



varisco[®]
solid pumping solutions

GB



**Instructions for use and
maintenance of ST-R series
self-priming centrifugal
pumps**

ST-R



Before putting the unit into operation, read the instructions herein carefully.

The unit has been thoroughly tested, for several hours, prior to delivery; performance has been checked and relevant requirements met, within the acceptable tolerance limits.

If the instructions for use and maintenance are observed, the unit will give full performance for a long time. This manual also contains information for the prevention and elimination of most common operating problems.

The following instructions are valid in general for installation, use and preventive maintenance of the pumping unit.

Record the type of pump and its serial number on your documents and quote them when asking for information or ordering spare parts.

Type of pump _____

Serial n° _____

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1 IDENTIFICATION

1.1 Manufacturer

VARISCO S.r.l. - Via Prima Strada, 37 - Zona Ind. Nord - 35129 PADOVA - ITALY

1.2 Type of pump

Horizontal self-priming centrifugal pump with open impeller for handling liquids containing solids in suspension. These pumps can operate satisfactorily with liquids containing air or dissolved gases.

1.3 Model

The model is given on the pump nameplate.

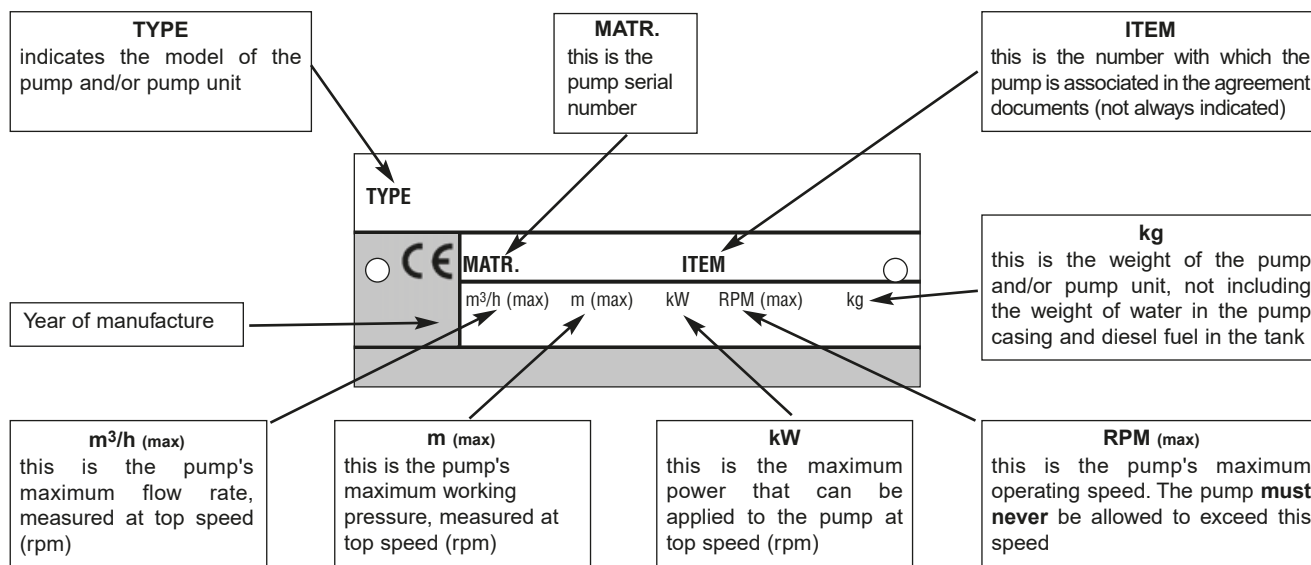
1.4 Year of manufacture

The year of manufacture is given on the pump nameplate.

1.5 Instruction book identification

Edition 2001 Rev.: 01 Code 400

1.6 Nameplate information



Ratings refer to testing with water at 20°C and with a density of 1,000 kg/m³

1.7 Field of application

Pumps are suitable for handling liquids of viscosity up to 50 cSt containing solids in suspension. They are used in industry, civil engineering, shipbuilding, waste water treatment, construction and agriculture.

1.8 In case of breakdown

Call the following number: **+39 049 82 94 111**

2 WARRANTY

- VARISCO S.r.l. warrants that only top-quality materials are used in the construction of their pumps and that machining and assembly are carried out to high standards.
- The company also warrants units supplied, in conformity with general terms of sale, against defective materials or faulty workmanship for a period of one year from the material's date of delivery unless specifically stated otherwise in writing.
- **The warranty is not valid if the unit has been tampered with by third parties.**
- Replacement of parts or of the unit itself can only be carried out after careful examination in an authorized workshop by qualified personnel. The unit should be sent carriage paid.
- This warranty does not cover materials subject to deterioration or normal wear and tear (seals, diaphragms, pressure and vacuum gauges, rubber or plastic items, etc.), electrical material, or damage caused by misuse or improper handling of the unit by the end user.
- Materials replaced under warranty become the property of VARISCO S.r.l..

3 GENERAL INSTRUCTIONS

The goods must be examined on arrival to ascertain any damage, particularly that incurred in transit. Also check that the goods correspond exactly to the description on the transport documents. Any damage or differences must be reported to the forwarding agent straight away on the transport document, and reported to the Manufacturer by means of registered letter with advice of delivery within seven days, or they will not be acknowledged. Always quote the pump type printed on the relevant nameplate, or the serial number.

