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DIN STANDARD 24255 HORIZONTAL Installation, Operation & Maintenance Manual

MAINTENANCE • INSTALLATION • OPERATIONS

**Installation
Manual**

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Operating and Service Manual

for

Centrifugal Pumps Series

DELTANORM

Size of the pump:	DN
Serial no.:	
Year of construction:	
Shaft seal:	
Bearing frame size:	
Operating point:	



This operating and maintenance manual contains important notices and warnings. Please read carefully before installation, electric connection, and initiation. Further instructions concerning components of the pump must be observed.

Operating and Service Manual of Centrifugal Pumps **DELTANORM** Series

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1. General

This rotary pump was developed in accordance with our current state of the art, manufactured with greatest care, and was subject to a continuous quality control during production.

This operating and service manual contains important notices for a safe, appropriate, and economical operation of the pump.

It is necessary to observe the operating and service manual in order to avoid dangers and to guarantee that the pump is properly operated.

The type plate shows the pump model and the serial number. We request you to quote these with queries, repeat orders, and in particular with the order of spare parts.

With receipt of the pump, an arrival inspection shall be carried out, in the course of which the aggregate must be checked for externally visible damages. Possibly identifiable shipping damages shall be immediately reported to the transport operator. Within the guarantee period of 6 months, beginning with the date of delivery of the pump ex our works, we assume the repair and replacement, respectively, of all components which, according to our assessment, are defective or damaged due to defects of material or fabrication. Wearing parts (e. g. axial face seals), damages due to non-observance of the instructions for use and inadequate servicing are not covered by the guarantee. The said components must be returned to us free of charge with the complete servicing records for the purpose of examination and determination of the type and extent of the guarantee. We shall not assume any responsibility for transport from or to the plant or for possible production damages or losses of production.

2. Safety

Before installation and initiation, respectively, this operating and service manual must under all circumstances be read by all persons involved in installing the pump or who will be operating the aggregate later on. Therefore, this manual should always be available at the pump.

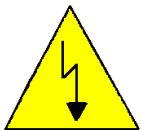
Other safety notices are listed under other paragraphs and must be observed under all circumstances.

2.1 Labelling of notices in the operating and maintenance manual

The safety notices contained in the operating instructions which may cause threats for persons in case of non-observance are labelled with the general danger symbol



in case of warning against electric voltage, with



With safety notices, the non-observance of which may cause threats to the machine and its functions, the word

Caution

has been inserted.

Safety notices , which are located directly on the aggregate, must be observed under all circumstances.

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2.2 Personnel qualification and training

The operation and any other handling of the aggregate may only be carried out by qualified personnel.

2.3 Dangers with non-observance of the safety notices

Non-observance may, among other things, result in threats to persons, threats to the environment, or a failure of the aggregate. Non-observance of safety notices results in the loss of any and all claims for damages.



2.4 Safety-conscious working

The listed safety notices, the existing national accident prevention rules, as well as possible internal job-related, operating, and safety provisions of the operator shall be observed.



2.5 Safety notices for the operator/operating personnel

- If hot or cold machine parts cause dangers, these parts must be protected by customer against accidental contact.
- Protection against accidental contact for moving parts (e. g. coupling) must not be removed from a machine which is in operation, and must be reinstalled under all circumstances before a new start.
- Leakage of hazardous materials to be delivered (e. g. explosive, poisonous, hot) must be carried off in such a way that there is no threat to persons and the environment.
In this process, the statutory provisions must also be complied with under all circumstances.
- Appropriate measures of precaution must be taken in order to rule out threats caused by electric energy.



2.6 Safety notices for service, inspection, and installation works

Works on the aggregate may only be carried out in switched off condition.

Pumps delivering media injurious to health must be decontaminated.

After completion of the works, all panellings, safety and protective devices must be reinstalled.

With reoperation, the same procedure as with initial operation shall be followed.

Caution

2.7 Modifications of the aggregate, spare parts

A modification of the aggregate is only permissible after agreement with the manufacturer.

When procuring spare parts, it must be taken care that the acquired parts are original spare parts. The use of other parts cancels the liability for the resulting consequences.



2.8 Inadmissible operating methods

The operating safety of the pump is only guaranteed with appropriate use.

The purpose of use results from the data stated in the offer or order, as e. g. the flow rate, delivery head, pumping medium, etc.

3. Transport, Intermediate Storage

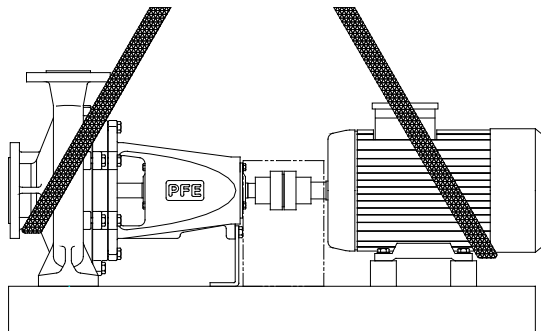
3.1 Transport

With transport of the aggregate, it must be taken care that no defective hoisting gear is used, and that the aggregate is in a horizontal position during the entire transporting time.

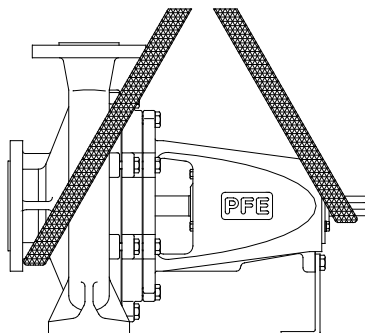
Hoisting gear must not be attached to the shaft end or to the ring loop of the motor.



If the aggregate slips out of the transport suspension, personal injuries and damage to property may occur!



Transport of the complete aggregate

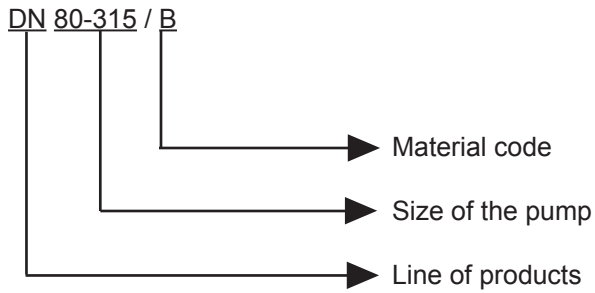


Transport of the pump with free shaft end

3.2 Intermediate storage

If the pump is supposed to be stored intermediately, the components in contact with the fluid, as far as they are made of grey cast iron or spheroidal graphite iron, and all other bright components (e. g. shaft ends) must be preserved with the appropriate agents inhibiting corrosion. In general, the aggregate is to be stored in a dry environment. If the pump is used in the area of enamelling lines or in conditioning zones, make sure the preservatives are free of silicone.

4. Designation



5. Mounting / Installation

5.1 Safety regulations

Electrical equipment operated in potentially explosive areas must fulfil the explosion proofness regulations. This is shown on the type plate of the motor.

With installation in potentially explosive areas, the locally valid explosion proofness provisions and the provisions of the test certificate provided with the delivery, which was issued by the competent test authority, shall be observed and complied with. The test certificate provided with the delivery shall be kept in the place of use.

5.2 Check-out before the beginning of mounting

The mounting area must be prepared in accordance with the dimensions of the dimension sheet/space assignment plan. If the pump is placed on a concrete foundation, sufficient solidity of the concrete (at least BN 150) must be guaranteed. The surface of the foundation must be horizontal and even.

When mounting the aggregate, it must be aligned horizontally using a water level. If it is necessary to underlay the mounting plate for the purpose of alignment, make sure the lining sheets are installed on the entire length of the mounting areas. Mounting plates with a width of 400mm or smaller are made of torsion-free channel steel and need not be grouted in with concrete.

Wider mounting plates must be grouted with shrinkage-free mortar.

