introduce the suction casing VDMA 106 with flange in the horizontal position and at right side of flange from discharge casing VDMA 107. Starting fitting the left suction element VDMA 109.1, add key VDMA 940.1, impeller VDMA 230, Gasket VDMA 400, left discharge element VDMA 114.1. Continue the assembly of gaskets, suction elements, keys, impellers, discharge elements as per sections 6 and 7 but with the left elements until the discharge casing VDMA 107.
- NOTE: In case mechanical seal is the type to be affixed to the shaft by means of set screws, prior to installing discharge casing VDMA 107, it is necessary to fit seal retaining ring VDMA 485 on the shaft as well as the rotating component of mechanical seal VDMA 433.2.
- Install the tie bolts VDMA 905 and tighten the nuts finger-tight. Place the pump horizontally on its feet on a flat base for alignment. Torque the tie bolts with a torque wrench. Torque values are listed in tab. 6.
- 9 - Fit seal locating ring VDMA 485 over the shaft, verify that the distance from the shaft shoulder holding the seal and the external face of the discharge casing VDMA 107 is given on tab. 1. Lubricate with compatible oil and insert rotating part of seal VDMA 433.2 over the shaft until it rests against the locating ring. If the mechanical seal is not bi-directional type, the seal should be suitable for C.W. (right) rotation. Lubricate the O-Ring of the seal stationary part VDMA 433.2 and press-fit it in the bearing housing VDMA 357. Clean both seal faces. Install the bearing housing on the discharge casing VDMA 107 with gasket VDMA 400.2 in between and tighten the bolts VDMA 914.1. Make sure the draining opening of the bearing housing is located at the bottom in same direction of pump feet.
- 10 - Insert the spacer VDMA 505 on the shaft so that the bearing inner ring resting against the spacer will be about 1 mm out in relation to the landing face on the bearing housing for the bearing outer ring. Fit the bearing on the shaft and against the spacer. Fit the snap ring VDMA 932 on the shaft. Place the bearing cover VDMA 360 on the bearing and secure it with bolts VDMA 914.
- 11 - Be sure that the pump rotor rotates freely by hand. Install manifold VDMA 147 on pump discharge casings with proper flange gaskets VDMA 400.8 and lock with nuts and bolts VDMA 901.8. Turn the pump upside down, install central foot VDMA 183 using bolts VDMA 901. Connect “T” fitting VDMA 731.5 to the two elbows VDMA 731.3 on the 2 casings by means of tubing VDMA 701. Hydro-test pump to 1.2 times the maximum attainable working pressure for the pump series (NOTE: not the operating pressure) and make sure that there are no leaks.



Tab. 6
TIE-BOLT TORQUE
VALUES

PUMP SERIES	TORQUE VALUE	
	Kgm	Nm
TBH & BT 1001 (1 stage)	8	78.5
TBH & BT 1002 & 1003 (2 & 3 stages)	8.5	83.4

8 – ASSEMBLY SCHEMATICS



9 - SPARE PARTS

When ordering the pump it is good practice to also order the recommended spare parts, especially when there are no stand-by units in the installation. This will minimise unnecessary down times in the event of pump failure.

Therefore, depending upon the type of pump and the number of pumps installed, the quantity of spare parts to be kept on hand should be determined.

Following are the minimum recommended spare parts:

1	Impeller	1	Set packing, where applicable
1	Suction Plate (Left & Right)	1	Set mechanical seals, where applicable
1	Discharge Plate (left & Right)	2	Sets gaskets
1	Shaft assembly	1	Set of spacers
1	Bearing set		

When ordering spare parts always provide the information printed on the pump nameplate: Pump model, serial number and year of manufacture.