The pumps must be used only for applications for which the Manufacturer has specified:

- construction materials
- operating conditions (pressure, speed, temperature, etc.)
- fields of application

For any applications not contemplated by the Manufacturer, contact VARISCO S.r.l.'s Servicing Department - Tel. **+39 049 82 94 111**

4 SAFETY RULES AND ACCIDENT PREVENTION

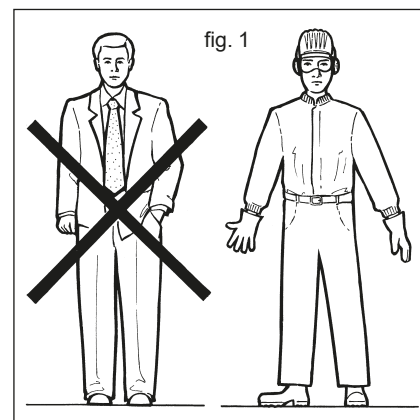
When working near the pumping unit, dress appropriately, avoiding baggy clothes with loose items (ties, scarves, etc.), which could get caught in moving parts. Use overalls made according to safety regulations, gloves, insulating shoes, safety glasses, safety earmuffs and hard hat (fig. 1). Internal combustion engines are fitted with mufflers, but the sound emission level is still high enough to make use of ear protection (PPE) by all operators compulsory.

Do not carry out maintenance on the engine while it is running.

Keep hands away from moving parts (e.g. belts, couplings, etc.).

Keep hands away from parts of the engine that get hot.

Do not climb on top of the pumping unit to perform work of any kind.



5 IN CASE OF EMERGENCY

Disconnect mains power (for motor pumps).

Shut off the engine (for engine-driven pumps).

Notify the person responsible for running the plant.

6 HANDLING AND TRANSPORT

6.1 Method of transport

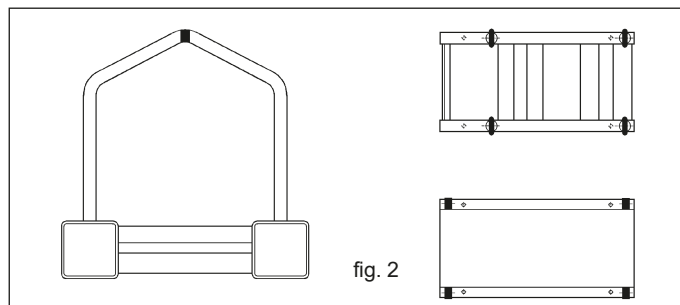
The unit must be transported horizontally and safely

6.2 Installation

During installation and maintenance, all components used must be handled securely using suitable slings. Handling must be carried out by specialized personnel to avoid damage to the pump and injury of personnel.

The lifting points of the various components should be used to lift the pumping unit only.

The lifting points of a few sample base plates are highlighted with a heavy black mark in figure 2.



Maximum lifting speed: $V_{max} \leq 0,5 \text{ m/s}$

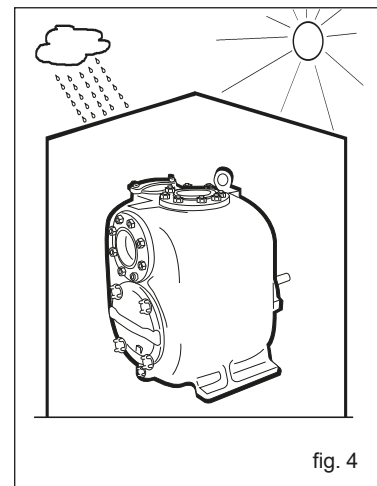
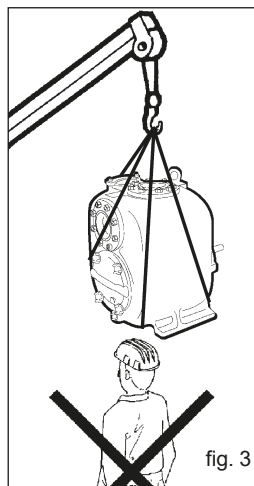
Do not linger or pass under the pump while it is lifted! (fig. 3)

7 STORAGE

Store the pump under cover wherever possible. If the pump must be stored in the open, cover it with a tarpaulin, lubricate bearings to prevent rust (fig. 4).

Prevent moisture from building up around the pump.

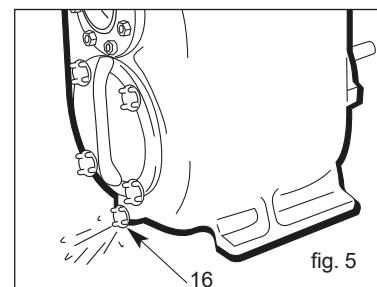
- 7.1 Do not leave liquid in the pump casing. Drain by unscrewing the drain plug (16) in (fig. 5). During winter months and in cold weather, the liquid could freeze and damage the pump. If the liquid is hazardous, take all necessary precautions to avoid damage and injury. At regular intervals, turn the shaft to prevent encrustation inside the pump.**



8 ASSEMBLY AND COUPLING

If the pump is supplied in the bare shaft version (pedestal pump), it must be coupled to the engine, taking account of the following:

- the coupling must be suitable for the power to be transmitted.
- the coupling must be aligned properly (see sect. 10).
- the coupling guard must comply with applicable safety standards.
- rated power of the engine.
- power absorbed by the pump (see engine's rating plate).
- engine speed (see engine's rating plate).
- pump speed.