5.3 Shaft alignment pump / motor

Caution

After mounting and fastening the mounting plate, the alignment offset of the pump/motor shaft must be checked and adjusted, if necessary.

For this purpose, place a ruler on the circumference of the coupling halves at four points which are offset against each other by 90° each. In addition, take care that the coupling halves have the same distance to each other at the circumference; this can be checked by means of a feeler gauge.

The deviations must not exceed 0.1mm in radial or axial direction.

The shaft offset must be checked again and adjusted, if necessary, after complete installation at operating temperature and with oncoming feed pressure.

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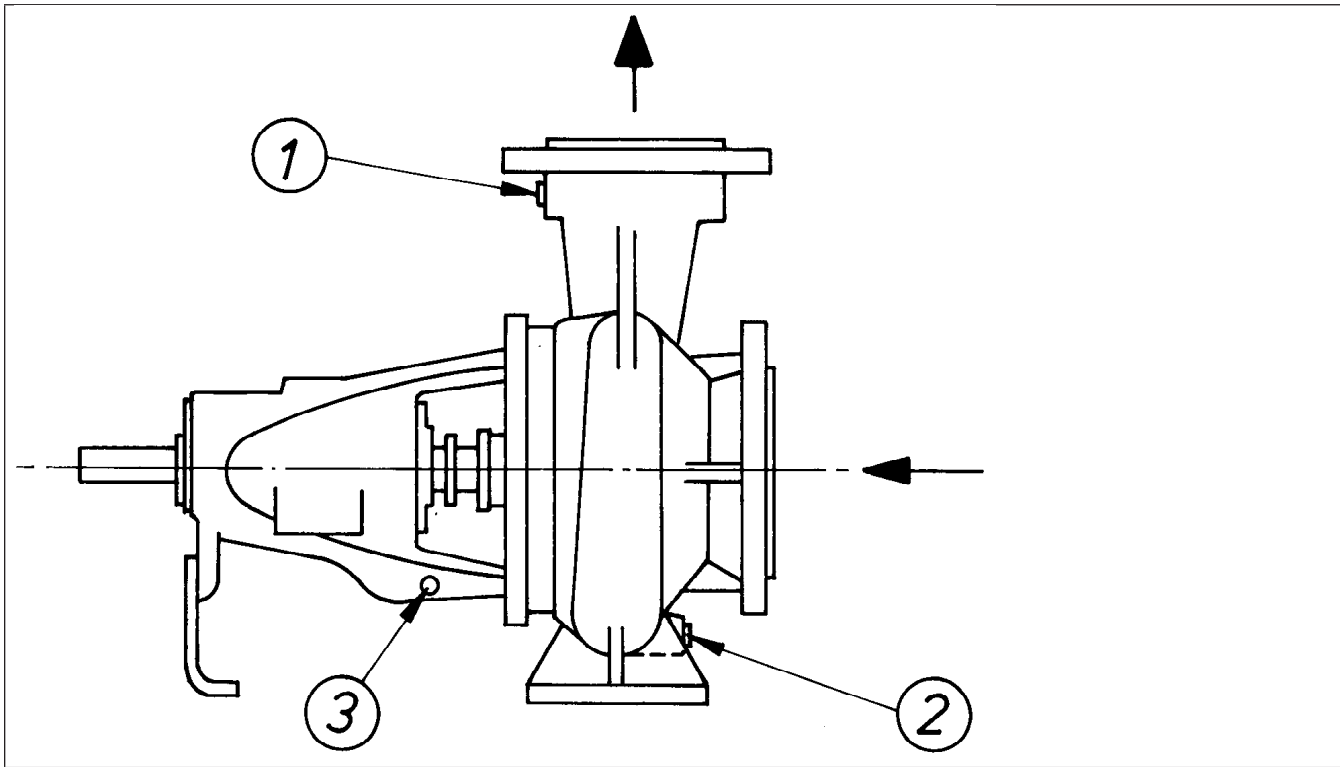
5.4 Connection of the tubing

Caution

The tubing shall be installed in such a way that it does not exercise any force or momentum on the connecting flanges of the pump.

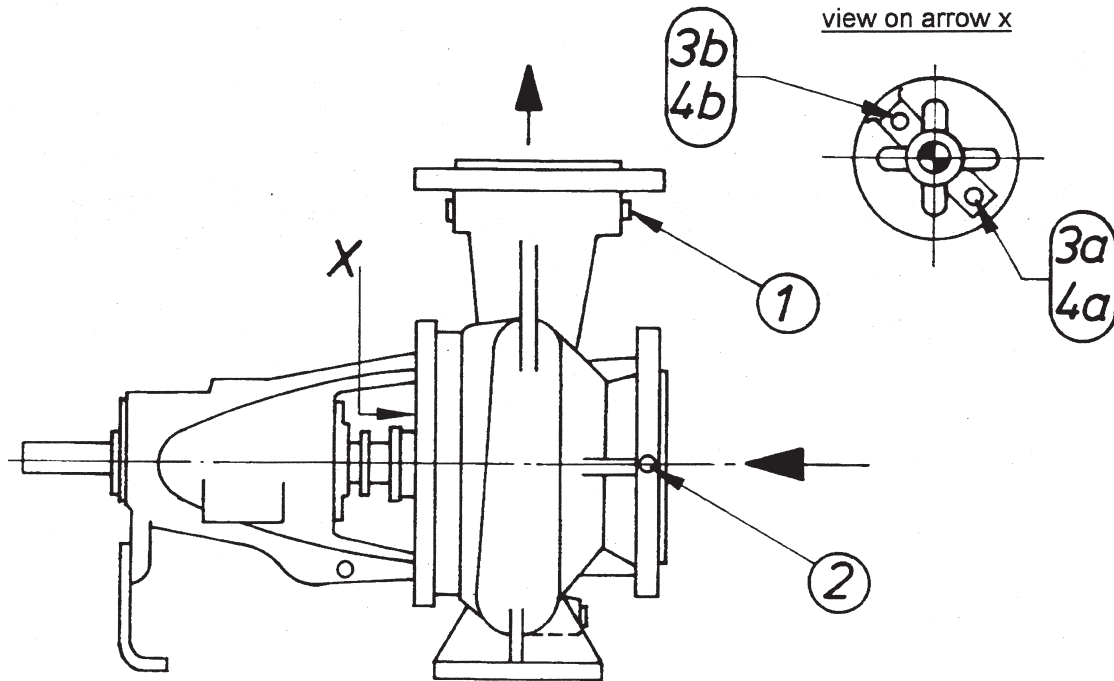
- A non-return valve should be installed between the pressure joint of the pump and the shut-off device in order to prevent the returning fluid from causing a rotation of the pump in opposite direction of the normal sense of rotation after shutting off the pump, which can lead to damages of the pump when running it again.
- In case of operating conditions with short standstill intervals, the use of such a non-return valve is absolutely necessary in order to guarantee troublefree operation of the pump.
- The compressed air gauge should always be installed immediately on the pressure joint of the pump, since the delivery head and the flow rate of the pump are influenced by resistances in the pipe system.
- In order to avoid air locks, the tubing shall be installed ascending towards the pump; with feed pressure, it shall be installed descending towards the pump.

