

INSTALLATION AND OPERATING INSTRUCTIONS

**Vertical multi-stage centrifugal pumps
Series: VMS/VMSE/VMS(S)/VMSCF/VMSLHS
Design Version B**

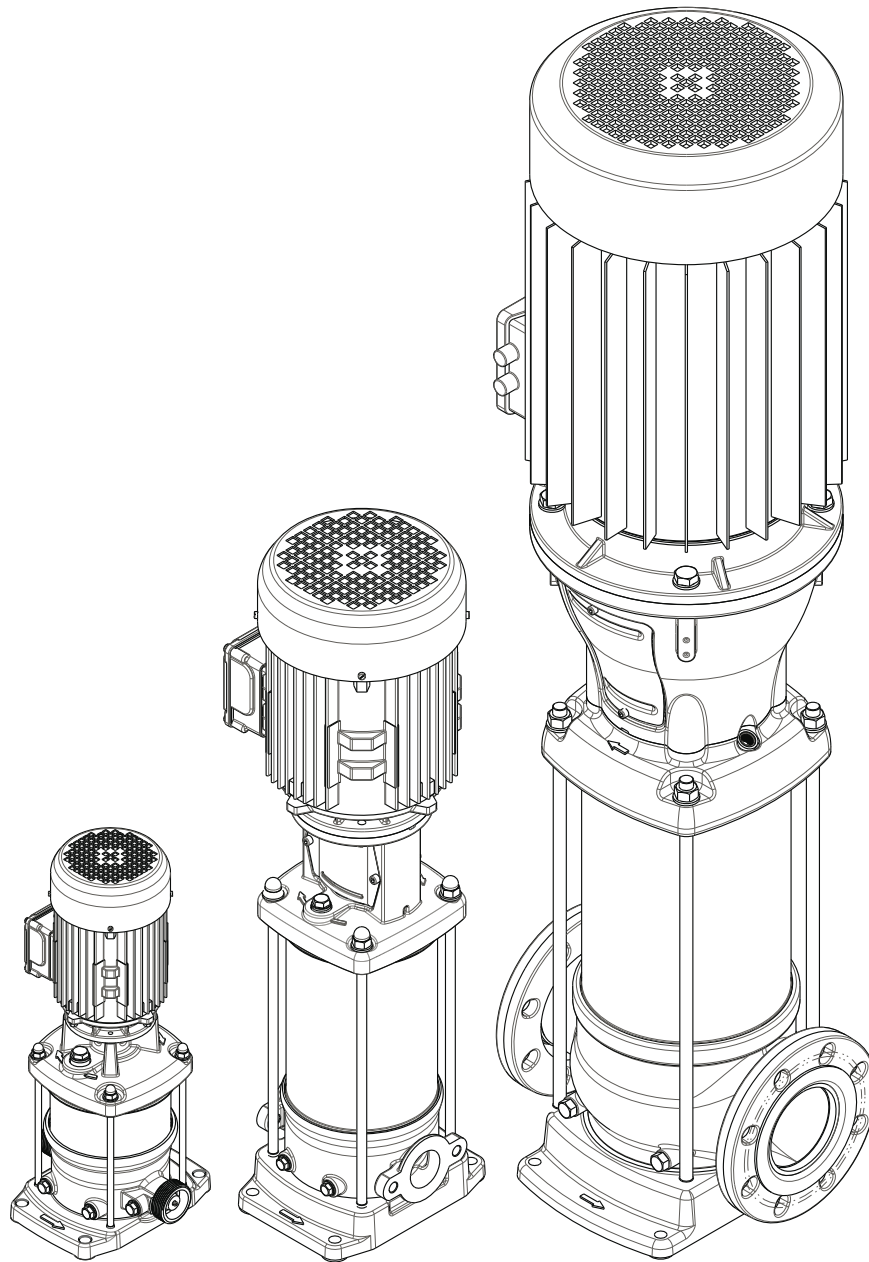


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1.0 MANUAL INTRODUCTION

1.1 PREFACE


This manual contains important information for reliable proper and efficient operation. Compliance with the operating instructions is of vital importance to ensure reliability and a long service life of the product and to avoid any risks.


The first chapters contain information about this manual and safety in general. The following chapters provide information about normal use, installation, maintenance and repairs of the product. The annexes contain the technical data, the parts drawings and the declaration(s) of conformity.


- Make yourself familiar with the content.
- Accurately follow the directions and instructions.
- Never change the sequence of the operations to be carried out.
- Keep this manual or a copy of it together with the logbook in a fixed place near the product which can be accessed by all personnel.


1.2 ICONS AND SYMBOLS

In this manual and in all accompanying documentation the following icons and symbols are used.

 **WARNING**
Danger of electric Voltage. Safety sign according to IEC 417 - 5036

 **WARNING**
Operations or procedures, if carried out without caution, may cause personal injury or damage to the product. General hazard sign according to ISO 7000-0434

 **ATTENTION**
Is used to introduce safety instructions whose non-observance may lead to damage to the product and its functions.

 **ENVIRONMENTAL INSTRUCTION**
Remarks with respect to the environment.

2.0 IDENTIFICATION, SERVICE AND TECHNICAL SUPPORT

2.1 OBTAINING DATA AND INFORMATION VMS 02A, 04A, 06A, 10A, 15A, 85A

The name plate indicates the type series / size, main operating data and identification number. Please quote this information in all queries, repeat orders and particularly when ordering spare parts. If you need any additional information or instructions exceeding the scope of this manual or in case of damage please contact Armstrong's nearest customer service centre.

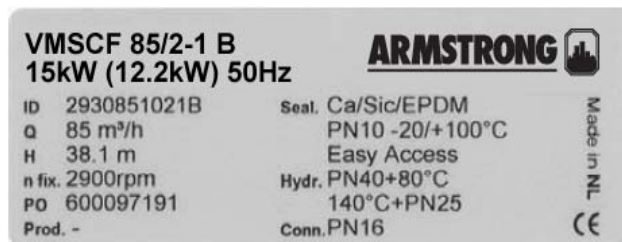


Figure 1: Pump with motor

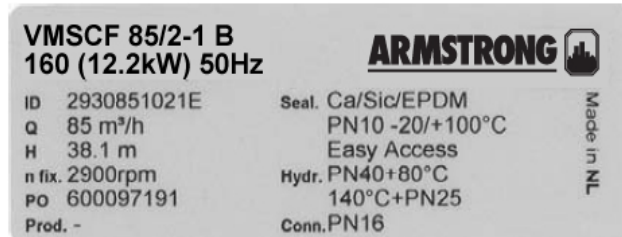


Figure 2: Pump without motor

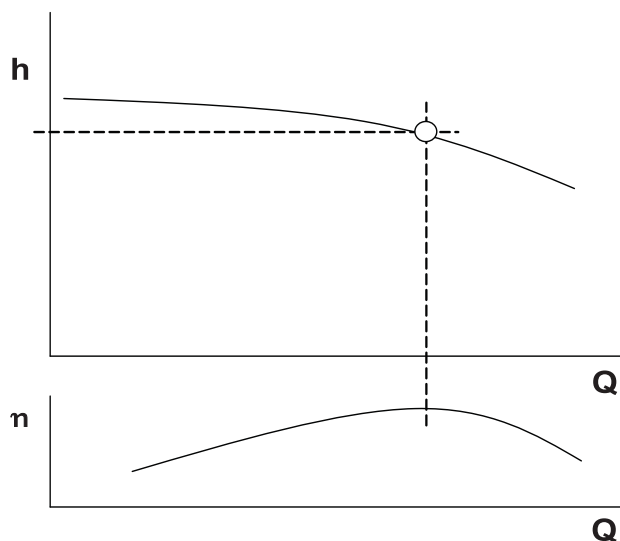


Figure 3: Duty point

Table 1: Description sticker

Indication		Meaning
VMSCF 85A/2-1 B		Basic pump type (design version B)
15 kW (12.2 kW)		Nominal motor power ¹ (required power)
50 Hz		Nominal frequency
Ca/Sic		Mechanical Seal Surface Code, See: 2.2Seal codes
EPDM		Pump Elastomers
Q	23.6 l/s	Optimum capacity running at fixed speed (see fig. Duty point)
H	38.1	Optimum heads running at fixed speed (see fig. Duty point)
n fix	2900 rpm	Rotation speed indication at which Q/H are given
Hydr.	140° C+PN25	Maximum temperature at mentioned pressure
Conn.	PN16	Pressure Class connection
Seal.	PN10 -20/+100° C	Maximum pressure at mentioned temperature ²
	Easy access	Seal construction type
ID	2930851021B	Pump ID > as build file
PO	600097191	Production order number
Prod	WW / YYYY – XXX	Production week/year and production serial number

1. Frame size in case without motor
2. At lower pressure a higher temperature is allowed (please consult your supplier)

Address data for service and technical support:

Armstrong Fluid Technology

Wenlock Way, Manchester

United Kingdom, M12 5JL

Tel: +44 (0) 8444 145 145

2.2 OBTAINING DATA AND INFORMATION VMS 32A, 45A, 65A

The name plate indicates the type series / size, main operating data and identification number. Please quote this information (first two lines*) in all queries, repeat orders and particularly when ordering spare parts. If you need any additional information or instructions exceeding the scope of this manual or in case of damage please contact Armstrong's nearest customer service centre.

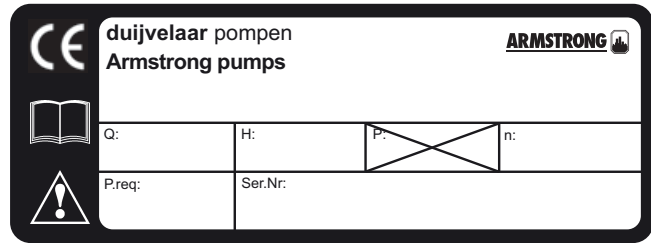


Figure 5: Pump without motor

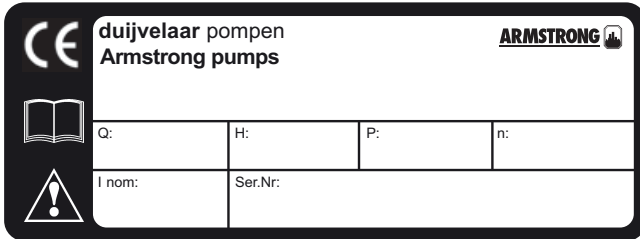


Figure 4: Pump with motor

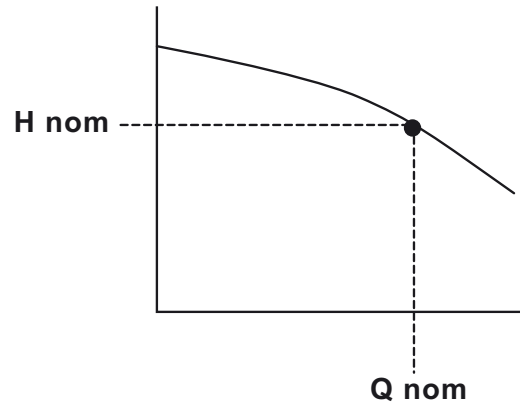


Figure 6: Duty point

Table 2: Description nameplate

Indication		Meaning
VMS	4-40	Pump type*
S: / ser.nr.		Serial number*
19/2004/234567	19	Production week*
	2004	Production year*
	234567	Product identification (as built file)*
Ca / Sic / EPDM	Ca	Rotating part mechanical seal (Carbon)*
	Sic	Stationary part mechanical seal (Siliconcarbide)*
	EPDM	Static sealing, O-rings (EPDM)*
PN	10	Pressure class (flange) connection*
Q	m ³ /h - l/sec - USGPM	Nominal capacity (see Q/H curve above)
H	mWc - PSI	Nominal head (see Q/H curve above)
I _{nom} ¹	A	Nominal current (see 2.2)
n	¹ /min	Nominal rotation speed
P	kW - HP	Installed motor power on the pump
P _{req}	kW - HP	Required motor power for the pump

1. For pumps delivered with special motors no values are given (please use values as indicated on the motor plate).

The following address data are available for service and technical support:

Armstrong Fluid Technology

Wenlock Way, Manchester
United Kingdom, M12 5JL
Tel: +44 (0) 8444 145 145

2.3 SEAL CODES

Table 3: Material code shaft seal

Code acc. to EN 12756	Description	Material		Note
B	Spring loaded ring	Carbon graphite	Ca	Resin impregnated
Q1		Silicon carbide	SiC	Sintered pressureless
U3		Tungsten carbide	TuC	CrNiMo-binder
A	Seat ring	Carbon graphite	Ca	Antimony impregnated
B		Carbon graphite	Ca	Resin impregnated
Q1		Silicon carbide	SiC	Sintered pressureless
U3		Tungsten carbide	TuC	CrNiMo-binder
E	Elastomers	EPDM	EPDM	Ethylene propylene rubber
V		Viton	Viton	Fluor carbon rubber
X4		HNBR	HNBR	Hydrogenated nitrile rubber
G	Spring	CrNiMo steel		
G	Other metal parts	CrNiMo steel		

2.4 CURRENT

2.4.1 NOMINAL CURRENT

VMS 02A, 04A, 06A, 10A, 15A, 85A

The nominal allowable current of the motor is stated on the motor plate. This shows the nominal working range of the motor and can be used to protect the motor.