9 INSTALLATION

The base plate of the engine- or electrically-driven pump unit must be anchored on a levelled concrete slab into which anchor bolts have been embedded following the layout supplied with each unit, or available on request. The slab must be heavy duty to absorb any vibration and rigid enough to maintain the alignment of the pump to the motor or engine

9.1 Assembly

When anchoring the base plate to the slab, we recommend you check levelness with the aid of a level placed on top of the pump delivery port flange.

If adjustments are required, always adapt the surface of the slab to the base plate, and **never** the base plate to the slab.

9.2 Pipework

Clean pipework thoroughly before connecting it to the pump.

Suction pipes must have the same diameter as the pump suction port (for larger diameters, seek Varisco's advice). Where possible, avoid curves, elbows or constrictions liable to limit the flow of liquid to the pump. Do not fit the foot valve: the pump comes with a built-in nonreturn valve (14.1) (fig. 9). Install the pump as near to the liquid to be pumped as possible. Where possible, try to reduce the length of the suction pipe. Suction pipe connections must be completely airtight: check pipe threads, flange gaskets, quick couplings etc..

The delivery pipe must let air escape from the system while the pump is priming.

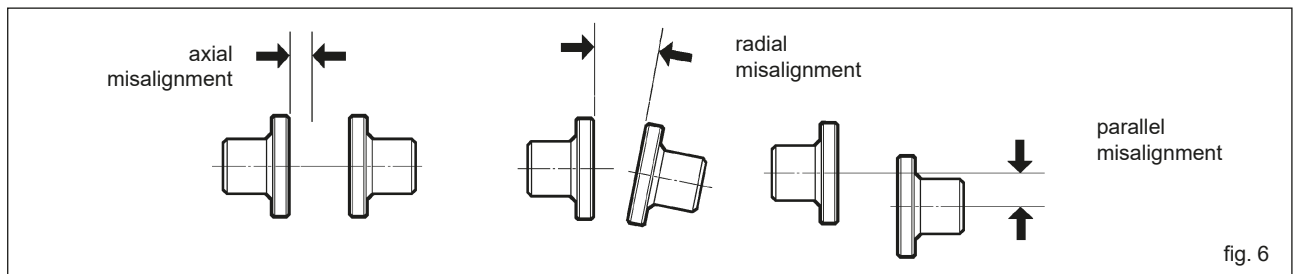
The suction and delivery pipes must be fitted so that they do not cause strain on the pump casing. The engine-driven pump units must have lengths of flexible rubber hose to isolate pipework from vibrations generated by the internal combustion engine.

10 ALIGNMENT

Before operating the pump, it is essential you make sure the unit's components (coupling/engine-motor) are aligned.

For units with a base plate, exact alignment is performed at the factory. Nonetheless, when the pump is delivered to the installation site, alignment must be rechecked:

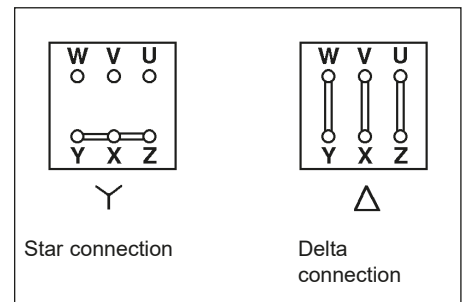
- set the base plate down on the surface of the slab, inserting the anchor bolts in the base plate's holes without tightening the nuts all the way.
- remove the coupling guard.
- tighten the anchor bolt nuts and recheck alignment as illustrated in figure 6, and adjust them, depending on the type of coupling, as specified in sections 13.10; 13.11; 13.12.
- replace the coupling guard before starting the pump.



11 WIRING

Wiring should be performed by specialized personnel only.

- Comply with instructions issued by the manufacturer of the motor and electrical equipment.
- **Connect the motor's earth correctly and make sure the electric motor is protected by a suitably rated overload cutout.**
- Three-phase electric motors are usually supplied for connection to a 380V supply (star connection). For a 220V supply, connect the electric motor's terminal strip in a delta configuration as indicated on the diagrams.
- Special voltage motors may be supplied. In this case, follow the instructions supplied with the motor.
- Make sure wire cross-sections are suitable for the amperage.

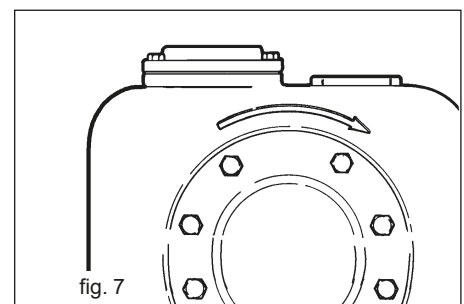


11.1 Direction of rotation

- Once wiring is complete, close the delivery line gate valve and make sure direction of rotation is correct as indicated by the arrow marked on the pump casing in fig. 7.
- If the pump rotates the other way, swap over two of the three supply wires.