5.5 Standard connections



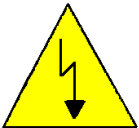
Item	Connection	Connection for	Position of connection with view towards shaft end	Connection size	Used with size of pump
1	Deairing	Filling and deairing of the impeller casing	At the pressure joint towards coupling side	1/4"	All sizes
2	Evacuation	Evacuation of the impeller casing	At the lower end of the impeller casing	1/4"	32-125 to 50-125 32-160 to 50-160 32-200 to 50-200 100-160
				3/8"	All other sizes
3	Leakage	Draining of possibly arising leakage	At the bearing carrier, bottom right	3/8"	32-125 to 65-125 32-160 to 65-200
				1/2"	All other sizes

5.6 Additional connections



Item	Connection	Connection for	Position of connection with view towards shaft end	Connection size	Used with size of pump
1	Compressed air gauge	-	At pressure joint towards suction side	1/2"	65-315 to 150-315 80-400 to 150-400 125-200, 100-250, 150-250, 200-250
				1/4"	All other sizes
2	Vacuum gauge	-	At suction joint, right	1/2"	65-315 to 150-315 80-400 to 150-400 125-200, 100-250, 150-250, 200-250
				1/4"	All other sizes
3a	Flushing connection inlet	External flushing (e.g. double-acting axial face seal)	At sealing space, bottom left or right	1/4"	32-125 to 65-125 32-160 to 50-160
				3/8"	All other sizes
3b	Flushing connection outlet	External flushing (e.g. double-acting axial face seal)	At sealing space, top left	1/4"	32-125 to 65-125 32-160 to 50-160
				3/8"	All other sizes
4a	Flushing connection inlet	cooling/heating axial face seal	At sealing space, bottom right	3/8"	All sizes
4b	Flushing connection outlet	cooling/heating axial face seal	At sealing space, top left	3/8"	All sizes

5.7 Electric connection



The electric connection shall be carried out by appropriately skilled electricians exclusively.
The relevant VDE provisions shall be observed.
The use of a protective motor switch is urgently recommended.

5.8 Test of sense of rotation

The sense of rotation of all Deltanorm pumps, viewed towards the shaft end of the pump, is to the right.
On the spiral casing of the pump, there is a cast on arrow indicating the sense of rotation, on the ventilator cowl of the driving motor, there is a sign with an arrow indicating the sense of rotation.

6. Initiation

Caution

Before initiating the aggregate, make sure that

- the electric connection of the motor is done properly
- all protective devices are installed
- the pump and the suction line are filled with pumping medium, that they have been deaired, and all shut-off devices on the suction side are open
- the sense of rotation has been checked
- with pumps with double-acting axial face seal, the sealing water supply is provided.

Caution

Running dry immediately leads to damages of the pump.

6.1 Switching on

Caution

The pump may only be switched on with closed shut-off device on the pressure side! After the full speed has been reached, the shut-off device is slowly opened, and adjusted to the operating point. Make sure that the delivery head specified in the offer or order is observed.

6.2 Switching off

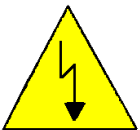
Caution

Close the shut-off device on the pressure side.
The shut-off device on the suction side must remain open.
Switch off the motor.

Pumps with double-acting axial face seal (in particular with delivery of lacquers or media tending to crystallise out) must be impinged on with sealing water during standstill.

With risk of frost or longer standstill periods, the pump must be evacuated.

7. Service / Maintenance



Works may principally only be carried out if the electric connections have been disconnected and the pump has been secured against undesired switching on.

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7.1 Monitoring

The following points must be observed:

- Running dry must be avoided under all circumstances
- The pump must run free from vibrations
- The max. room temperature must not exceed 40°C
- The pump must not be operated against a closed shut-off device for a longer period of time
- The max. number of switching operations must not exceed 6 starting cycles per hour
- The elastic elements of the shaft coupling must be checked for wear

7.2 Lubrication

The used rolling bearings are provided with grease lubrication for the designed service life of the bearings.

Pumps of special designs with regreasing appliances require the following lubricating intervals:

1000 1/min	approx. every 6000 operating hours
1500 1/min	approx. every 4000 operating hours
3000 1/min	approx. every 2000 operating hours

After 1000 operating hours, but no later than after 2 years, the bearings should be disassembled, washed out, provided with a fresh grease filling, and remounted.

Depending on the operating conditions (higher ambient temperature, dust, high air moisture, etc.), the regreasing intervals have to occur more often.

Required grease quantity per bearing:

Bearing carrier size	Grease quantity per bearing
Size 1	5g
Size 2, Size 2/1	8g
Size 2H	14g
Size 3, Size 3/1	12g

Caution

If the bearings are overlubricated (too much grease in the bearing), there is a danger of overheating of the bearings.

We recommend the following or comparable greases:

Manufacturer	Type
ESSO	Beacon EP3
SHELL	Shell Alvania R2
BP	BP Energrelse LS3

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7.3 Dismantling

Dismantling is carried out according to the following steps:

1. Make sure the personnel is appropriately qualified.
2. Secure the aggregate against switching on.
3. Close shut-off devices on suction and pressure side.
4. If necessary, let the aggregate cool down to room temperature.
5. Evacuate the pump casing.
6. Disconnect current supply to the motor.
7. Dismount additional connections.
8. Remove coupling protection.
9. Detach motor from mounting plate and remove from the plate.
10. Disconnect flanges on suction and pressure side from the tubing.
11. Detach support foot of the pump from the mounting plate.
12. The spiral casing remains in the tubing and on the mounting plate.
13. Unscrew the hexagon nuts on the collar of the pump casing.
14. Pull out bearing carriers completely with pressure lid and impeller.
15. With larger pumps, the bearing carrier must be supported or under-propped on the impeller side when pulling out in order to avoid tipping over.
16. Release circlip securing ring (093).
17. Unscrew impeller nut (922) and remove from the shaft together with circlip (093).
18. Pull impeller (230) off the shaft (if necessary, with the aid of a take-off).
19. Remove feather key (940.1) from the shaft.
20. Remove impeller distance bush from the shaft.
21. Remove distance washer from the shaft.
22. Loosen sealing lid and pull out of the casing towards the bearing carrier.
23. Remove casing cover (with some pumps, the casing cover is cramped, with others, the nuts on the collar of the bearing carrier must be unscrewed).
24. Pull axial face seal off the shaft.
25. Remove sealing lid from the shaft.
26. Remove stationary ring of the axial face seal together with O-ring from the sealing lid.
27. Unscrew cap pieces of the bearings (330 and 360) from the bearing carrier, and take off.
28. Pull shaft together with bearing out of the bearing carrier.

7.4 Shaft seal

In order to replace the shaft seal, please proceed as described under section 7.3 item 1 to 26. Before assembly, first clean the shaft or, if provided, the shaft sleeve, and check whether there is any scoring on the seating of the shaft seal. If so, the shaft or protective shaft sleeve must be replaced. Now clean the sealing lid.

Assembly occurs in reverse order of dismantling described above.

When mounting the axial face seal, extreme cleanliness must be observed, and work has to be carried out with greatest care.

Damage to the sealing surfaces and sealing rings must be avoided under all circumstances; the seal must never be placed on the sealing surfaces (polished side of the sealing rings), since even slight scratches on the sealing surface lead to immediate failure of the seal.

Clean the shaft or, if provided, the shaft sleeve and the seating of the seal in the sealing lid from possible deposits, and subsequently clean the components.

- Oil or grease must never be used when mounting the axial face seal.
- Moisten the O-ring of the stationary ring of the axial face seal with water, and push the stationary ring together with the O-ring by hand into the sealing lid.
- Slide the sealing lid together with the stationary ring over the shaft and fasten it on the collar of the bearing casing.
- Slide the axial face seal onto the shaft until the slide faces of stationary and rotating component touch.
- The assembly of the pump occurs in reverse order of dismantling described above.

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7.5 Ordering of spare parts

For spare part orders, we always need the following information provided on the type plate of the pump:

Model: e.g. DN100-315/B
Serial no.: e.g. 0385-005

as well as the part number and designation which you will find in this manual.