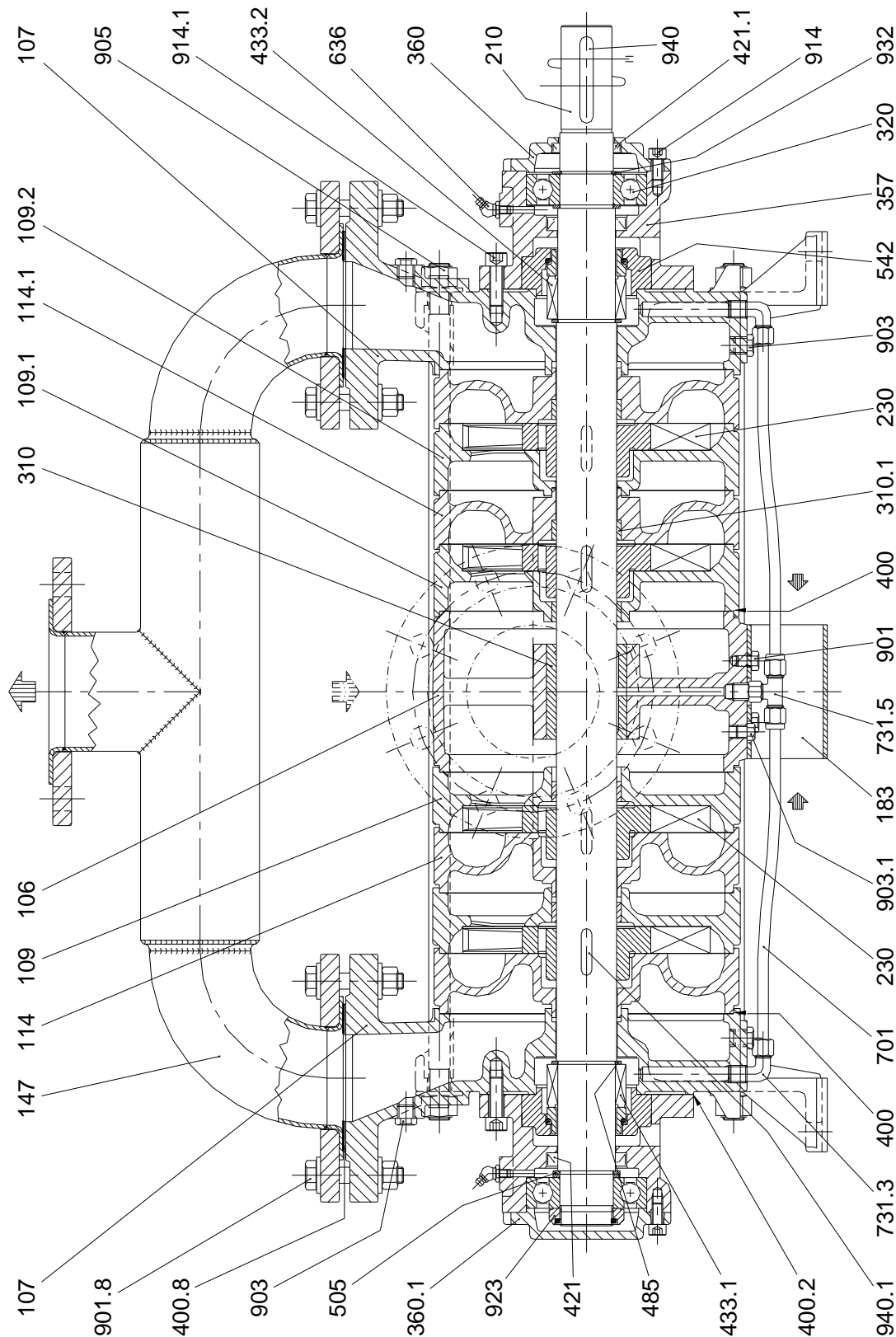
Provide also the part item number, description and quantity required. Sectional drawings and parts list can be found in chapter 11 and 10 respectively.

To avoid losing the manufacturer guarantee, the use of original spares are recommended all the times. POMPETRAVAINI declines any responsibility for pump performance or reliability when parts or repairs are from unauthorized sources.

10 - PARTS LIST

VDMA No.	DESCRIPTION
106	Suction casing
107	Discharge casing
109	Suction plate, right
109.1	Suction plate, left
109.2	Suction plate, right
114	Discharge plate, right
114.1	Discharge plate, left
116...	Cooling half-chamber
147	Manifold
183	Pump foot
210	Shaft
230	Impeller
310	Sleeve bearing
310.1	Sleeve bearing casing
320	Ball bearing
357	Mechanical seal and bearing housing
360	Bearing cover
360.1	Bearing cover
400	Gasket
400.2	Gasket
400.8	Gasket
421	Radial seal ring

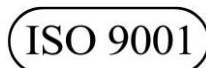
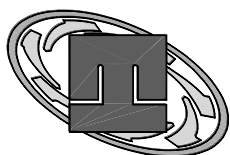
VDMA No.	DESCRIPTION
431.1	Radial seal ring
433.1	Mechanical seal, CCW
433.2	Mechanical seal, CW
485	Retainer ring, mechanical seal
505	Spacer ring, bearing
542	Seal insert
636	Grease nipple
701	Tubing
731.3	Elbow fitting
731.5	"T" fitting
901	Screw
901.8	Bolt
903	Plug
903.1	Plug
905	Tie-bolt with washers and nuts
914	Screw
914.1	Screw
923	Bearing nut
932	Snap ring
932.3	Snap ring for bore
940	Key ,
940.1	Key



Pump model TBH & BT 1002/2 construction /C

NA4.SM.TBT1.1000
Disassembly TBH – BT 1000 English

Continuing research of POMPETRAVAINI results in product improvements: therefore any specifications may be subject to change without notice.



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