On request, pumps due to pump brackish water can be supplied with a galvanic corrosion-inhibiting device, which consists in a series of zinc discs fastened on the covers. Every 1,000 hours, you must check the zinc's state of repair and, where necessary, replace.

While the pump is running, check the electric motor's demand, which must never exceed the rated value.



12 STARTING

Before operating the pump, check that electrical and mechanical parts of the system have been correctly installed.

Make sure all safety devices are operative.

Make sure the pump's direction of rotation is correct (section 11.1)

Check the seal and bearing oil level by means of the oil level sight glasses on the support (fig. 7a)

The seal is an oil-immersed model (Mobil Delvac SAE 15W-40.), and should be replaced after 5,000 hours of operation, or once a year.

Topping up oil

Top up oil using cap (1) for the seal and cap (2) for bearings.

Pour in oil until it is half way up oil level sight glass (6) for the seal and oil level sight glass (3) for bearings.

Draining oil

Drain oil using plug (5) for the seal and plug (4) for bearings.

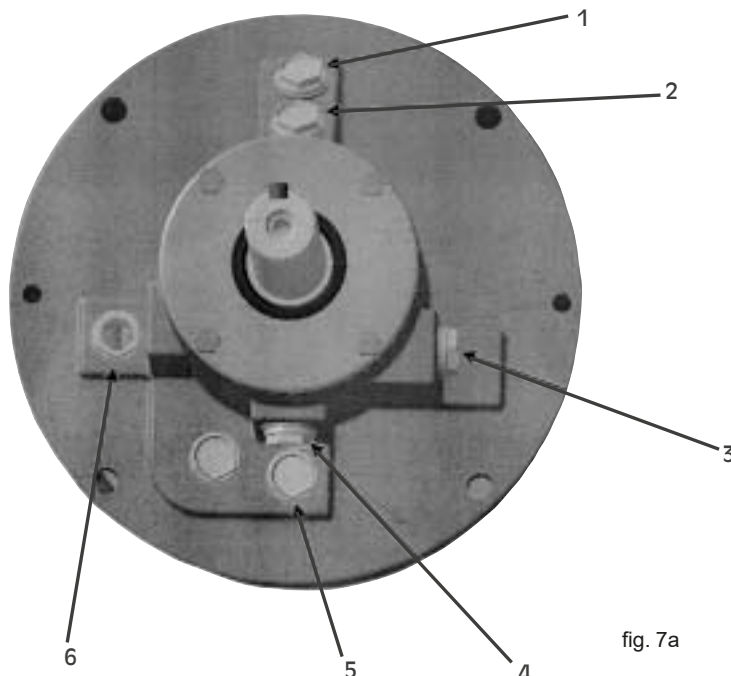


fig. 7a

12.1 Filling the pump casing

Fill the pump casing completely with the liquid to be pumped through the relevant hole on the top of the casing (fig. 8).

With the pump stopped, the casing does not empty, meaning you do not need to fill it.

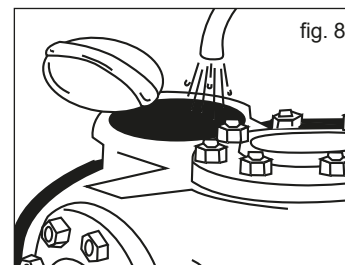


fig. 8

12.2 Priming

Warning: if the pump does not prime, do not operate it for more than 3 minutes to avoid overheating the liquid. If the pump does not prime, refer to section 14.1

Engine-driven pumps should be brought up to running speed gradually. **Never** change the accelerator lever limit stop: at speeds higher than those for which the engine is set, the pump absorbs more power than the engine can supply.

Never exceed the maximum speed given on the pump nameplate.

When the pump has primed:

- Make sure the current absorbed by the motor does not exceed the motor rated value, shown on the nameplate.
- If the pump does not seem to be operating normally, it is imperative to stop the pump and determine the causes (see section 14).

13 MAINTENANCE

Before maintenance is carried out, the pump must be stopped and the power supply disconnected. The supply must only be switched back on by the operator performing maintenance.

Warning: residual liquid may be found in the pump casing, head and suction line. Comply with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

13.1 Inspection and checks

Check the pump is working correctly at regular intervals. Use the instruments installed in the system (pressure gauge, vacuum gauge, ammeter etc.) to check the pump is still fit for duty.

We recommend periodic maintenance of the various parts subject to wear, particularly the impeller and wear plate.

13.2 Replacing the impeller (fig. 9)

- Drain the pump casing as indicated in section 7.1

Warning: residual liquid may be found in the pump casing, head and suction line. Comply with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

- Drain the seal's oil by unscrewing drain plug 5 (fig. 7a).

- Unscrew the screws (47) and remove the rotating unit made up of the impeller (03), head (19), support (06) and shaft (07)

- Block the impeller (03), unscrew the screw (33) and remove the ogive piece (66) for series ST-R2, R3 and R8; for ST-R4 and R6, remove the Belleville washer (33.1).

- Remove the impeller and replace it with a new one

- To reassemble, repeat the procedure in reverse

- Make sure the impeller is positioned accurately with respect to the wear plate, as indicated in point 13.7.

13.3 Replacing rear wear plate (fig. 9)

- Drain the pump casing as indicated in section 7.1

Warning: residual liquid may be found in the pump casing, head and suction line. Comply with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

- Drain the seal's oil by unscrewing drain plug 5 (fig. 7a).