7.6 Stockkeeping of spare parts

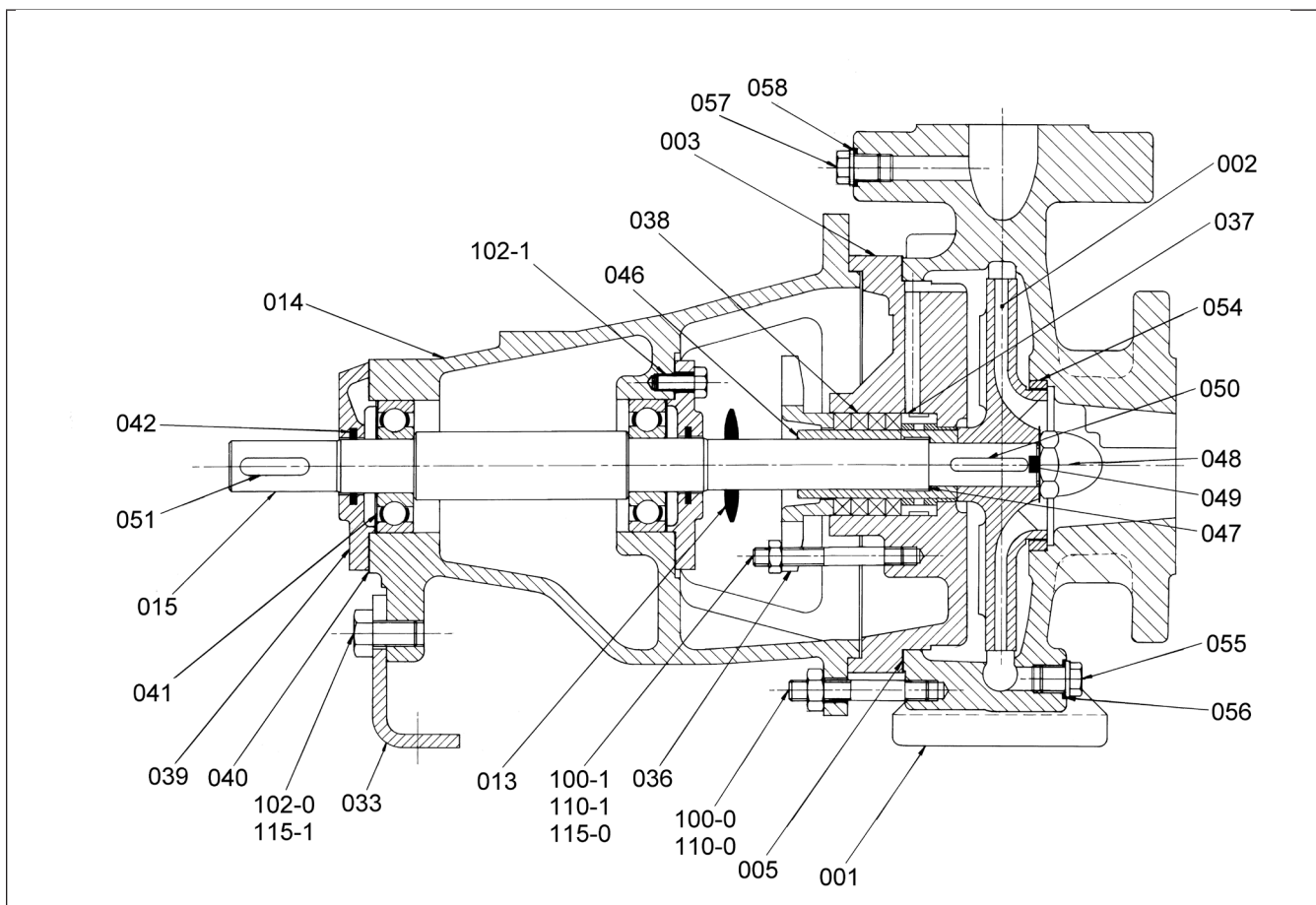
For continuous operation of two years, we recommend keeping stock of the following spare parts:

Part no.	Part designation	Number of pumps (incl. backing pumps)					
		1	2	3	4	5	6 and more
015	Shaft	1	1	1	2	2	50%
046	Shaft sleeve*	1	1	1	2	2	50%
002	Impeller	1	1	1	1	2	30%
054	Wear ring, suction side	1	1	1	1	2	30%
053	Wear ring, pressure side	1	1	1	1	2	30%
041.1	Radial ball bearing	1	2	2	4	4	100%
041.2	Radial ball bearing	1	2	2	4	4	100%
005	Casing seal	2	4	6	8	10	200%
038	Shaft seal	1	2	3	4	5	100%
	O-ring (sealing lid)	1	2	3	4	5	100%
049	Circlip	2	4	6	8	10	200%

* only if provided

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8.1 Parts list		Size of pumps
		32-125 to 65-125
		32-160 to 100-160
		80-200 to 125-200



Item	Description	Number	Item	Description	Number
001	Impeller casing	1	042	Joint gasket ¹⁾	2
002	Impeller	1	046	Protective shaft sleeve ¹⁾	1
003	Casing cover	1	047	Seal of protective shaft sleeve ¹⁾	1
005	Casing seal	1	048	Impeller nut	1
013	Splash ring	1	049	Circlip	1
014	Bearing casing	1	050, 051	Feather key	1
015	Shaft	1	054	Split ring	1
033	Support foot	1	055, 057	Screw plug	1
036	Seal gland	1	056, 058	Joint gasket ³⁾	1
037	Flushing ring ²⁾	1	100-0, 100-1	Stud bolt	8/12 2
038	Packing ring ²⁾	4	102-0, 102-1	Hexagon bolt	1 6
039	Cap piece of bearing	2	110-0, 110-1	Hexagon nut	8/12 2
040	Seal of cap piece of bearing	2	115-0, 115-1	Plain washer	2 1
041	Thrust bearing	2			