Measuring the actual current of the pump during operation can be used to pre-set the motor protection switch to protect the pump/motor combination. This current value can also be used to determine the proper electrical equipment such as variable frequency drive, main switch, wiring diameter etc.



WARNING

Not only the motor, but also the pump has to be protected in its application.

2.4.2 MAXIMUM CURRENT

VMS 32A, 45A, 65A



The maximum allowable current of the motor is mentioned as I_{max} on the motor plate. This maximum allowable current shows the maximum working range of the motor and can be used to protect the motor.



WARNING


Be careful in using it this way, because, not only the motor, but also the pump has to be protected in its application.

On the pump plate (sleeve sticker) this "pump current at 400 Volts" will be mentioned as I_{nom} and can be used to pre-set the motor protection switch to protect the pump/motor combination.


ARMSTRONG 

duijvelaar pompen
Armstrong pumps

Q:	H:	P:	n:
I nom:	Ser.Nr:		



This current value can also be used to determine the proper electrical equipment such as variable frequency drive, main switch, wiring diameter etc.

2.5 SUPPLEMENTARY DOCUMENTATION

Apart from this manual, the documentation given below is also available:

Document	Date/	Code
General terms of delivery	10-1998	119 / 1998
VMS 02A, 04A, 06A, 10A, 15A & 85A		
Technical Data 50Hz version B	02-2010	97004455
Technical Data 60Hz version B	02-2010	97004435
VMS 32A, 45A & 65A		
Engineering Reference	11-2008	BE00000329
Technical Data 50Hz	07-2008	97004434
Technical Data 60Hz	07-2008	97004435
Technical Data 60Hz	12-2007	97004436
Motec operating instructions	09-2001	BA-8200-motec-frequency-inverters-V3-
See also armstrongintegrated.com		

3.0 WARRANTY

3.1 TERMS OF WARRANTY

The warranty period is settled by the terms of your contract or at least by the general terms and conditions of sales.



ATTENTION

Modifications or alterations of the product supplied are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for consequential damage.



ATTENTION

The warranty relating to the operating reliability and safety of the product supplied is only valid if the product is used in accordance with its designated use as described in the following sections of this manual. The limits stated in the data sheet must not be exceeded under any circumstances.

The warranty becomes invalid if one or more of the points below occur.

- The buyer makes modifications himself.
- The buyer carries out repairs himself or has these carried out by a third party.
- The product has been handled or maintained improperly.
- The product has non original Armstrong spare parts fitted.

Armstrong remedies defects under warranty if the points below are observed.

- Defects are caused by flaws in the design, the materials or the production.
- The defect has been reported within the warranty period.

Other terms of warranty have been included in the general terms of delivery, which are available upon request.

4.0 SAFETY AND ENVIRONMENT

4.1 GENERAL

This Armstrong product has been developed using state-of-the-art technology; it is manufactured with utmost care and subject to continuous quality control. Armstrong does not accept any liability for damage and injury caused by not observing the directions and instructions in this manual. This also applies in cases of carelessness during the installation procedure, use and maintenance of the product.

Non-compliance with safety instructions can

jeopardize the safety of personnel, the environment and the product itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages. For example, in particular non-compliance can result in:

- Failure of important pump/system functions,
- Failure of prescribed maintenance and servicing practices,
- Injury to persons by electrical, mechanical and chemical effects,
- Hazard of the environment due to leakage of
- Hazardous substances,
- Explosions.

Depending on specific activities, extra safety measures may be required. Contact Armstrong if a potential danger arises during use.



ATTENTION

The owner of the product is responsible for compliance with the local safety regulations and internal company guidelines.



ATTENTION

Not only must the general safety instructions laid down in this chapter on "Safety" be complied with, but also the safety instructions outlined under specific headings

4.2 USERS

All personnel involved in the operation, maintenance, inspection and installation of the product must be fully qualified to carry out the work involved.

Personal responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question is not already in possession of the required know-how, appropriate training and instruction must be provided. If required, the operator may commission the manufacturer / supplier to take care of such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

4.3 SAFETY PROVISIONS

The product has been designed with the greatest possible care. Original parts and accessories meet the safety regulations. Modifications in the construction or the use of non-original parts may lead to a safety risk.



ATTENTION

Make sure that the product operates within its working range. Only then the product performance is guaranteed.

4.3.1 LABELS ON THE PRODUCT

The icons, warnings and instructions applied to the product are part of the safety provisions. The labels may not be removed or covered. Labels must remain legible during the entire life of the product. Replace damaged labels immediately.

4.4 SAFETY PRECAUTIONS


4.4.1 DURING NORMAL USE


- Contact the local electricity company for questions about the power supply.
- Cover the parts that can become hot, so direct contact is impossible.
- When applicable, always place unreformed coupling protection plates to protect the coupling, before putting the pump into use. Make sure that the coupling protection plates are never in contact with the running coupling.
- Always close the terminal box on the pump.


4.4.2 DURING INSTALLATION, MAINTENANCE AND REPAIR


During installation, maintenance and Repair


Only authorised personnel may install, maintain and inspect the product and repair electrical components. Observe the local safety regulations.


 **WARNING** Always disconnect the energy supply to the product first, before installation, maintenance and repairs. Secure this disconnection.

 **WARNING** Surfaces of a pump can be hot, after continuous operation.

 **WARNING** Make sure that no one can be near rotating components when starting a pump.

 **WARNING** Handle a pump with dangerous liquids with the utmost care. Avoid danger for persons or the environment when repairing leakages, draining liquids and venting. It is strongly recommended to place a relief barge under the pump.


 **WARNING** Immediately following completion of the work, all safety-relevant and protective devices must be re-installed and / or re-activated.

 **WARNING** Please observe all instructions set out in the chapter "Commissioning/Startup" before returning the product to service.

4.5 ENVIRONMENTAL ASPECTS


4.5.1 GENERAL

The products of Armstrong are designed to function in an environmentally friendly way during their entire life. Therefore, when applicable, always use biodegradable lubricants for maintenance.

 **ENVIRONMENTAL INSTRUCTION** Always act according to the laws, bylaws regulations and instructions with respect to health, safety and the environment.

4.5.2 DISMANTLING

Dismantle the product and dispose of it in an environmentally friendly way. The owner is responsible for this.

 **ENVIRONMENTAL INSTRUCTION** Ask at the local government about the re-use or the environmentally friendly processing of discarded materials

5.0 PUMP INTRODUCTION

5.1 MODEL KEY

Table 4: Model key Example VMSSF85A/3-1 B

	VMS	S	F	85	/3	-1	B	
Label	VM							Product Label
Material/Construction		C						All wetted parts Stainless Steel 1.4301 / AISI 304
		M						Cast Iron pump foot and top bracket hydr. 1.4301 / AISI 304
		S						All wetted parts Stainless Steel 1.4301 / AISI 304 with closed coupled motor
Connections			E					All wetted parts Stainless Steel 1.4401 / AISI 316
								Male thread (with non-return valve insert)
								Oval flange with female thread
			F					Round flange
			V					Victaulic connections
		T					Tri-clamp connections	
				85				Capacity in m ³ /h at Q _{-opt.}
					/3			Number of stages
					/3	-1		Number of stages of which one stage with reduced head
							B	Design version

5.2 DESCRIPTION OF THE PRODUCTS

The vertical, single or multi stage centrifugal pump series are designed for pumping clean, or lightly aggressive, watery mediums.

Suction and discharge of the pump are in-line, making the pump easy to install.

The hydraulic assembly is driven by an electric motor. All hydraulic parts of the pump are made of stainless steel.

5.3 MODULAR SELECTION

To suit almost every application the pump is assembled out of modules which can be selected depending on the required working range. Basic modules are:

- **Basic pump model**, which defines the capacity, pressure and basic material
- **Connections**, which define the suction and discharge connection as well as the base plate.
- **Sealings**, which define the elastomers, the mechanical seal and the shaft seal type.
- **Electric motor**, which defines all requirements of the motor such as motor size, power, voltage, frequency and all possible motor accessories.

5.4 OPERATION

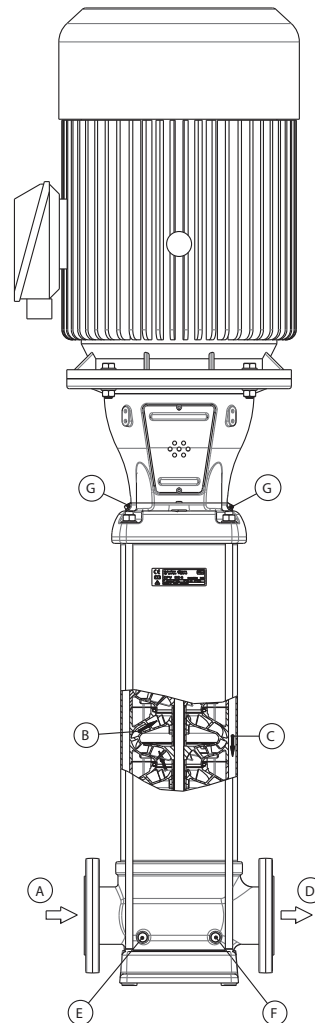


Figure 7: VMSF 85A

During centrifugal operation of the pump an negative pressure is created at the inlet of the impeller. This under pressure enables the medium to enter the pump at the suction connection (A).

Every stage (B) consists of an impeller and diffuser. The passage of this stage determines the capacity of the pump. The diameter of the stages is related to the centrifugal forces and its "stage pressure": the more stages, the more pressure.

This total capacity and raised pressure will be guided to the outside of the pump, between the pump stages and the outer sleeve (C) and the medium will leave the pump at the discharge connection (D).

5.5 MEASURING DRAINING AND VENTING

The pump is provided with plugs for measuring, draining and venting.

Connection (E) is meant to drain the inlet part of the pump. Or to measure the inlet / suction pressure using a G 1/4 connection.

Connection (F) is meant to drain the outlet part of the pump. Or to measure the discharge pressure using a G 1/4 connection.

Connections (G) are meant to vent the pump system when the pump is not in operation. Or to measure the discharge pressure of the pump using a G 3/8 connection.

5.6 WORKING RANGE

VMS 02A, 04A, 06A, 10A, 15A and 85A

The working range depends on the application and a combination of pressure and temperature. For specific and detailed limits advice the working ranges are described in the chapter 5.3 Modular selection. The overall working range of the pumps can be summarised as follows:

Pump type	VMS	Note
Ambient temperature [°C]	-20 up to 40	1
Minimum inlet pressure	NPSH _{req.} + 1m	
Viscosity [cSt]	1-100	2
Density [kg/m ³]	1000-2500	2
Cooling	forced motor cooling	3
Minimum frequency [Hz]	10	
Maximum frequency [Hz]	60	4
Allowable size of solids pumped	5µm to 1mm	

Table 5: Specification of the working range

1. If the ambient temperature exceeds the above value or the motor is located more than 1000 m above sea level, the motor cooling is less effective and could require an adapted motor power. See table 9: Motor load dep. sea level or amb. temp or please contact your supplier for more detailed advice.
2. Deviation in viscosity and/or density could require an adapted motor power. Please contact your supplier for more detailed advice.
3. The free space above the motor cooling fan must be at least 1/4 of the diameter of the inlet of the cooling fan in order to have a sufficient flow of (cooling) air.
4. Pumps that are intended for 50 Hz operation, may not be connected to 60 Hz power supply.