- Remove the impeller (03) as described in section 13.2

- Unscrew the screws (57.1) securing the head (19)

- Replace the plate (02.1)

- To reassemble, repeat the procedure in reverse.

13.4 Replacing front wear plate (fig. 9)

- Drain the pump casing as indicated in section 7.1

Warning: residual liquid may be found in the pump casing, head and suction line. Comply with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

- Unscrew the bolts (53.2) and remove the cover (26)

- Unscrew the nuts (57.2)

- Remove and replace the wear plate (02)

- To reassemble, repeat the procedure in reverse.

- Make sure the impeller is positioned accurately with respect to the wear plate, as indicated in point 13.7.

13.5 Replacing the valve (fig. 9)

- Drain the pump casing as indicated in section 7.1

Warning: residual liquid may be found in the pump casing, head and suction line. Comply with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

- Unscrew the bolts (53.2) and remove the cover (26)

- Grip the valve (14.1) with your hand inside the pump casing and unscrew the supporting screw

- Slip off the valve (14.1) and replace it

- To reassemble, repeat the procedure in reverse.

13.6 Replacing the seal (figs. 9-10)

- Drain the pump casing as indicated in section 7.1

Warning: residual liquid may be found in the pump casing, head and suction line. Comply with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

- Drain the seal oil by unscrewing drain plug 5 (fig. 7a).

- Unscrew the screws (47) securing the mount (06)

- Remove the mount (06) complete with impeller and head from the pump casing (01)

- Remove the impeller (03) as described in section 13.2

- Slip off the rotating part of the seal (40) with the shaft sleeve (31) (fig. 10)

- Unscrew the nuts (57.2) and remove the head (19) with the fixed part of the seal fitted (38-39) (fig. 10)

- Slip the seal's stationary seal (38-39) (fig. 10) off the head (19)

- Wash the seal's seat in the head (19) and in the shaft sleeve (31) (fig. 10) with solvent

- Fit the stationary seal (39) complete with gasket (38). To make the operation easier, grease the seat and gasket. If necessary, use a wooden plunger or similar tool to push the stationary seal (39) into the seat in the head (19)

- Secure the head (19) to the mount (06) using the nuts (57.2)

- Smear the seal (40) and shaft sleeve (31) with oil and slip the rotating part of the seal onto one end of the shaft sleeve

- Slip the whole assembly onto the shaft and push to overcome the slight resistance offered by the lip seal (41).

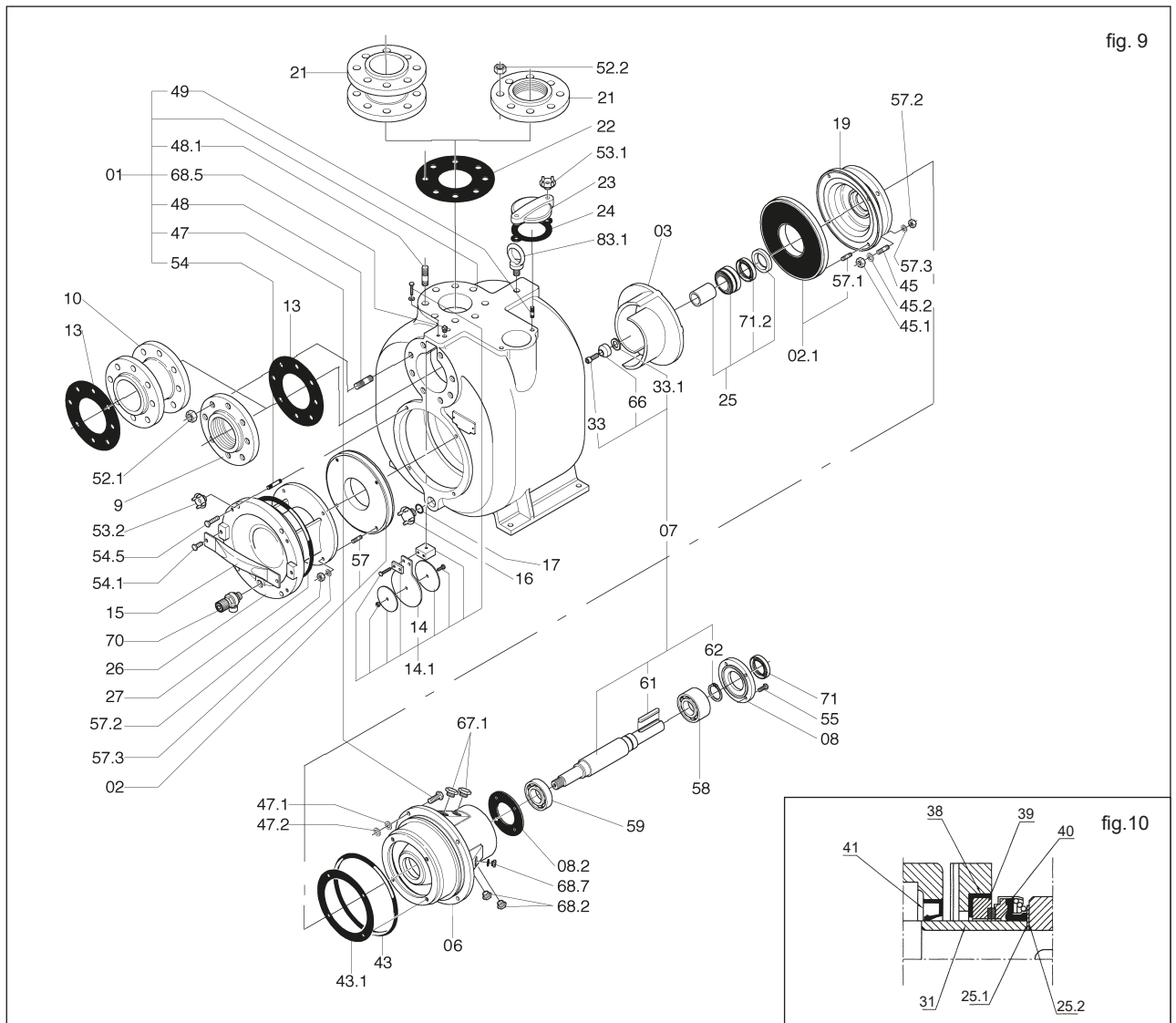
Be careful the seal does not slip off the shaft sleeve.