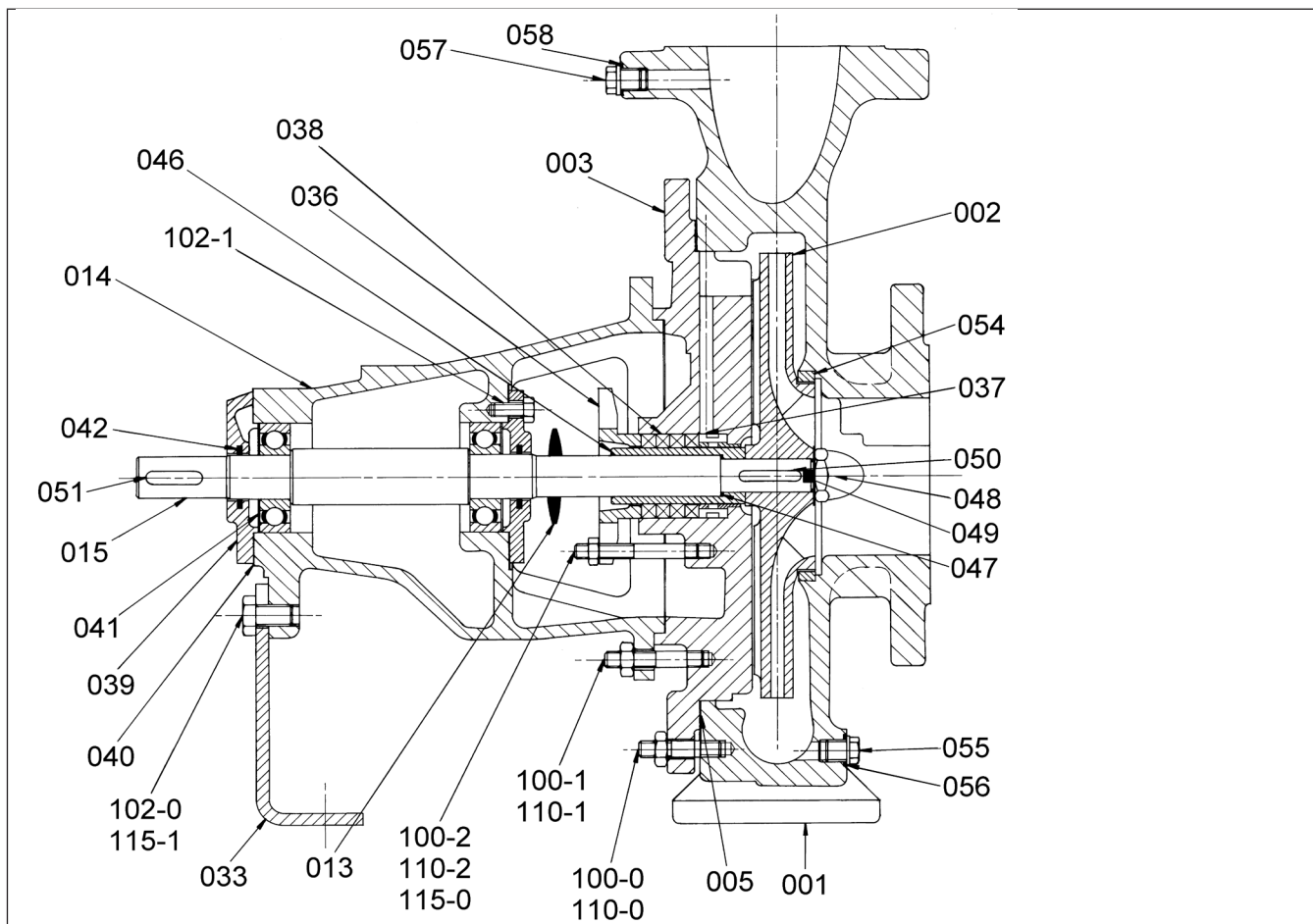
¹⁾ only with pumps of special design

²⁾ not with pumps with axial face seal

³⁾ may also be replaced by Teflon tape

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8.2 Parts list		Size of pumps
		32-200 to 65-200
		32-250 to 125-250



Item	Description	Number	Item	Description	Number
001	Impeller casing	1	042	Joint gasket ¹⁾	2
002	Impeller	1	046	Protective shaft sleeve ¹⁾	1
003	Casing cover	1	047	Seal of protective shaft sleeve ¹⁾	1
005	Casing seal	1	048	Impeller nut	1
013	Splash ring	1	049	Circlip	1
014	Bearing casing	1	050, 051	Feather key	1
015	Shaft	1	054	Split ring	1
033	Support foot	1	055, 057	Screw plug	1
036	Seal gland	1	056, 058	Joint gasket ³⁾	1
037	Flushing ring ²⁾	1	100-0, 100-1, 100-2	Stud bolt	8/12 6/8 2
038	Packing ring ²⁾	4	102-0, 102-1	Hexagon bolt	1 6
039	Cap piece of bearing	2	110-0, 110-1, 110-2	Hexagon nut	8/12 6/8 2
040	Seal of cap piece of bearing	2	115-0, 115-1	Plain washer	2 1
041	Thrust bearing	2			

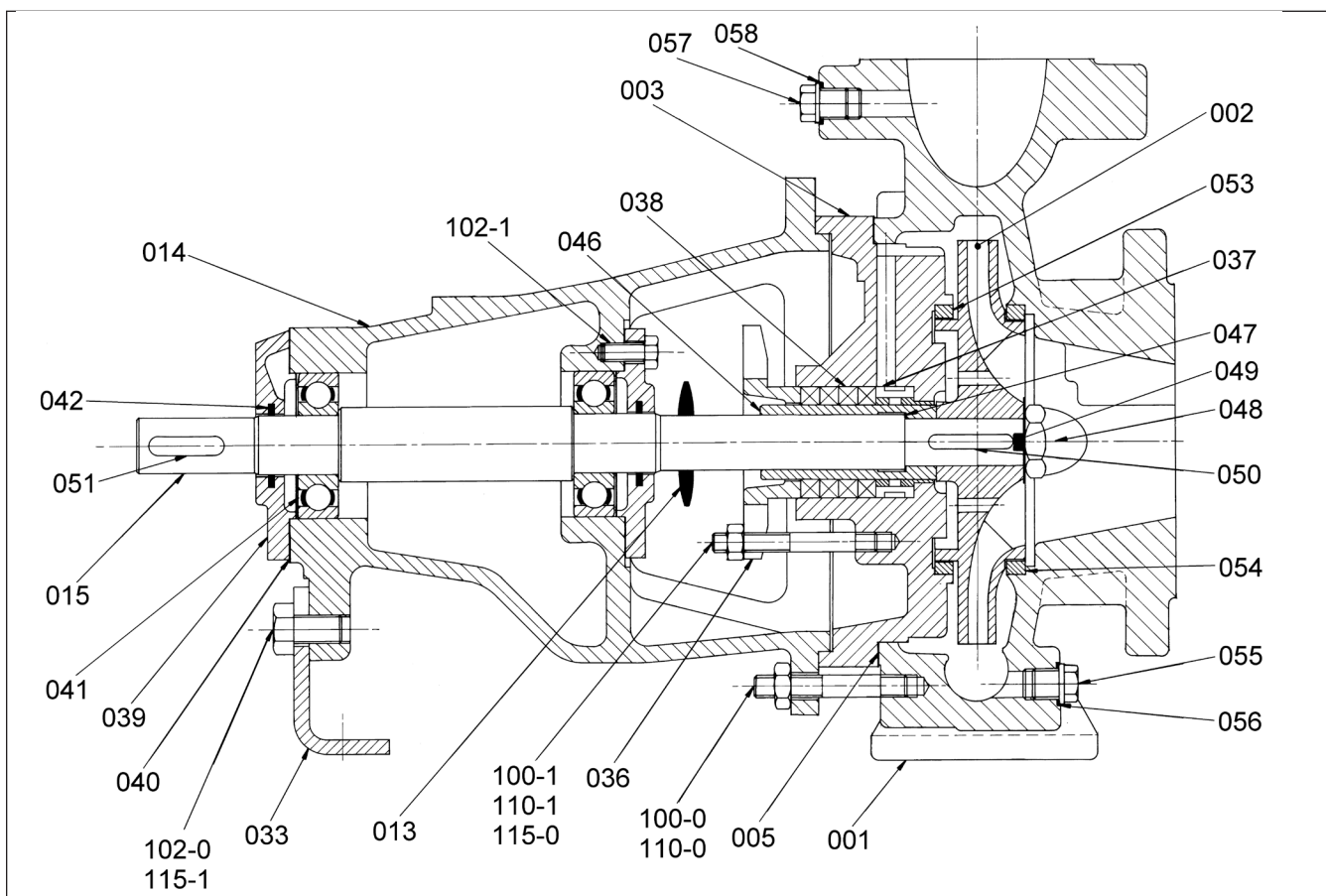
¹⁾ only with pumps of special design

²⁾ not with pumps with axial face seal

³⁾ may also be replaced by Teflon tape

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8.3 Parts list		Size of pumps
		150-200



Item	Description	Number	Item	Description	Number
001	Impeller casing	1	042	Joint gasket ¹⁾	2
002	Impeller	1	046	Protective shaft sleeve ¹⁾	1
003	Casing cover	1	047	Seal of protective shaft sleeve ¹⁾	1
005	Casing seal	1	048	Impeller nut	1
013	Splash ring	1	049	Circlip	1
014	Bearing casing	1	050, 051	Feather key	1
015	Shaft	1	053	Split ring, casing cover	1
033	Support foot	1	054	Split ring, suction side	1
036	Seal gland	1	055, 057	Screw plug	1
037	Flushing ring ²⁾	1	056, 058	Joint gasket ³⁾	1
038	Packing ring ²⁾	4	100-0, 100-1	Stud bolt	8/12 2
039	Cap piece of bearing	2	102-0, 102-1	Hexagon bolt	1 6
040	Seal of cap piece of bearing	2	110-0, 110-1	Hexagon nut	8/12 2
041	Thrust bearing	2	115-0, 115-1	Plain washer	2 1