For minimum flow at medium temperature of 20 °C see table 6 Minimum capacity (Q_{min}); for higher temperatures see table

Table 6: Minimum capacity (Q_{min})

Size	Q _{min} [m ³ /h]			
	50 Hz		60 Hz	
	2 pole	4 pole	2 pole	4 pole
2	0.2		0.2	
4	0.4		0.5	
6	0.6		0.8	
10	1.1	0.5	1.3	0.6
15	1.6	0.8	2.0	1.0
85	8.5	4.3	10.2	5.1

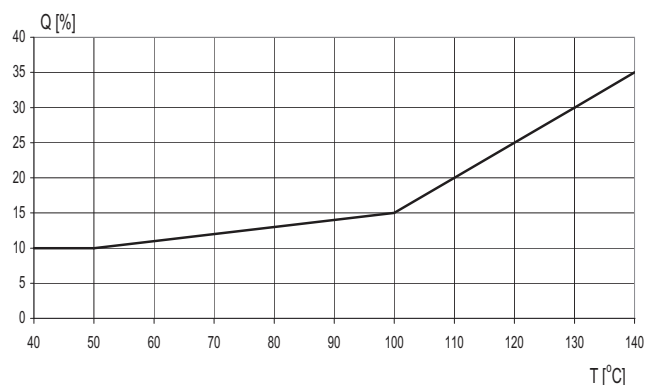
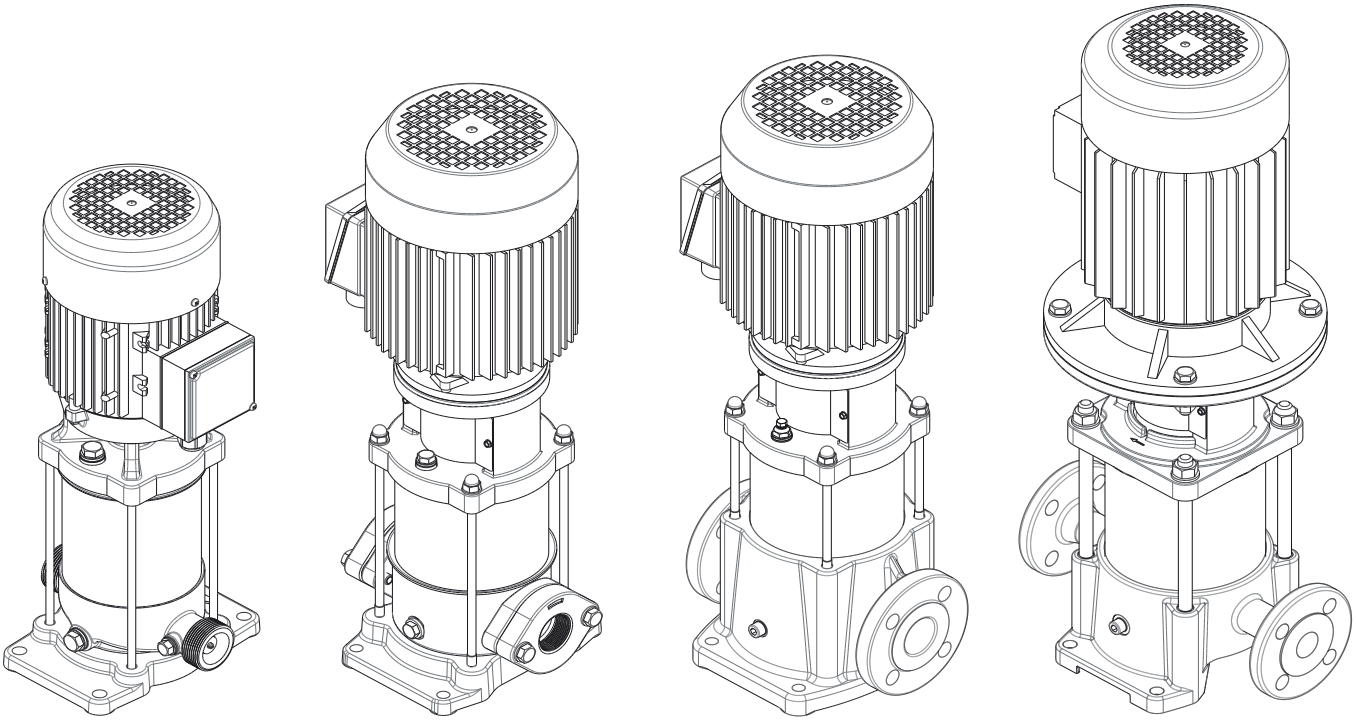


Figure 8: Minimum capacity vs. temperature (in % of Q optimum)

5.7 GENERAL



Vertical pumps:

VMSE

VMS(S)

VMSCF

VMSLHS

The vertical, multi-stage centrifugal pumps VMSE, VMS(S), VMSCF and VMSLHS are produced by Armstrong

5.8 INTENDED USE

The pumps VMSE, VMS(S), VMSLHS and VMSCF are suitable to transport and increase the pressure of cold and hot water without wear to parts within the indicated working range. The transport of liquids with a different viscosity or density than water is possible as well. For this a motor with an adjusted power is used. Ask Armstrong or your distributor for advice.

Any other or further use of the pump is not in conformity with its intended use. Armstrong does not accept any liability for any damage or injury that results from this. The pump is produced in accordance with the current standards and guidelines. Use the pump only in a perfect technical state, in conformance with the intended use described below.

The Intended use as laid down in EN 12100-1 is the use for which the technical product is intended according to the specifications of the manufacturer. The use of the product has been described in the sales brochure and in the user manual. Always observe the instructions given in the user manual. When in doubt the product must be used as becomes evident from its construction, version and function.

5.9 WORKING RANGE VMS 32A, 45A and 65A

The working range of the pumps in this series can be summarised as follows:

Table 7: Specification of the working range

Pump type	VMSE	VMS	VMSF/V	VMSS	VMSSF/V	VMSCF	VMSHS
Ambient temperature [°C]	+4 to 40						
Liquid temperature [°C]	-15 to 60	-15 to 100 ¹		-15 to 120 ²		-15 to 120	-15 to 80 ³
Maximum working pressure [bar]	10 ⁴	16 ⁴	25 ⁴	16 ⁴	25 ⁴	25 ⁴	40 ⁴
Allowable size of solids pumped	5µ to 1mm						
Minimum supply pressure	Not cavitating ⁵ .						
Viscosity liquid [cSt]	1						
	A higher viscosity may require more motor power ⁵ .						
Density liquid [kg/m ³]	1000						
	A higher density may require more motor power ⁵ .						
Cooling	The space above the cooling fan of the motor must at least be equal to 1/4 of the diameter of the inlet of the cooling fan of the motor in order to have a sufficient supply of air.						
Number of starts	Related to the motor ⁶						
Minimum frequency [Hz]	10						
Maximum frequency [Hz]	60 ⁷						

- Using the factory option “o-ring sealing EPDM E425” the max. temp. limit is 120°C.
- When pumping water, the max. allowable liquid temp is 80°C.
- Higher temperatures are possible at lower pressure. For specific limits consult your supplier.
- The total of the supply pressure and no-load delivery pressure with closed outlet shut-off valve may not exceed the maximum working pressure.
- Contact your supplier for more detailed advice.
- For standard motors see the technical specifications. When the pump is fitted with another motor brand, please consult the motor supplier.
- Pumps that are intended for 50 Hz operation, may not be connected to 60 Hz.

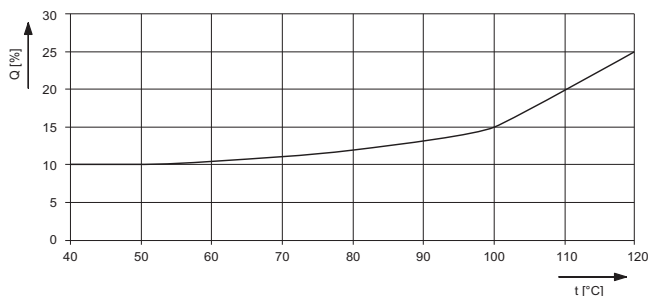


Figure 9: Minimum volume flows (Q) in % of Q optimum temperatures (t).

Table 8: Minimum capacity (Q_{min})

Armstrong	50 Hz	60 Hz
	Q _{min} [m ³ /h]	
6	0.8	0.8
10	1.2	1.4
14	1.0	1.1
18	2.4	2.4
24	2.2	2.6
32	4.0	4.0
45	4.6	5.1
65	6.1	6.1

Table 9: Specific applications

Type	Application area
VMS	(Drinking) water supply systems, irrigation systems, water treatment systems, carwash systems, sprinkler systems.
VMSS	Water-supply systems for drinking water, softened and demineralised water, systems for brackish water, sea water and swimming-pool water, however limited with respect to temperature, pressure and chlorine percentage.
VMSCF	Systems for boiler supply and discharge of condensed water
VMSLHS	Reverse osmosis installations and high pressure cleaning systems.
VMSE	(Drinking) water supply systems.

5.10 EXPLOSION SAFETY



ATTENTION

This sub chapter contains fundamental information which has to be taken in consideration when installing the pump with ATEX permission in a hazardous environment.

5.10.1 GENERAL

Stickers or indicators on the pump sleeve and the motor indicate whether the pump is suitable for use in an environment with risk of explosion.

It is allowed to install the pump in a zone which is classified in directive 1999/92/EC. When in doubt it is compulsory to check the above Directive

5.10.2 INDICATION



Figure 10: Indication sticker explosion safety

Table 10: Explosion safety

Indication	Meaning
II	Product group for use above ground, with the exception of mine working where there can be danger of explosion due to mine gas and/or flammable substances.
2	Category 2: Equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/dusts mixtures are likely to occur.
G	Suitable for an environment that is explosive due to gas, vapour or fumes; not suitable for an environment that is explosive due to dust.
T4/T3	Temperature class: T4 for medium temperatures up to 100° C; T3 for medium temperatures up to 60° C



ATTENTION

When the pump is placed in an explosion hazardous environment no pump should be opened or disassembled on site. Due to the probable creation of sparks during loosening and tightening of nuts and bolts.

5.10.3 COMMISSIONING (CHECK LIST)

It is compulsory to check these points prior putting the pump in operation.

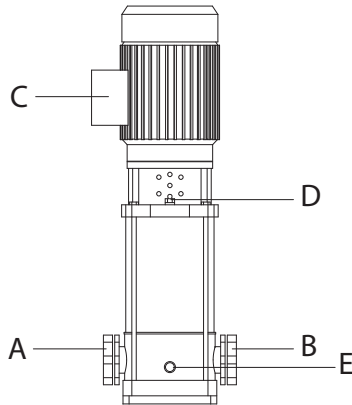
- Check if the ATEX-data on the motor and the pump are in line with the specified category. See table 11 ATEX-Categories 12.
- When the categories of the motor and the pump are different, the lowest category is leading.
- For category 2: make sure that the pump is protected against damage from outside.
- Check that the motor cable is suitable for the current drawn by the motor.
See: motor type plate.
- Check that the pump is fully filled with the liquid (de-aerated). Do not run the pump dry.
- Check the rotational direction of the motor. The motor has to run clockwise (seen from the non driven side). This direction is indicated with an arrow on the pump top bracket.
- Make sure that the liquid temperature never exceeds the temperature mentioned in the explosion safety code T3 or T4. See table 10 Explosion safety 12.
- Avoid overheating of the pump to ensure a minimum flow in the pump according with the description in chapter 5.3 Working range 10.
- The pumps has to be de-aerated again when:
 - The pump is taken out of operation.
 - Some air has gathered in the pump.
- Make sure that the pump and the motor shaft are running smoothly and without excessive noise (e.g. no parts are running against each other).
- Make sure that the pump is connected to ground.

Table 11: ATEX-Categories

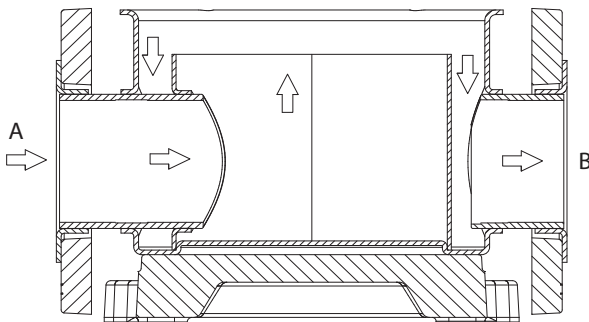
Group	Category	Zone	Pumps	Motors
I	M	1	None	None
		2	None	None
II	1	G 0	None	None
		D 20	None	None
	2	G 1	VMSCF	2G Eex e T3 2G Eex d T4
		D 21	None	None
	3	G 2	VMSCF	2G Eex e T3 2G Eex d T4
		D 22	None	none

5.11 OPERATION

The liquid is sucked in through the pump inlet (A) on the supply side under minimum pressure. The pump increases the pressure. The liquid leaves the pump through the pump outlet (B) on the delivery side under increased pressure.



- A Pump inlet
- B Pump outlet
- C Terminal box
- D Fill plug/air relief plug
- E Drain plug



6.0 TRANSPORT

6.1 TRANSPORT

1. Transport the pump in the position as indicated on the pallet or packaging.
2. Make sure the pump is stable.
3. If present, observe the instructions on the packaging.