- Slip on the seal support ring (25.1). Push it forward until the key (60) can be reassembled

- Refit the impeller (03), ogive piece (66) and tighten the screw (33) for series ST-R2, R3 and R8; for ST-R4 and R6, refit Belleville washer 33.1 (fig. 9)

- Make sure the impeller is positioned accurately with respect to the wear plate, as indicated in point 13.7.

- Refit the casing and fasten the nuts, making sure the impeller is free to turn.



13.7 Impeller positioning with respect to wear plate(s) (fig. 11)

In all models, the distance between the tip of the impeller blades (03) and surface of the wear plate (02) must be in the range 0.5 - 0.7 mm. To achieve this value, you need to move wear plate (02) away from the impeller (03) by turning the screws (54.5) once you have calculated "C" as described below.

$$C = (B - A + R)$$

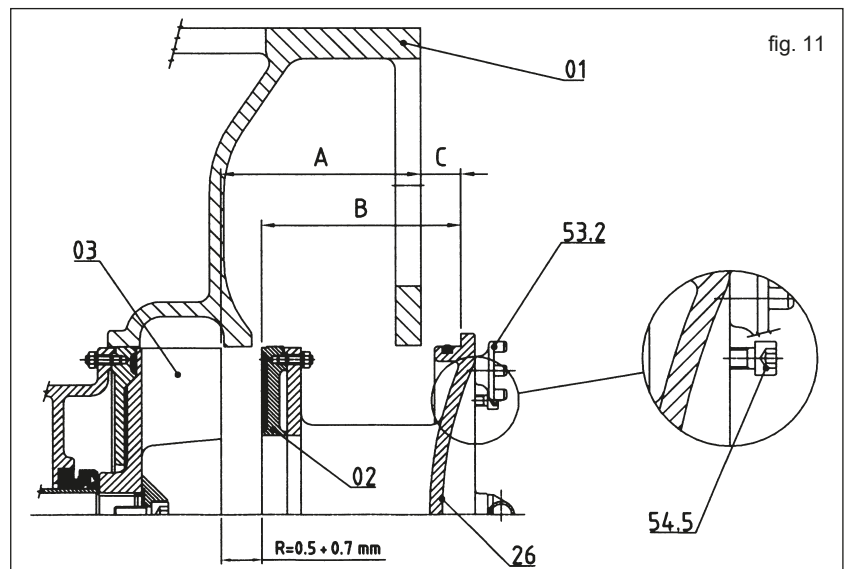
Where A = distance between impeller (03) and machined surface of the casing (01)

B = distance between wear plate (02) and machined surface of the inspection cover (26)

R = distancing value adopted in the range 0.5-0.7 mm

Generally, when "C" has a value of 1 mm, the distancing value "R" will be 0.5 mm. Tightening the screws (54.5) moves the cover (26) away from the casing (01).

N.B.: This operation must be performed with the bolts (53.2) loosened. Once the right distance "R" between the impeller (03) and wear plate (02) has been reached, retighten the bolts (53.2).



13.8 Bearings maintenance (fig. 9)

The pump is supplied with oil-immersed bearings (DELVAC SAE 15W - 40) and they do not require maintenance for the first 5,000 hours of operation. Change oil once a year.

13.9 Replacing bearings

- Drain the pump casing as indicated in section 7.1

Warning: residual liquid may be found in the pump casing, head and suction line. Comply with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

- Drain the seal and bearing oil by unscrewing drain plugs 4 and 5 (fig. 7a)
- Unscrew the screws (47) securing the mount (06)
- Remove the mount (06) from the pump casing (01) complete with impeller and head
- Remove the impeller (03) as described in section 13.2
- Remove the seal (25) as described in section 13.6
- Remove the bearing cover (08)
- Pull out the shaft (07) complete with bearings (58) and (59)
- Replace bearings
- To reassemble, repeat the procedure in reverse.

13.10 Replacing TWIN-DISC coupling blocks (RBD series) (fig. 12)

- Remove the pump from its seat
- Remove the worn blocks and replace with new ones
- Check the aluminium flange's state of wear
- Couple the pump to the motor
- Max. alignment error: 0.7 mm
- When ordering spare blocks, specify shaft diameter and the type of coupling.