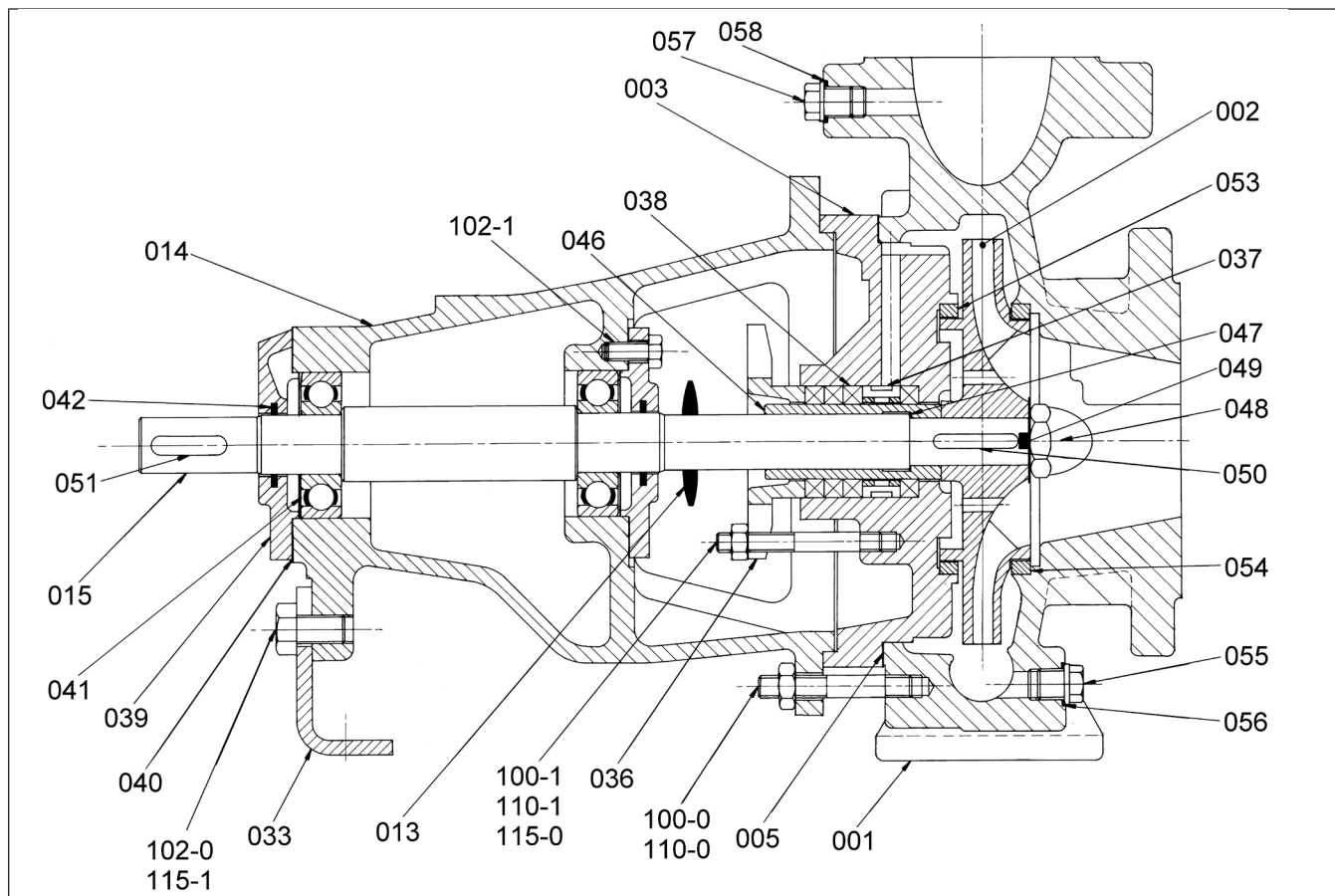
¹⁾ only with pumps of special design

²⁾ not with pumps with axial face seal

³⁾ may also be replaced by Teflon tape

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8.4 Parts list	Size of pumps
	150-250, 200-250



Item	Description	Number	Item	Description	Number
001	Impeller casing	1	042	Joint gasket ¹⁾	2
002	Impeller	1	046	Protective shaft sleeve ¹⁾	1
003	Casing cover	1	047	Seal of protective shaft sleeve ¹⁾	1
005	Casing seal	1	048	Impeller nut	1
013	Splash ring	1	049	Circlip	1
014	Bearing casing	1	050, 051	Feather key	1
015	Shaft	1	053	Split ring, casing cover	1
033	Support foot	1	054	Split ring, suction side	1
036	Seal gland	1	055, 057	Screw plug	1
037	Flushing ring ²⁾	1	056, 058	Joint gasket ³⁾	1
038	Packing ring ²⁾	4	100-0, 100-1	Stud bolt	8/12 2
039	Cap piece of bearing	2	102-0, 102-1	Hexagon bolt	1 6
040	Seal of cap piece of bearing	2	110-0, 110-1	Hexagon nut	8/12 2
041	Thrust bearing	2	115-0, 115-1	Plain washer	2 1