WARNING

Lift the pump, if necessary using a hoist and suitable slings. Attach the slings to the transport lugs on the packaging, where present.



WARNING

The pump must be lifted according to the current hoist guidelines. Only qualified personnel is allowed to lift the pump.



WARNING

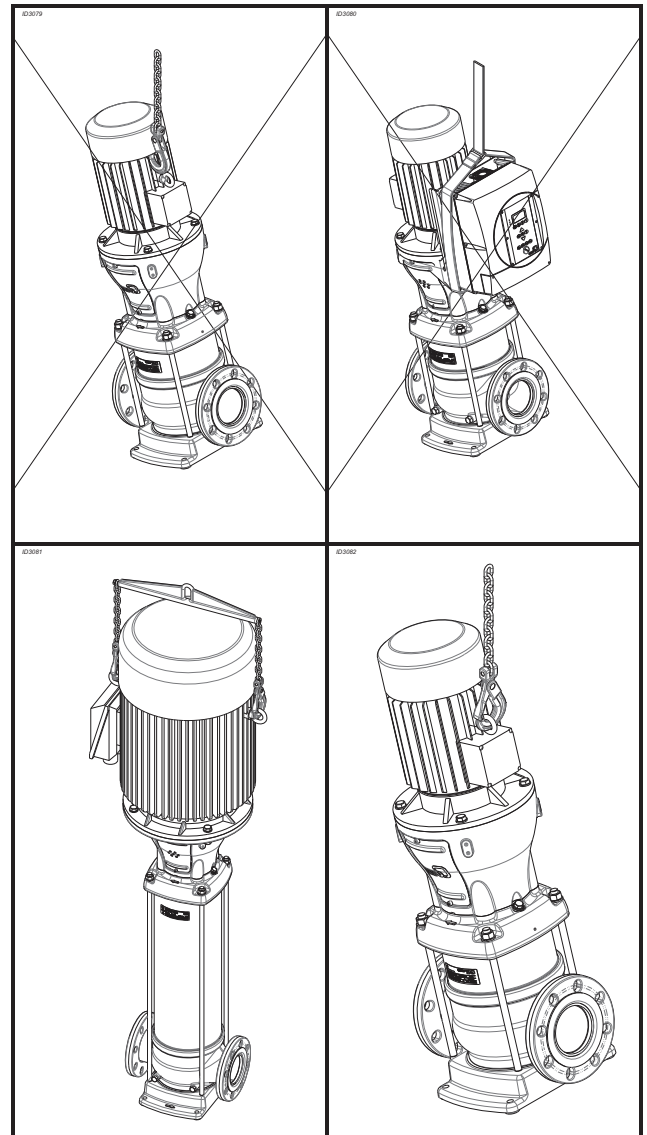
Do not lift the pump by using the frequency converter (if placed), electrical parts or the motor cover. Be sure that the pump is always



WARNING

Pumps could tilt while lifting. Do not remove the lifting devices from the pump before the pump is placed and mounted correctly.

Table 12: Transport positions



6.2 STORAGE

Fill the pump with glycol in order to protect it against the risk of frost.

Storage	
t_{ambient} [°C]	-10/40
Max. rel. humidity [%]	80% at 20°C not condensing

Table 13: Storage

6.2.1 INSPECTION DURING STORAGE

1. Turn the shaft every three months and just before putting into operation.

7.0 INSTALLATION INSTRUCTIONS

7.1 SETTING UP THE PUMPS


ATTENTION
 Make sure that the pump connections are not over-stressed at the inlet and outlet connections. Please see the table below.

Table 14: Allowable forces VMS (S)F

Type	DN [mm]	Force [N]			
		F _x	F _y	F _z	ΣF
V(S)F 2 B	25	3300	2400	1700	4400
V(S)F 4 B	25	3300	2400	1700	4400
V(S)F 6 B	32	3300	2400	1700	4400
V(S)F 10 B	40	4000	3100	3100	5900
V(S)F 15 B	50	4000	3100	3100	5900
V(S)F 85 B	100	3500	2500	1000	4400

20090283-C

Table 15: Allowable torque VMS (S)F

Type	DN [mm]	Moment [Nm]			
		M _x	M _y	M _z	ΣM
V(S)F 2 B	25	280	95	210	400
V(S)F 4 B	25	280	95	210	400
V(S)F 6 B	32	280	95	210	400
V(S)F 10 B	40	440	180	200	500
V(S)F 15 B	50	440	180	200	500
V(S)F 85 B	100	750	500	625	1100

20090283-C

Table 16: Allowable forces VMSCF

Type	DN [mm]	Force [N]			
		M _x	M _y	M _z	ΣM
VCF 2 B	25	9400	3200	3200	10400
VCF 4 B	25	9400	3200	3200	10400
VCF 6 B	32	9400	3200	3200	10400
VCF 10 B	40	11000	2000	6500	12900
VCF 15 B	50	11000	2000	6500	12900
VCF 85 B	100	60000	40000	40000	82500
VCFCF 32A	65	54000	25000	44000	74000
VCFCF 45A	80	48000	17000	31000	59600
VCFCF 65A	100	60000	21000	33000	71600


20090283-C

Table 17: Allowable torque Armstrong VCF

Type	DN [mm]	Force [N]			
		M _x	M _y	M _z	ΣM
VCF 2 B	25	600	300	360	800
VCF 4 B	25	600	300	360	800
VCF 6 B	32	600	300	360	800
VCF 10 B	40	460	460	1000	1200
VCF 15 B	50	460	460	1000	1200
VCF 85 B	100	3600	6100	4800	8600

Table 18: Allowable forces VMSCF

Type	DN [mm]	Force [N]			
		F _x	F _y	F _z	ΣF
VMSCF 32A	65	2300	1700	2000	3500
VMSCF 45A	80	2700	2700	2300	4500
VMSCF 65A	100	3300	3600	3000	5700

ATTENTION
 For the values mentioned in the tables above, it is assumed that they occur simultaneously.

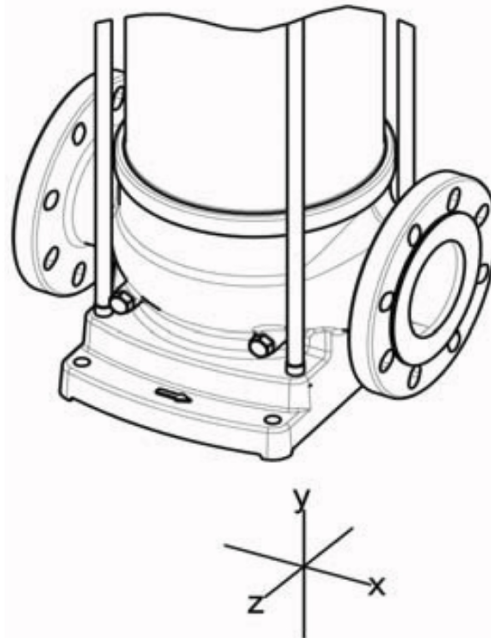




Figure 10: Allowable forces

ATTENTION
 Pumps which do not stand steady or stable on their own, should be mounted on a rigid and stable base.

ATTENTION
 Locate the pump at the place with the lowest risk for noise nuisance.

1. Place and install the pump on a level, stable surface in a dry and frost-free room.
2. Make sure that sufficient air can reach the cooling fan of the motor. For this purpose the free space above the cooling fan should be at least 1/4 of the diameter of the fan cover air intake.
3. Install the pump with counter flanges. For pumps with non-standardised connections, counter flanges are delivered separately.
4. It is advised to install a valve on the supply and on the delivery connection of the pump.
5. To avoid medium flowing back through the pump, when idle, make sure a non-return valve is installed.
6. Make sure that the inlet of the pump is never clogged.

7.1.1 INDICATORS

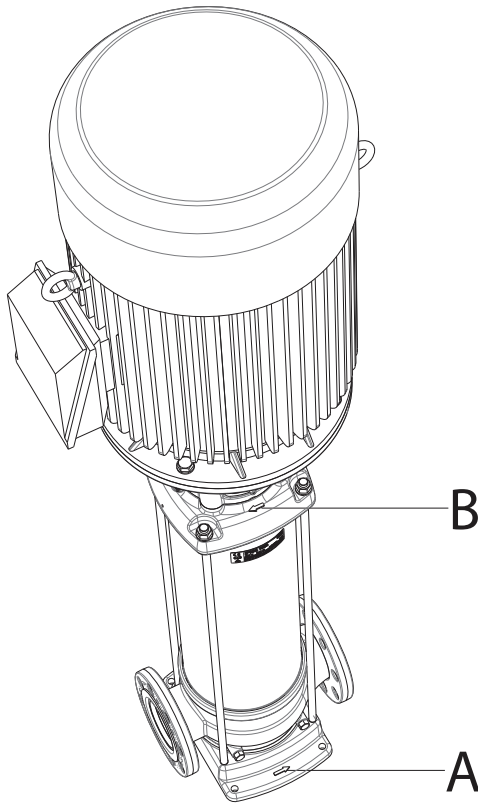


Figure 11: Pump indicators

The arrow (A) on the pump foot indicates the flow direction of the liquid. The arrow (B) on the top bracket indicates the rotating direction of the motor.

7.1.2 INSTALL BYPASS

Install a bypass if the pump operates against a closed valve. The required capacity of the bypass is at least 10% of the optimum volume flow. At high operating temperatures a higher volume flow is required. Refer to the table "Minimum volume flows" in the paragraph "Working range".

7.2 MOUNTING A MOTOR ON THE PUMP



ATTENTION

It is advised to use a specially designed Armstrong motor. Before installing an other brand/standard IEC-norm motor, Armstrong has to be consulted to verify the applicability.

The motor has to conform to the following conditions:

- Reinforced bearing at driven end (to withstand the axial force)
- Axially fixed rotor (to minimize the axial play of the pumps hydraulic)
- Smooth shaft, no key lock (to improve the coupling grip and to improve the motor balance)
- Increased power output (to limit the standard installed motor power)
- Fixed bearing at driven end (to minimize the axial play)

The advised bearings per motor type are:

For pump series: VMS 02A, 04A, 06A, 10A, 15A, 85A

Table 19: Minimum required motor Driven-end Bearing

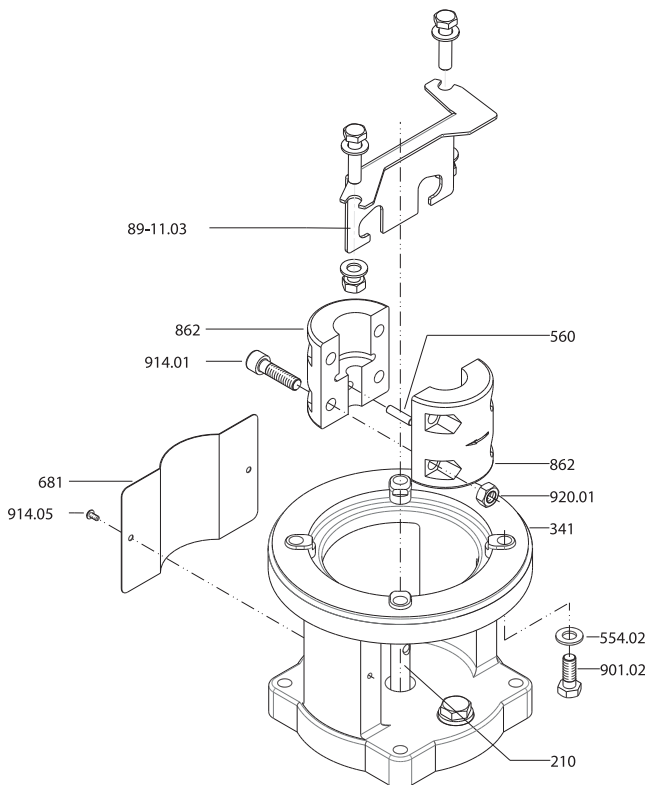
Bearing type			
Power output [kW]	1 phase 50 Hz	3 phase 50/60 Hz	
		2 pole	4 pole
0.25			6203-2Z-C3
0.37	6202-2Z-C3	6203-2Z-C3	6203-2Z-C3
0.55	6202-2Z-C3	6203-2Z-C3	6204-2Z-C3
0.75	6204-2Z-C3	6204-2Z-C3	6204-2Z-C3
1.1	6305-2Z-C3	6204-2Z-C3	6305-2Z-C3
1.5	6305-2Z-C3	6305-2Z-C3	6305-2Z-C3
2.2	6305-2Z-C3	6305-2Z-C3	6306-2Z-C3
3		6306-2Z-C3	6306-2Z-C3
4		6306-2Z-C3	6306-2Z-C3
5.5		6308-2Z-C3	6308-2Z-C3
7.5		6308-2Z-C3	6308-2Z-C3
11		7309-BEP	
15		7309-BEP	
18.5		7209-BEP	
22		7311-BEP	
30		7312-BEP	
37		7312-BEP	
45		7313-BEP	

Or use a thrust bearing housing.