13.11 Replacing SURE-FLEX coupling rubber collar (fig. 13)

- Unscrew the anchor bolts at the base of the pump or motor/engine and separate the two halves of the coupling.
- Remove the worn rubber collar (fig. 13a) and replace with the new one. If the rubber collar is in two pieces (type S), leave the steel ring free to move in one of the two grooves near the indentation.
- Move the pump towards the motor/engine and fit the indentation of the half coupling and rubber collar together.
- Close the coupling, leaving an end play of max. 2 mm for J-type couplings and max. 3 mm for S-type couplings.
- Check radial and angular alignment as follows:
 - radial:** (fig. 13b) with a ruler placed on the outer surface of the half couplings, on at least four points around the circumference, measure maximum misalignment (value C) and try to adjust the value so that it is as close to zero as possible (see table fig. 13).
 - angular:** (fig. 13b) with a gauge, measure the distance between the two halves of the coupling in at least four points and adjust so that the difference (b-a) is as close to zero as possible (see table fig. 13)
- Tighten the anchor bolts at the base of the pump and motor/engine.
- When ordering spare parts, specify the type of coupling (stamped on the inside of the half couplings) and shaft diameter.

13.12 Replacing GBF BALBONI coupling rubber collars (fig. 14)

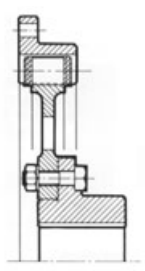
- Unscrew the anchor bolts at the base of the pump or motor/engine and separate the two halves of the coupling.
- Remove the worn blocks and replace with new ones, fastening them in their seat with a little adhesive.
- Move the pump and motor/engine close until the coupling is fully closed, then move them back by 2 - 3 mm to separate the two halves of the coupling.
- Tighten the anchor bolts at the base of the pump and motor/engine.
- When ordering spare blocks, specify shaft diameter and the type of coupling.

14 TROUBLESHOOTING: CAUSES AND REMEDIES

Warning: before commencing troubleshooting, make sure testing instruments (vacuum gauge, pressure gauge, revolution counter, flow recorder, electrical gauges etc.) are working properly.

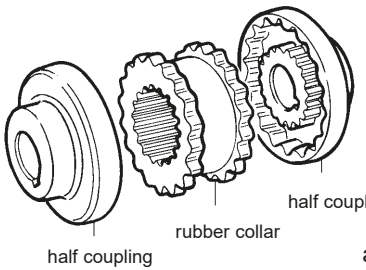
14.1 PUMP DOES NOT PRIME

- 1 pump casing is empty or not full enough**
fill pump casing through filler hole (fig. 8).
- 2 liquid inside pump casing overheating**
add cold liquid inside the pump casing through the filler hole (fig. 8).
- 3 air may be getting in at joints or cracks in the suction pipe**
check joints are airtight and inspect suction pipe.
- 4 delivery pipe under pressure**
bleed delivery pipe.
- 5 pump speed low**
only increase speed once you have checked the contract data and pump performance curves
- 6 impeller may be worn or broken**
check state of impeller through the inspection cover (26) (fig. 9), or remove the pump casing as described in section 13.2

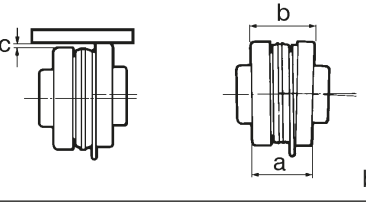


Type of coupling	Max. speed (rpm)	Max. torque dNm	
		Continuous duty	Intermit. duty
8 S	4500	17	2
10 S	4000	31	30
10 SS	4000	31	30
11 S	3500	48	62
14 S	2800	94	121

fig. 12



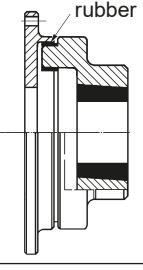
half coupling
rubber collar
half coupling
a



b

Type coupling	C mm	(b-a) mm	Torque N m
J4	0,25	1,1	10
J5	0,4	1,4	20
S6	0,4	1,8	40
S7	0,5	2,1	70

fig. 13



rubber collar

Type of coupling	Max. torque kgm	rpm
14	15	4800
20	25	4400
27	40	4100
40	60	3500
55	80	3300
88	110	3000
110	150	2700
145	190	2500
180	240	2200
250	300	2150
330	400	2000

fig. 14

- 7 cutwater (leading edge of the volute) is worn**
remove pump casing as indicated in section 13.2. Build up the cutwater with weld and shape it to restore the original profile. If cutwater is severely worn, replace the casing.
- 8 suction strainer, where applicable, may be clogged**
remove obstructions.
- 9 excessive suction lift**
reduce suction lift.
- 10 air entering through seal**
disassemble seal and clean it (see sect. 13.6); if the problem persists, change the seal.
- 11 impeller clogged by foreign matter**
check state of impeller through the inspection cover (26) (fig. 9), or remove the pump casing as described in section 13.2.

14.2 PUMP DOES NOT DELIVER LIQUID

- 12 pump does not prime**
see causes given in point 14.1.
- 13 head required by the system is greater than the rated head of the pump**
revise system design or select a different pump.
- 14 excessive flow resistance along suction line**
revise distribution of elbows, valves, constrictions etc. ; where necessary, increase diameter of pipework.
- 15 impeller clogged by foreign matter**
check state of impeller through the inspection cover (26) (fig. 9), or remove the pump casing as described in section 13.2.
- 16 suction/delivery pipes may be obstructed or clogged**
locate the obstructed or clogged area and clean.