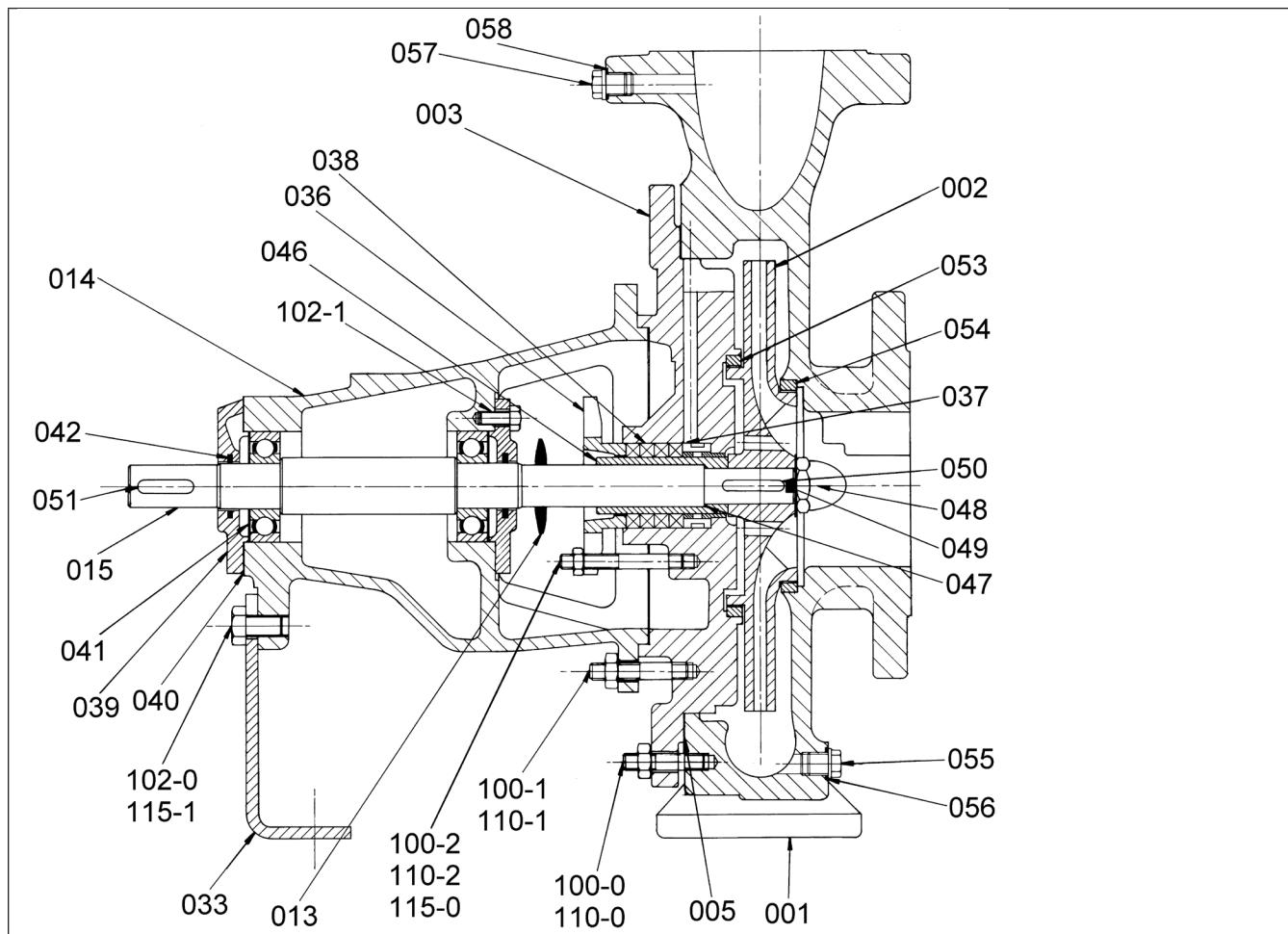
¹⁾ only with pumps of special design

²⁾ not with pumps with axial face seal

³⁾ may also be replaced by Teflon tape

Operating and Service Manual of Centrifugal Pumps **DELTANORM** Series

8.5 Parts list		Size of pumps
		40-315 to 100-315



Item	Description	Number	Item	Description	Number
001	Impeller casing	1	042	Joint gasket ¹⁾	2
002	Impeller	1	046	Protective shaft sleeve ¹⁾	1
003	Casing cover	1	047	Seal of protective shaft sleeve ¹⁾	1
005	Casing seal	1	048	Impeller nut	1
013	Splash ring	1	049	Circlip	1
014	Bearing casing	1	050, 051	Feather key	1
015	Shaft	1	053	Split ring, casing cover	1
033	Support foot	1	054	Split ring, suction side	1
036	Seal gland	1	055, 057	Screw plug	1
037	Flushing ring ²⁾	1	056, 058	Joint gasket ³⁾	1
038	Packing ring ²⁾	4	100-0, 100-1, 100-2	Stud bolt	8/12 6/8 2
039	Cap piece of bearing	2	102-0, 102-1	Hexagon bolt	1 6
040	Seal of cap piece of bearing	2	110-0, 110-1, 110-2	Hexagon nut	8/12 6/8 2
041	Thrust bearing	2	115-0, 115-1	Plain washer	2 1

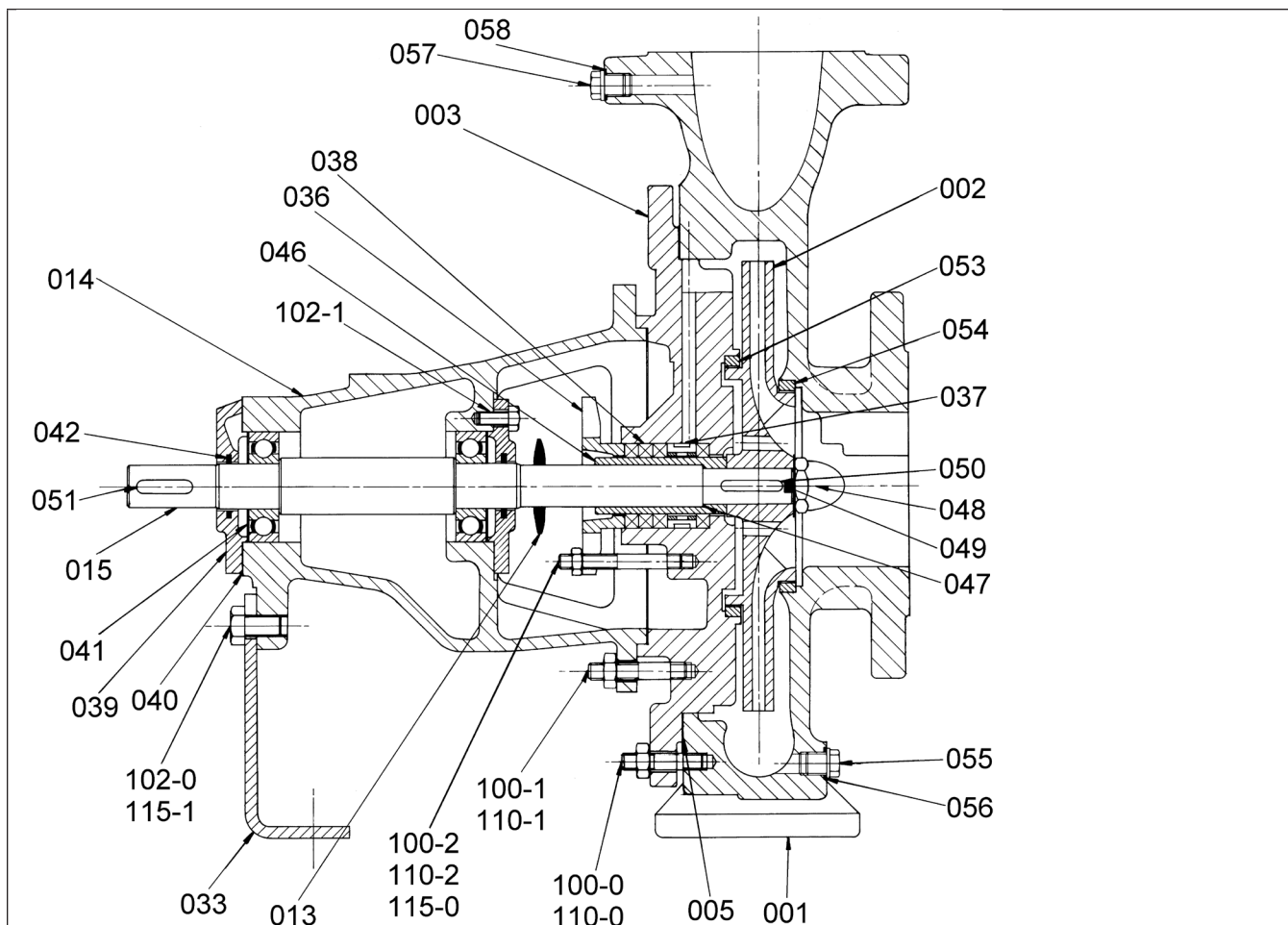
¹⁾ only with pumps of special design

²⁾ not with pumps with axial face seal

³⁾ may also be replaced by Teflon tape

Operating and Service Manual of Centrifugal Pumps **DELTANORM** Series

8.6 Parts list		Size of pumps
		125-315 to 150-315
		80-400 to 150-400



Item	Description	Number	Item	Description	Number
001	Impeller casing	1	042	Joint gasket ¹⁾	2
002	Impeller	1	046	Protective shaft sleeve ¹⁾	1
003	Casing cover	1	047	Seal of protective shaft sleeve ¹⁾	1
005	Casing seal	1	048	Impeller nut	1
013	Splash ring	1	049	Circlip	1
014	Bearing casing	1	050, 051	Feather key	1
015	Shaft	1	053	Split ring, casing cover	1
033	Support foot	1	054	Split ring, suction side	1
036	Seal gland	1	055, 057	Screw plug	1
037	Flushing ring ²⁾	1	056, 058	Joint gasket ³⁾	1
038	Packing ring ²⁾	4	100-0, 100-1, 100-2	Stud bolt	8/12 6/8 2
039	Cap piece of bearing	2	102-0, 102-1	Hexagon bolt	1 6
040	Seal of cap piece of bearing	2	110-0, 110-1, 110-2	Hexagon nut	8/12 6/8 2
041	Thrust bearing	2	115-0, 115-1	Plain washer	2 1