For pump series: VMS 32A, 45A, 65A

[kW]	Axial bearing	[kW]	Co-axial bearing
0.37	6203-2RS-C3	11	7309-BEP
0.55	6203-2RS-C3	15	7309-BEP
0.75	6204-2RS-C3	18.5	7309-BEP
1.1	6204-2RS-C3	22	7311-BEP
1.5	6305-2Z-C3	30	7312-BEP
2.2	6305-2Z-C3	37	7312-BEP
3	6306-2Z-C3		
4	6306-2Z-C3		
5.5	6308-2Z-C3		
7.5	6308-2Z-C3		

7.2.1 INSTALL THE MOTOR ON PUMPS, SUPPLIED WITHOUT MOTOR, WITH A STANDARD MECHANICAL SEAL

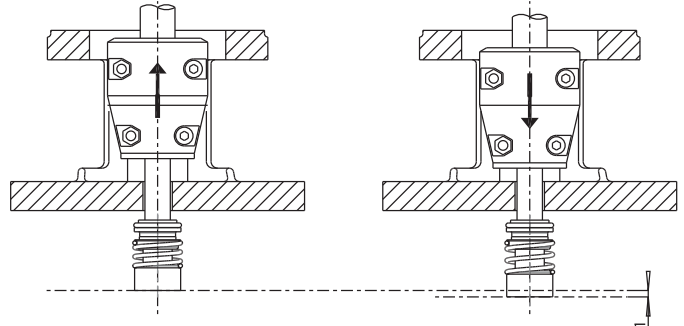


1. Remove the coupling guards (681) and the coupling shells (862).
2. Remove the seal protection bracket (89-11.03) and its mounting material. For pumps with a taper piece (722) (with motor of 5.5 kW or higher), the two bolts (914.02 or 901.02) has to be placed back to connect the taper piece to the motor stool. Thoroughly clean the motor stool (341), the shaft (210), the coupling shells (862) and the motor shaft.



ATTENTION

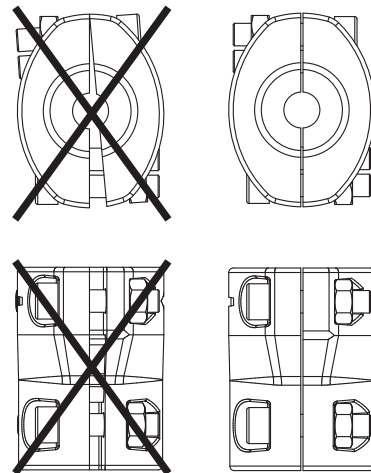
For motors of 11 kW or higher, block the rotor when adjustments are made to the coupling. This ensures that the rotor will not come out of its bearings.



WARNING

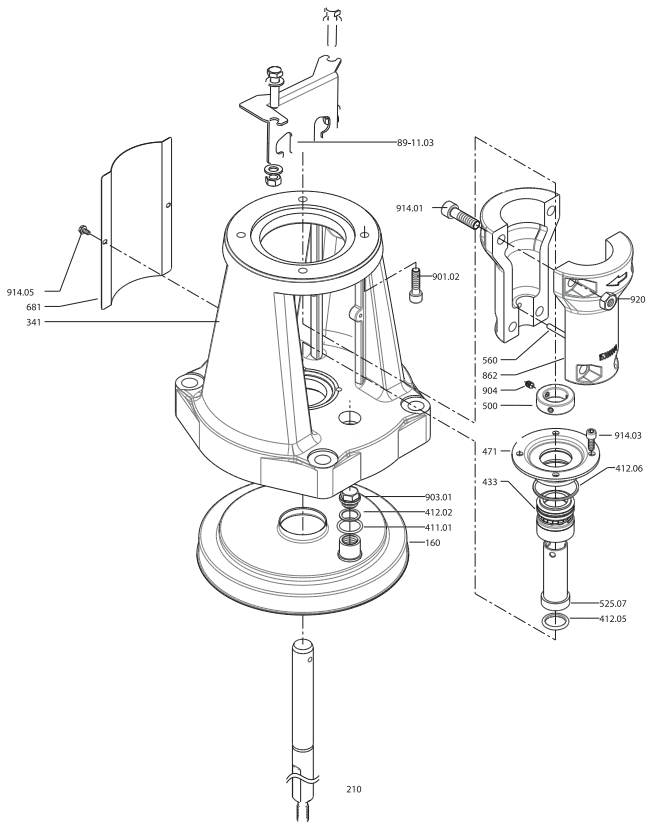
Correct seal tension max. -1 mm lower than the maximum upwards position!

3. Loosely fasten the coupling shells (862) with the coupling pin (560) on the shaft (210). Use the hexagon socket head cap screw (914.01) and the nut (920.01) for this. (When the pump is equipped with a steel coupling, never use the same coupling twice but order a new one).



4. Place the motor on the motor stool (341).
5. Tighten the lower bolts of the coupling shells (862) in such way, that the coupling slightly clamps around the motor shaft.
6. Lift the pump assembly to the maximum upwards position and mark the shaft. Use a tyre lever to lift the coupling.
7. Position the pump assembly 1 mm lower than the maximum upwards position as mentioned earlier.
8. Fully tighten the couplings at the given torque (see "Torques" in the annexes). Make sure that the gaps between the couplings are equally divided on both sides (see drawing).
9. Attach the coupling guards (681) with the socket head cap screws (914.05) to the motor stool (341).
10. Connect the electricity supply to the motor. See 7.3 Electrical install.

7.2.2 INSTALLING THE MOTOR ON PUMPS, SUPPLIED WITHOUT MOTOR, WITH A CARTRIDGE SEAL

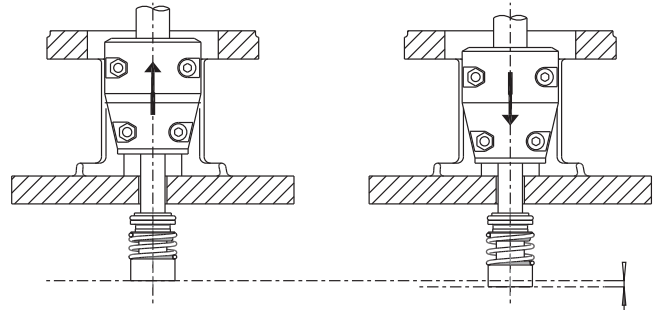


1. Remove the coupling guards (681) and the coupling shells (862).
2. Remove the seal protection bracket (89-11.03) and its mounting material. For pumps with a taper piece (722) (with motor of 5.5 kW or higher), the two bolts (914.02 or 901.02) has to be placed back to connect the taper piece to the motor stool. Thoroughly clean the motor stool (341), the shaft (210), the coupling shells (862) and the motor shaft.
3. Loosely fasten the coupling shells (862) with the coupling pin (560) on the shaft (210). Use the hexagon socket head cap screw (914.01) and the nut (920.01) for this. (When the pump is equipped with a steel coupling, never use the same coupling twice but order a new one).
4. Place the motor on the motor stool (341).
5. Loosen the three cartridge grub screws (904) one turn.
6. Push the hydraulic pump assembly in the lowest position.
7. Tighten the three cartridge grub screws (904) firmly to the shaft.
8. Tighten the lower bolts of the coupling shells (862) so that the coupling slightly clamps around the motor shaft.
9. Lift the pump assembly to the maximum upwards position and mark the shaft. Use a tyre lever to lift the coupling.



ATTENTION

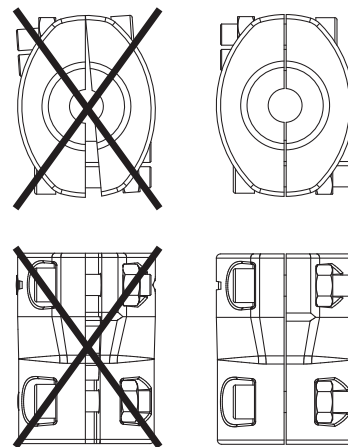
For motors of 11 kW or higher, block the rotor when adjustments are made to the coupling. This ensures that the rotor will not come out of its bearings.



WARNING

Correct seal tension max. -1 mm lower than the maximum upwards position!

10. Position the pump assembly 1 mm lower than the maximum upwards position as mentioned earlier.
11. Fully tighten the couplings at the given torque (see "Torques" in the annexes). Make sure that the gaps between the couplings are equally divided on both sides (see drawing).



12. Install the coupling guards (681) with the socket head cap screws (914.05) to the motor stool (341).
13. Electrically connect the motor. See 7.3 Electrical install.

7.3 ELECTRICAL INSTALL



WARNING

Only authorised personnel is allowed to make electrical connections to the motor. This is in accordance with the local regulations.



ATTENTION

Connect the motor according to table and always check the rotation direction.

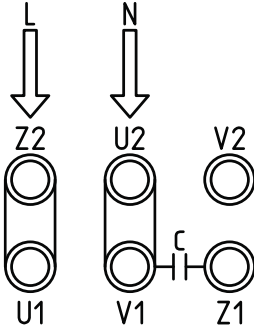
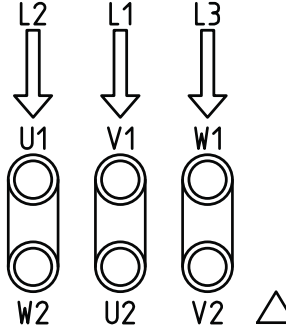
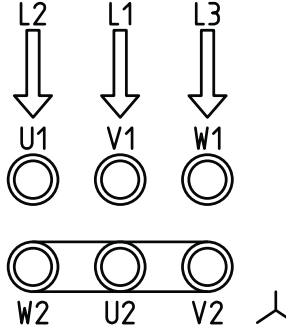
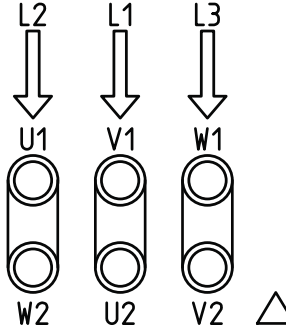
$V \sim$ (M)	1x 230V	$V \sim$ (M)	3x 230V	3x 400V
230V		230/400V		
		400/692V		

Figure 20: Motor connections

PTC connection STM 140 EK:

- Standard motors 3 kW and up are equipped with a PTC thermistor. Consult Table 21 Technical specifications PTC STM 140 EK.
- Connect the PTC on a thermistor relay.

Table 21: Technical specifications PTC STM 140 EK

	Value
t_n [°C]	140
$R_{20\text{ °C}}$ [Ω]	~ 20
$R_{t_n-20\text{ °C}}$ [Ω]	~ 250
$R_{t_n+5\text{ °C}}$ [Ω]	< 550
$R_{t_n+5\text{ °C}}$ [Ω]	> 1330
$R_{t_n+15\text{ °C}}$ [Ω]	> 4000
U_n [VDC]	$2.5 < U < 30$

Electrical connections:

- Make sure that the motor specifications correspond with the power supply to which the pump motor is connected. Consult "Electrical diagrams" in the annexes for the correct connection diagram.
- Connect the motor using a motor safety switch.

7.4 COMMISSIONING



WARNING

The pump must not be switched on when it is not completely filled up.



ATTENTION

Seen from the top of the motor the pump should rotate clockwise. See 7.1.1 Indicators 16 (B). In case of a 3-phase motor the rotating direction can be changed by exchanging two of the three phase wires.

7.4.1 IN AN OPEN OR CLOSED CIRCUITE WITH SUFFICIENT SUPPLY PRESSURE

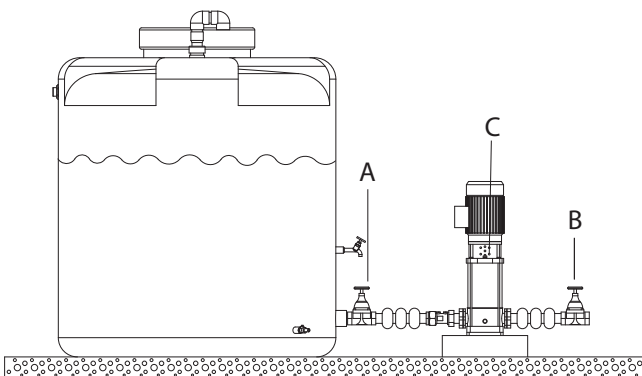


Figure 12: Pump with open or closed circuit

1. Close the suction shut-off valve (A) and the outlet shut-off valve (B).
2. Open the fill plug (C).
3. Gradually open the suction shut-off valve until the liquid flows from the fill plug (C).
4. Close the fill plug.
5. Fully open the suction shut-off valve.
6. Check the rotational direction of the pump.
7. Fully open the outlet shut-off valve.