14.3 THE PUMP DOES NOT DELIVER ENOUGH LIQUID

- 17 air leaks in suction line**
check joints are airtight and inspect suction pipe.
- 18 impeller and/or wear plate may be worn**
replace them by disassembling the pump as described in sections (13.2; 13.3, 13.4).
- 19 diameter of the suction pipe too small**
replace suction pipe.

14.4 THE PUMP DOES NOT PROVIDE ENOUGH PRESSURE

- 20 viscosity of the liquid is higher than expected**
contact VARISCO once you have measured the viscosity of the liquid. Viscosity for centrifugal pumps should not exceed 50 cSt. Check for other possible causes: see point 5 in section 14.1, and section 14.2.

14.5 THE PUMP ABSORBS TOO MUCH POWER

- 21 rotation speed too high**
check correct rotation speed.
- 22 pump operates under conditions that are different from those specified in the contract**
check operating conditions of pump and compare them to those on the pump's nameplate.
- 23 density of the liquid is higher than expected**
measure density of the liquid and compare it with the agreed value.
- 24 incorrect unit alignment**
check unit is correctly aligned as described in section 10.
- 25 there may be friction inside the pump between rotating and non-rotating components**
disassemble pump casing as described in section 13.2 and check for scratches on surfaces.
- 26 foreign matter in impeller**
check state of impeller through the inspection cover (26) (fig. 9), or remove the pump casing as described in section 13.2.

14.6 THE PUMP VIBRATES AND IS NOISY

- 27 pump is operating with a flow rate that is too low**
check settings of the valves in the system and readings on the pressure and vacuum gauges.
- 28 pump or pipework is not fixed securely**
make sure system pipework is correctly clamped.
- 29 pump cavitates**
see section 14.2
Check possible causes: see section 14.1.
- 30 foreign matter in impeller**
check state of impeller through the inspection cover (26) (fig. 9), or remove the pump casing as described in section 13.2.

14.7 THE PUMP JAMS

- 31 mechanical breakdown**
check shaft, couplings, motor or engine, pulleys and belts, gearboxes etc. for breakages.
- 32 foreign matter in impeller**
check state of impeller through the inspection cover (26) (fig. 9), or remove the pump casing as described in section 13.2.

14.8 BEARINGS DO NOT LAST

33 lack of lubrication

lubricate bearings as described in section 13.8

34 foreign matter in bearings

replace bearings as described in section 13.9

35 bearings are rusted

replace bearings as described in section 13.9

14.9 THE SEAL LEAKS

36 poor lubrication

Check oil level.

If the pump leaks during operation, the seal must be replaced. (see section 13.6)

14.10 RUBBER PARTS OF COUPLING WEAR DOWN QUICKLY

Check unit is correctly aligned as described in section 10 and follow the replacement procedure given in sections 13.10, 13.11 and 13.12.

15 RESIDUAL HAZARDS

Residual risks are any risks that cannot be eliminated through pump design:

- knocks
- anomalous pressure rises
- misuse
- manoeuvring errors in the pump's vicinity.

16 REPAIRS

Before carrying out repairs on the unit, it is essential to:

- disconnect mains power (see section 13) or switch off the internal combustion engine
- close the pump's suction and delivery gate valves
- if the liquid pumped is hot, allow the pump to cool down to ambient temperature
- **drain liquid pumped from pump casing as indicated in section**
- remove and clean, removing any liquid pump still inside, complying with safety procedures for the handling of hazardous liquids (flammable, corrosive, poisonous, infected etc.).

17 DISASSEMBLY

17.1 DISASSEMBLING PUMP FROM SYSTEM

Follow procedure given in section 16.

- Remove nuts securing the suction and delivery flanges
- Remove bolts fastening the pump to the base plate
- Pull the pump from the coupling, if there is one, or remove it from the engine
- Before lifting the pump using the lifting hook (83.1 fig. 9) with appropriate means, refer to the pump weights table.

18 ASSEMBLY

18.1 ASSEMBLING PUMP ON SYSTEM

- Lift the pump using the lifting hook (83.1 fig. 9) with appropriate means
- Place pump on the base plate
- Restore connections with the coupling or engine, as applicable
- Check alignment as described in section 10
- Fasten pump to the base plate
- Connect pump to pipework
- Refit any coupling guards.

19 SPARE PARTS

To assure the pump's lasting efficiency, it is advisable, when ordering the unit, to purchase the spare parts recommended for the first maintenance operation:

- impeller
- seal
- front and rear wear plates
- complete set of gaskets
- check valve
- self-locking impeller nut.

19.1 Ordering spare parts

To order spare parts, specify the following:

- type of pump
- the pump's serial number
- reference number and description of the part as shown in the exploded drawing.

20 DISPOSAL

- Do not release to the environment.
- Metal parts can be recycled as scrap.
- Greases and oils should be recovered, stored and disposed of through approved agencies in accordance with the regulations in force.
- Elastomer gaskets must be kept separate and disposed of through an authorized waste disposal agency.



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