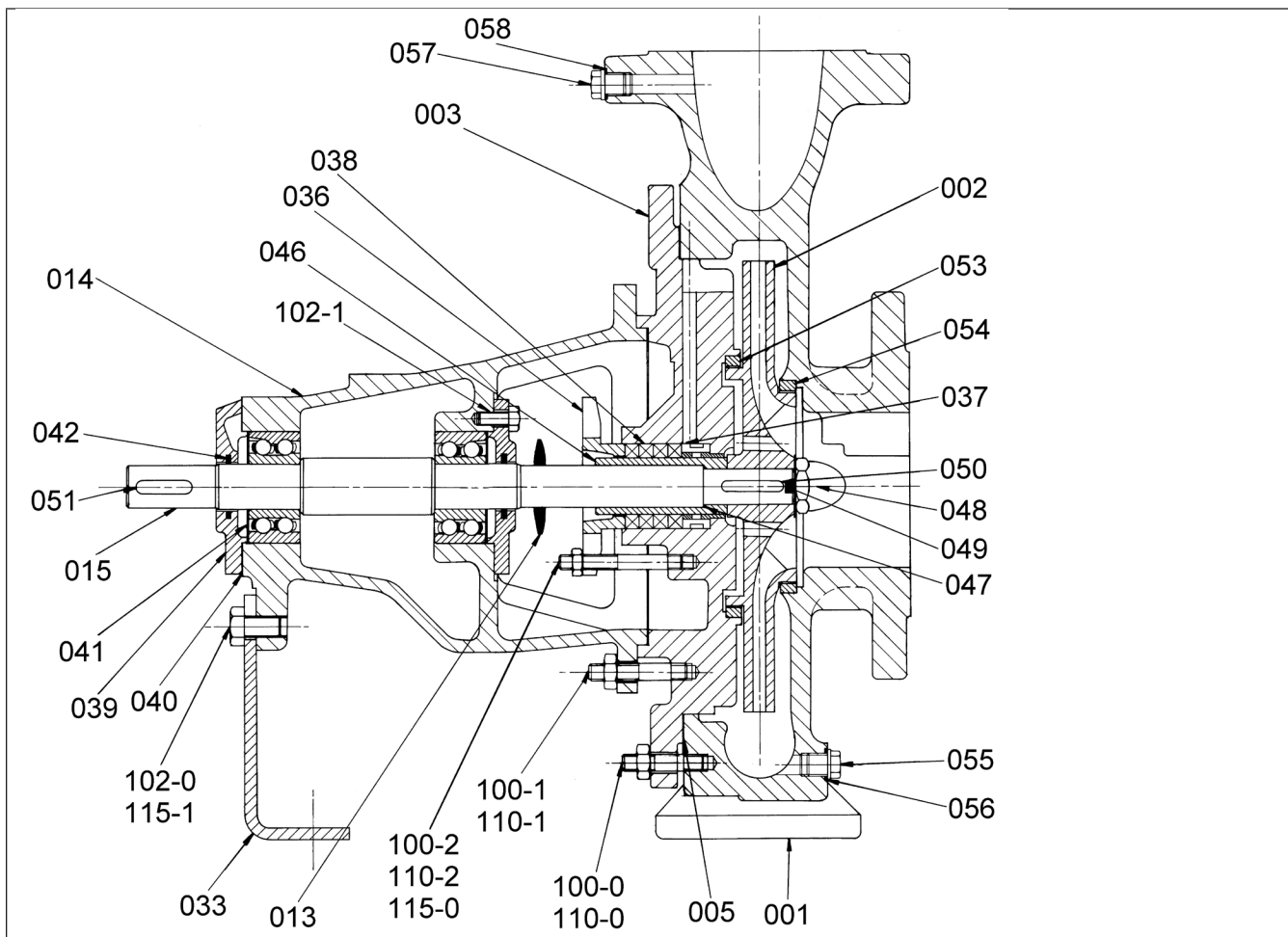
¹⁾ only with pumps of special design

²⁾ not with pumps with axial face seal

³⁾ may also be replaced by Teflon tape

Operating and Service Manual of Centrifugal Pumps **DELTANORM** Series

8.7 Parts list	Size of pumps
	40-315H to 80-315H



Item	Description	Number	Item	Description	Number
001	Impeller casing	1	042	Joint gasket ¹⁾	2
002	Impeller	1	046	Protective shaft sleeve ¹⁾	1
003	Casing cover	1	047	Seal of protective shaft sleeve ¹⁾	1
005	Casing seal	1	048	Impeller nut	1
013	Splash ring	1	049	Circlip	1
014	Bearing casing	1	050, 051	Feather key	1
015	Shaft	1	053	Split ring, casing cover	1
033	Support foot	1	054	Split ring, suction side	1
036	Seal gland	1	055, 057	Screw plug	1
037	Flushing ring ²⁾	1	056, 058	Joint gasket ³⁾	1
038	Packing ring ²⁾	4	100-0, 100-1, 100-2	Stud bolt	8/12 6/8 2
039	Cap piece of bearing	2	102-0, 102-1	Hexagon bolt	1 6
040	Seal of cap piece of bearing	2	110-0, 110-1, 110-2	Hexagon nut	8/12 6/8 2
041	Thrust bearing	2	115-0, 115-1	Plain washer	2 1

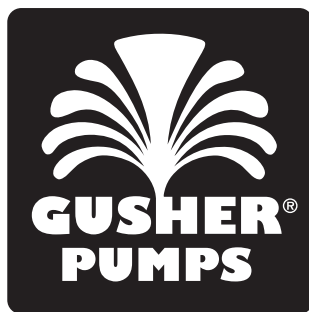
¹⁾ only with pumps of special design

²⁾ not with pumps with axial face seal

³⁾ may also be replaced by Teflon tape

9. Malfunctions / Causes

Cause	Malfunction						
	No pumping output	Pumping output too little	Pressure build-up too little	Pumping output stops after start	Vibrations	Motor becomes hot	Cavitation (noise development)
Pump not filled, tubing is air bound	X						
Speed too low	X	X	X				
Speed too high						X	X
Suction line leaky	X	X		X	X		X
Air or gas lock in the pumping medium			X	X	X		X
Counterpressure too high	X	X	X			X	
Suction head too high				X			
Feed pressure too low with hot pumping medium		X					
Tubing on suction side not sufficiently covered with liquid	X	X		X	X		X
Density of pumping medium too high		X	X			X	
Viscosity of pumping medium too high		X	X			X	
Impeller obstructed	X	X		X			
Tubing on suction side obstructed	X	X		X			
Wrong sense of rotation	X	X	X				
Split rings worn out		X	X				
Impeller damaged		X	X		X		
Driving motor defective						X	
Voltage too low						X	
Frequency too low						X	
Running on 2 phases						X	
Installation / foundation unstable					X		
Motor – pump not well aligned					X	X	
Bearing worn out					X		
Balance error in the impeller					X		
Impeller too small		X	X				



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Ruthman... Another Word for Innovation



It began in 1913, servicing mechanical components of the steamboats on the Ohio River. The company founder, Alois Ruthman, was a man of vision and saw part of the future of the company was in the development of a reliable industrial pump.

In 1924, with the conception of the first vertical ball bearing seal-less centrifugal pump, Ruthman Pump and Engineering furthered the design on a unit with a one piece motor driven shaft. The pump was called "Gusher", giving birth to the trade name Gusher Pumps, and the coining of the term "coolant pump".

Wanting to carry on the tradition of quality and reliability started by his father, Thomas R. Ruthman joined the company in 1949. In the early 1990's Thomas R. Ruthman's son, Thomas G. Ruthman joined the company, continuing this same tradition. Maintaining the reputation of Gusher Pumps by innovation and customer service, the company has grown to service companies worldwide.

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