7.4.2 IN AN OPEN CIRCUITE WITH LIQUID LEVEL LOWER THAN THE PUMP

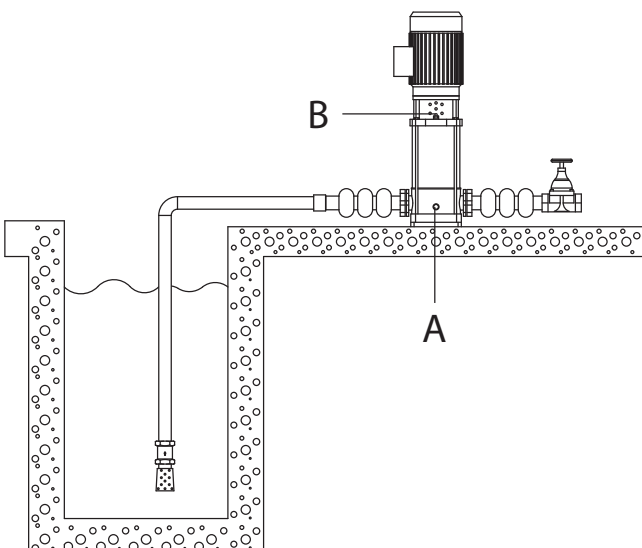


Figure 13: Liquid level lower then pump

1. Remove the fill plug (B) from the top bracket.
2. Close the outlet shut-off valve.
3. Fill the pump housing to the maximum through the fill plug with the liquid that is to be pumped.
4. Insert the fill plug in the top bracket.
5. Check the rotational direction of the pump.
6. Open the outlet shut-off valve.

7.4.3 AFTER AN EXTENDED PERIOD OF NON-OPERATION OR STORAGE

During first start-up, check the mechanical seals for leakage due to seizure or dehydration of the lubricating film. If so, please proceed as following:

1. Turn shaft manually or;
2. Start up the pump, then open and close the outlet shut-off valve quickly during operation.
3. Check if the mechanical seal is still leaking.

If the shaft is still leaking:

1. Disassemble the mechanical seal.
2. Thoroughly clean and decrease the running surfaces.
3. Assemble the mechanical seal again and retry start-up.

If this doesn't solve the shaft leakage, replacement of the mechanical seal is necessary.

8.0 OPERATION

8.1 OPERATION

The pump is controlled externally and therefore does not need any operation guidance.

9.0 MAINTENANCE

9.1 INTRODUCTION



WARNING

Observe the general safety precautions for installation, maintenance and repair.

Regular maintenance is necessary for the correct operation of a pump. For maintenance of the pump, please contact your supplier.

9.2 LUBRICATION

Standard motors, with a maximum power of 7.5 kW, are provided with maintenance free sealed bearings.

Motors with lubricating nipples must be lubricated after 2000 hours. If the pump works under extreme conditions, such as vibrations and high temperatures, the motors must be lubricated more often.

Use a lithium based -30 °C / 160 °C bearing lubricant (about 15 grams).

When the pump is delivered without a motor and fitted with an other brand or the standard motor is replaced by an other brand than Armstrong, please consult the maintenance instructions of the motor supplier.



ATTENTION

Also follow the instructions in § 7.2 Mounting a motor on the pump.

9.3 MAINTAINING THE PUMP FOR AN EXTENDED PERIOD OF NON-OPERATION

Turn the shaft every three months. This protects the seals from seizure.

Protect the pump against if there is a risk of frost. Proceed as follows:

1. Close all pump valves.
2. Drain each pump and/or the system.
3. Remove all plugs from the pump.
4. Open the shut-off and fill/air vent plug, if present.

9.4 REPLACE VMS NON-RETURN VALVE

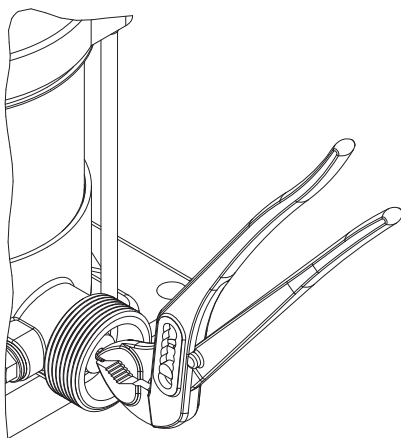


Figure 14: replace VE non-return valve

To replace the non-return valve of the pump types VMSE, proceed as follows:

1. Use a pair of pliers to remove the non-return valve.
2. Remove the O-ring.
3. Install a new O-ring.
4. Install the new non-return valve.

10.0 FAILURES

10.1 FAILURES TABLE



WARNING

Observe the general safety precautions before install, maintenance and repair.

Problem	Possible cause	Possible solution	Checkpoints
Leakage along the shaft	Running surfaces of the mechanical seal worn or damaged	Replace the mechanical seal.	Check the pump for dirt - abrasive parts.
	New pump: seal stuck due to assembly	Open and close the outlet shut-off valve quickly during operation	
	Mechanical seal mounted incorrectly	Install the mechanical seal correctly. Use water and soap as a lubricant	
	Elastomers affected by medium	Use the right rubber compound for the mechanical seal	
	Pressure too high	Use the right type of mechanical seal	
	Shaft worn	Replace shaft and mechanical seal	
	Pump has been operating without water	Replace the mechanical seal	
Leakage along the shroud at the top bracket or at the pump foot	O-ring worn	Replace the O-ring	
	O-ring not resistant to the medium to be pumped	Replace O-ring by an O-ring with better resistance	
	Too much tension on the pump foot; it becomes oval	Decrease tension on piping Mount the pump foot tensionless Support the connections	

Problem	Possible cause	Possible solution	Checkpoints
Pump is vibrating or noisy	Coupling mounted incorrectly	Install the coupling in parallel	
	Faulty setting of the hydraulic assembly	Adjust the assembly according to the manual	
	There is no water in the pump	Fill and vent the pump	
	No supply	Make sure there is sufficient supply. Check for blockages in the supply line	
	Bearings of pump and/or motor worn	Have the bearings replaced by a certified company	
	Available NPSH too low (cavitation)	Improve suction condition	
	Pump does not work in its working range	Select another pump or adjust the system to work within its working range	
	Pump is standing on an uneven surface	Level the surface	
Malfunction	Internal blockage in the pump	Have the pump inspected by a certified company	
Pump does not start	No voltage on the terminal clamps	Check the power supply	<ul style="list-style-type: none"> • Circuit • Main switch • Fuses
		Check the motor safety relay	<ul style="list-style-type: none"> • Earth leakage switch • Protective relay
	Thermal motor safety switch triggered	Reset the thermal motorsafety. Contact the supplier, if this problem occurs more often.	Check if the correct value is set. Find the correct value (I_{nom}) on the motortype plate
The motor is running, but the pump does not work	The pump shaft has broken	Contact the supplier	
	The coupling between pump- and motor shaft is loose	Tighten the connecting screws to the recommended torque	

Problem	Possible cause	Possible solution	Checkpoints
Pump supplies insufficient capacity and/or pressure	Outlet and/or inlet shut-off valve is closed	Open both shut-off valves	
	There is air in the pump	Vent the pump	
	The suction pressure is insufficient	Increase the suction pressure	
	Pump rotates in the wrong direction	Change over L1 and L2 of the three phase supply.	
	The suction line has not been vented	Vent the suction line	
	Air bubble in the suction line	Install the suction line with pump end higher than the other end	
	Pump sucks air because of leakage in the suction line	Repair the leakage	
	Too little water consumption so air bubbles clog up in the pump	Make sure the consumption increases or use a smaller pump	
	The diameter of the suction line is too small	Increase the diameter of the suction line	
	Capacity of water meter in the supply line is too small	Increase the capacity of the water meter	
	Foot valve blocked	Clean the foot valve	
	The impeller or the diffuser is blocked	Clean the inside of the pump	
	O-ring between impeller and diffuser is gone	Replace the O-rings	
	O-ring not resistant to the medium to be pumped	Replace O-ring by an O-ring with better resistance	

11.0 ANNEXES

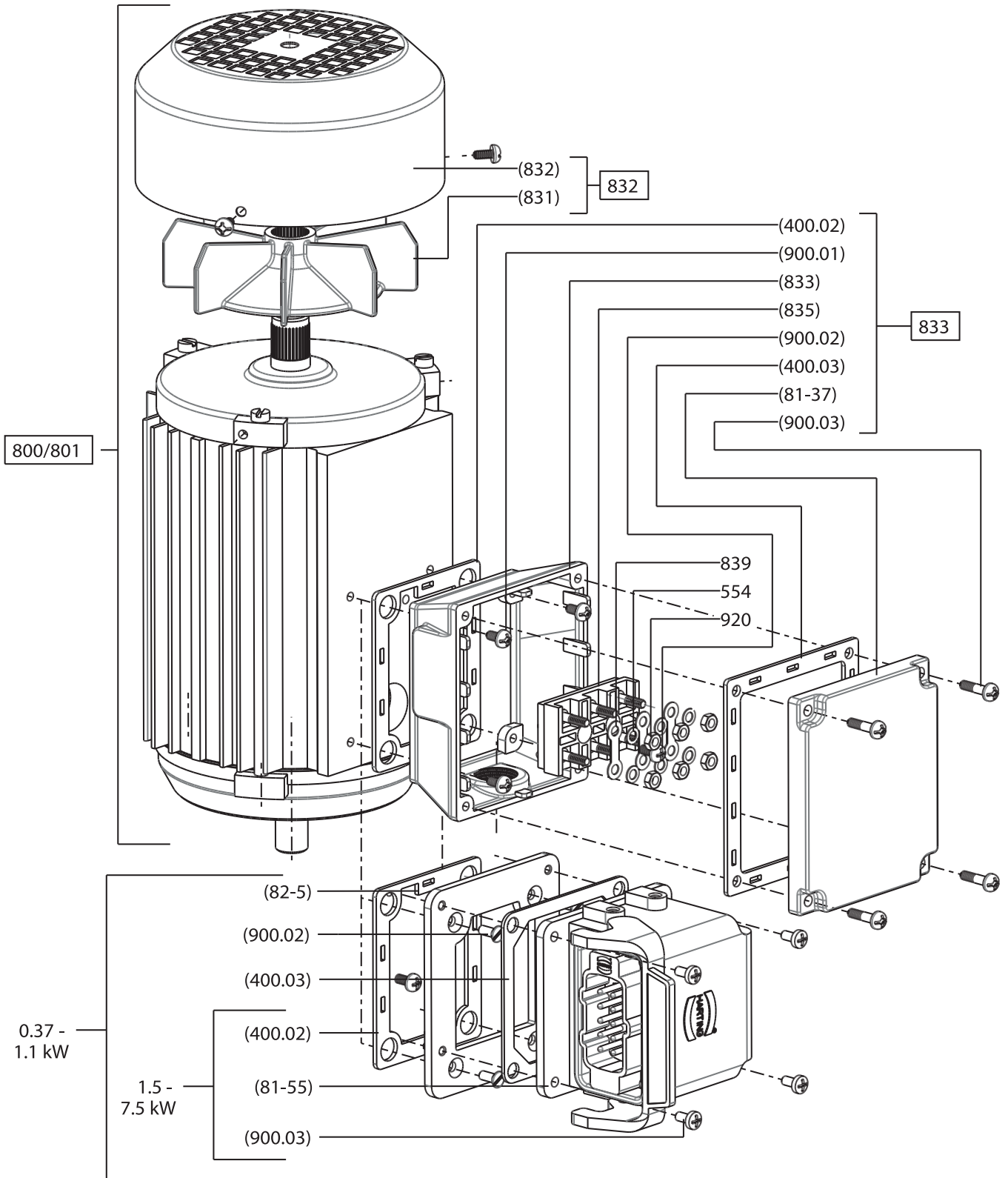
11.1 SPARE PART KITS

Spare part Kit	Kit Nr
Fan Hood Kit Fan hood (832) + Fan Impeller (831)	832
Coupling Kit 4/6 x Nut (920.01) + 4/6 x hexagon socket head cap screw (914.01) + 2 x coupling shell (862) + coupling pin (560)	862
Drain / air relief plug Kit Screwed plug (903.01) + joint ring (411.01) + screwed plug (903.02) + joint ring (411.02)	903
Stage casing compl. with bearing Kit Stage casing with bearing (108.02) + bearing sleeve (529) + impeller (230) + spacer sleeve short (525.01)	10-5
Spacer sleeve Kit 2 x Spacer sleeve short (525.01) + 6 x spacer sleeve long (525.03) + spacer sleeve (525.08) + spacer sleeve seal (525.05)	525
Sealing Kit Mechanical seal (433) + 2 x O-ring (412.01) + 2 x gasket (400)	433
Shaft end Kit Spacer sleeve end (525.04) + lock nut (920.02) + safety device, Nord-lock (930) + circlip (932)	81-88
Flange Kit 2 x Flange (723) + 4/8/16 x hexagon head bolt (901.03) + 0/4/8/16 x nut (920) + 4/8/16/32 x washer (554.03) + 2 x gasket (400)	723
Terminal box kit Gasket (400.02) + terminal box (833) + terminal board (835) + gasket (400.03) + terminal box coverplate (81.37) + 4 x screw (900)	833
Capacitor Capacitor (837)	837

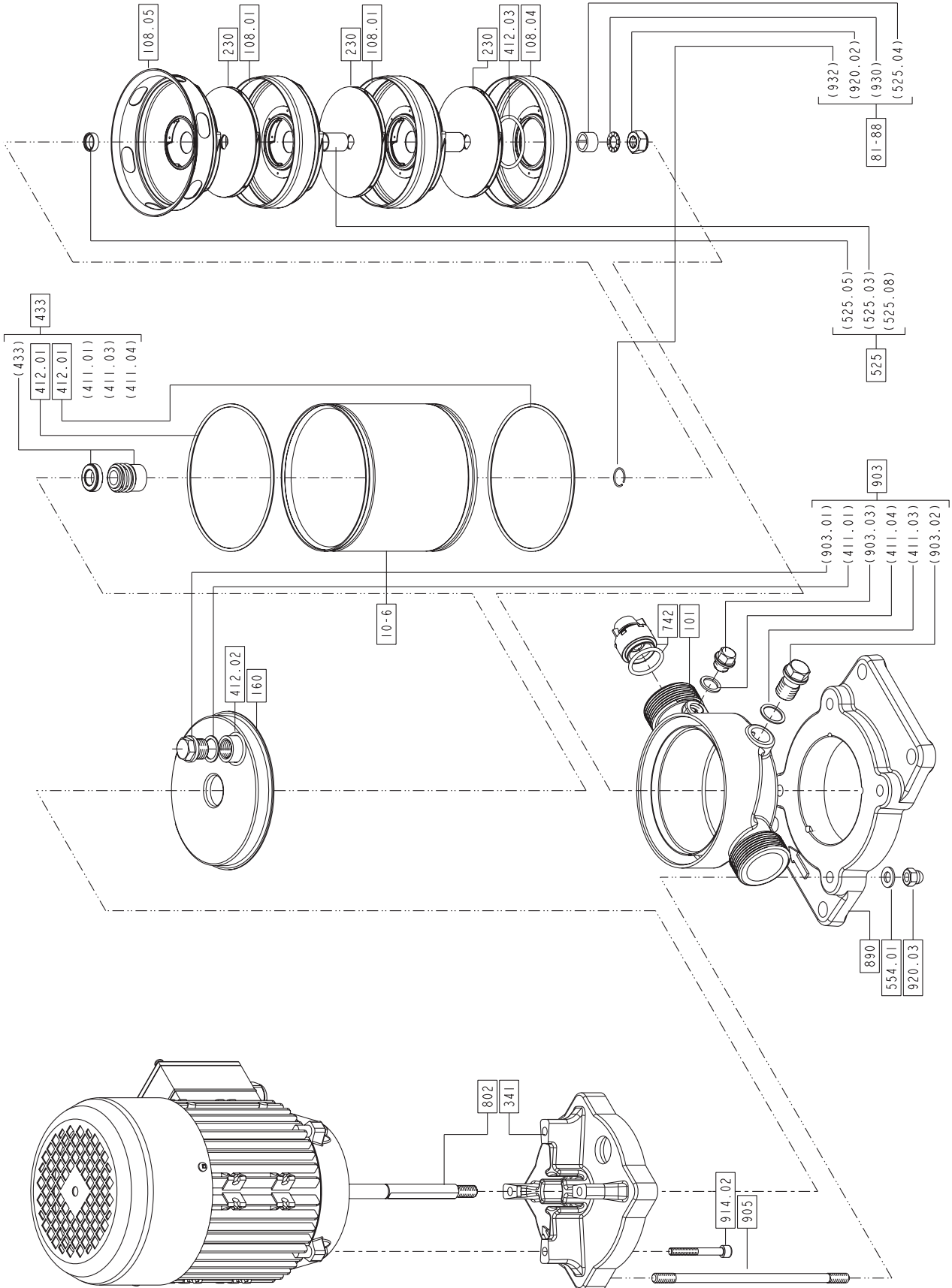
11.1.1 PARTS LIST

Number (ZN)	Name
101	Pump casing
108	Stage casing
160	Cover
171	Diffuser
210	Shaft
230	Impeller
341	Motor stool
400	Gasket
411	Joint ring
412	O-ring
433	Mechanical seal
471	Seal cover
500	Ring
509	Intermediate ring
525	Spacer sleeve
525.08	Spacer sleeve
529	Bearing sleeve
554	Washer
560	Pin
681	Coupling guard
722	Taper piece, flanged
723	Flange
742	Non-return valve
800	Motor
801	Flanged motor
802	Motor for close coupling
831	Fan impeller
832	fan hood
833	Terminal box
835	Terminal board
837	Condenser
862	Coupling shell
890	Baseplate fabricated or cast
900	Screw
901	Hexagon head bolt
903	Screwed plug
904	Grub screw
905	Tie bolt
913	Vent plug
914	Hexagon socket head cap scr.
920	Nut
930	Safety device
932	Circlip
10-6	Pump shroud
81-37	Terminal box cover plate

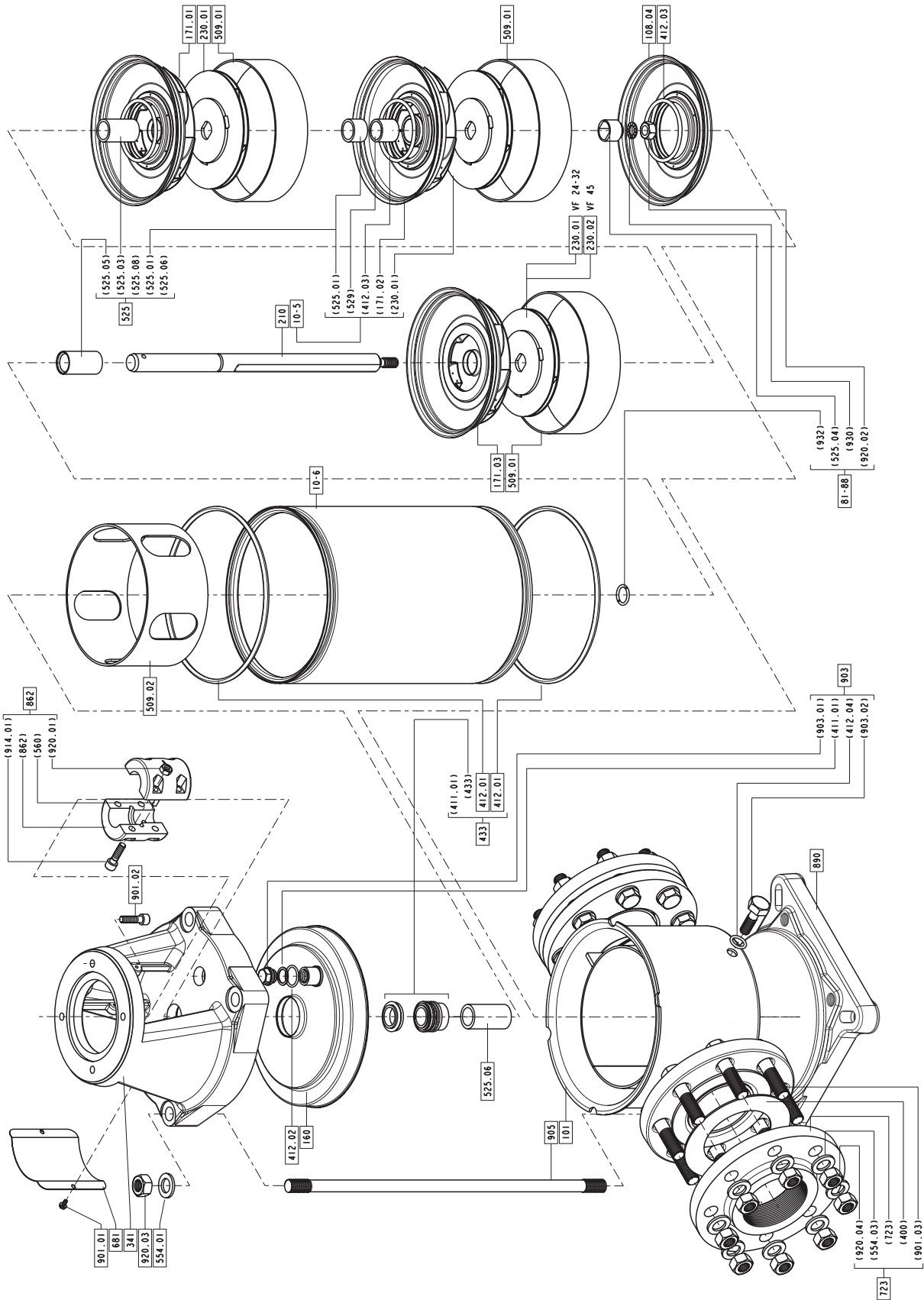
11.1.2 PARTS DRAWING MOTOR



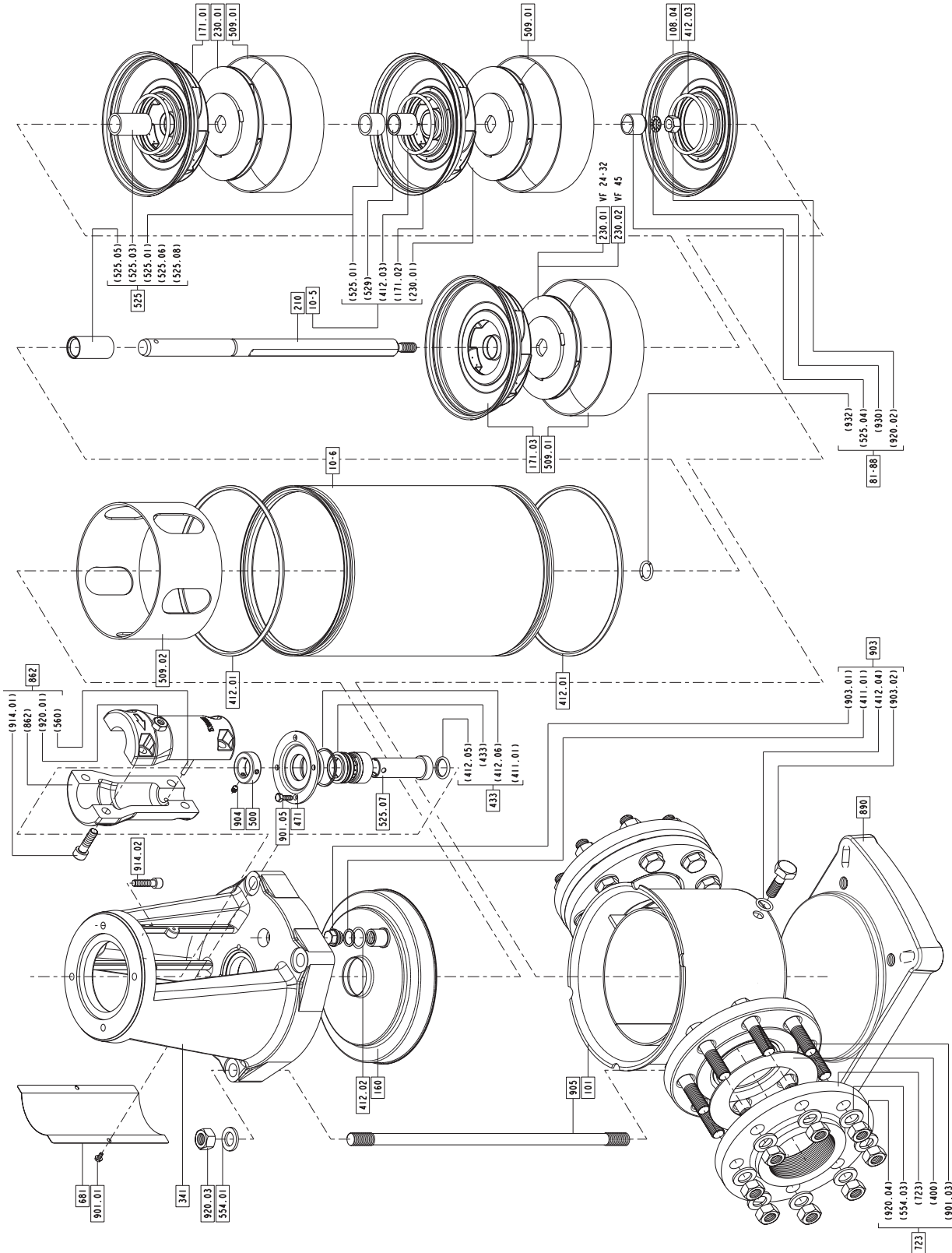
11.1.3 PARTS DRAWING VMSE 02A/04A/10A/14A



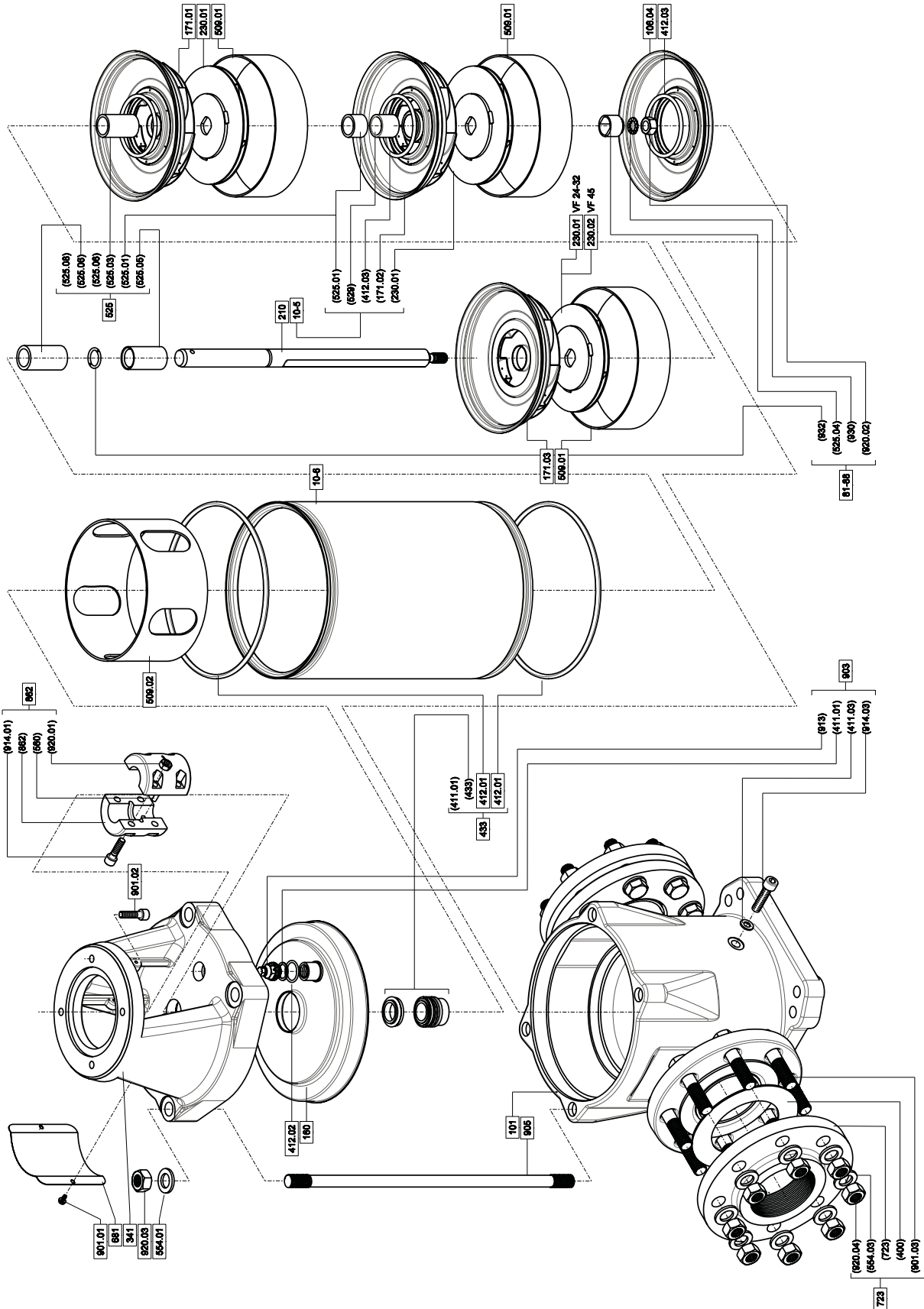
11.1.4 PARTS DRAWING VMSF 32A/45A



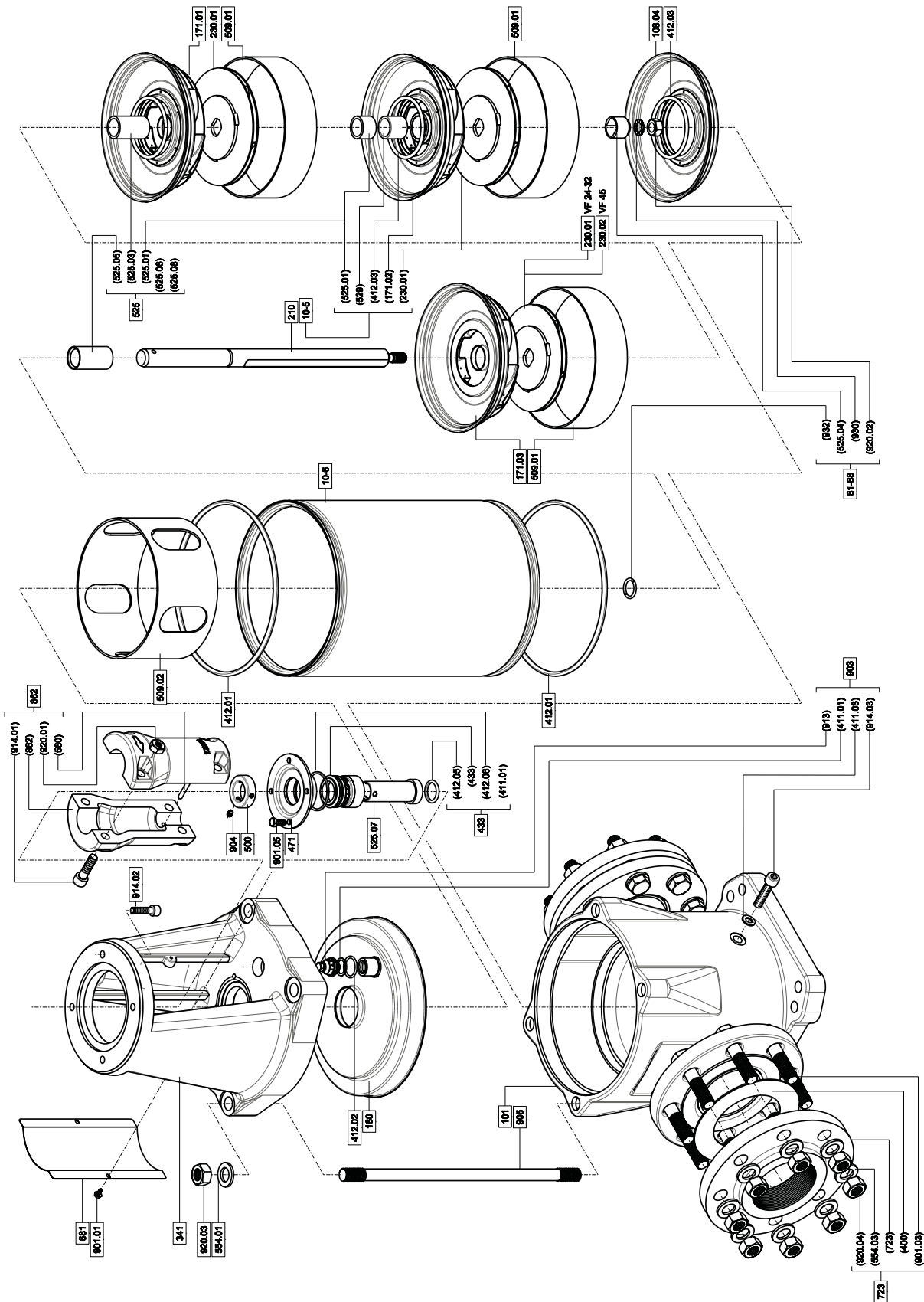
11.1.5 PARTS DRAWING VMSF 32A/45A WITH CARTRIDGE SEAL



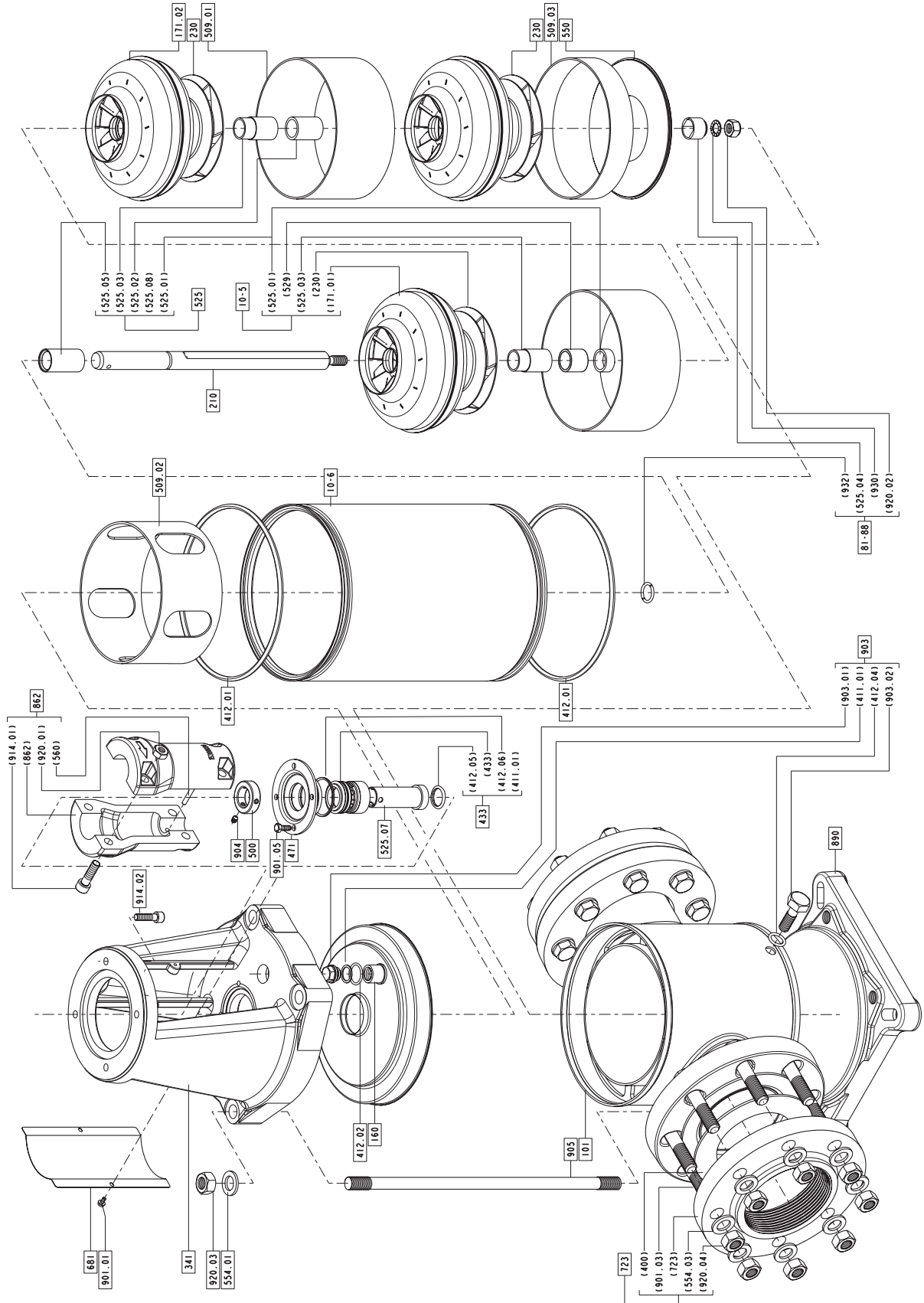
11.1.6 PARTS DRAWING VMSCF 32A/45A



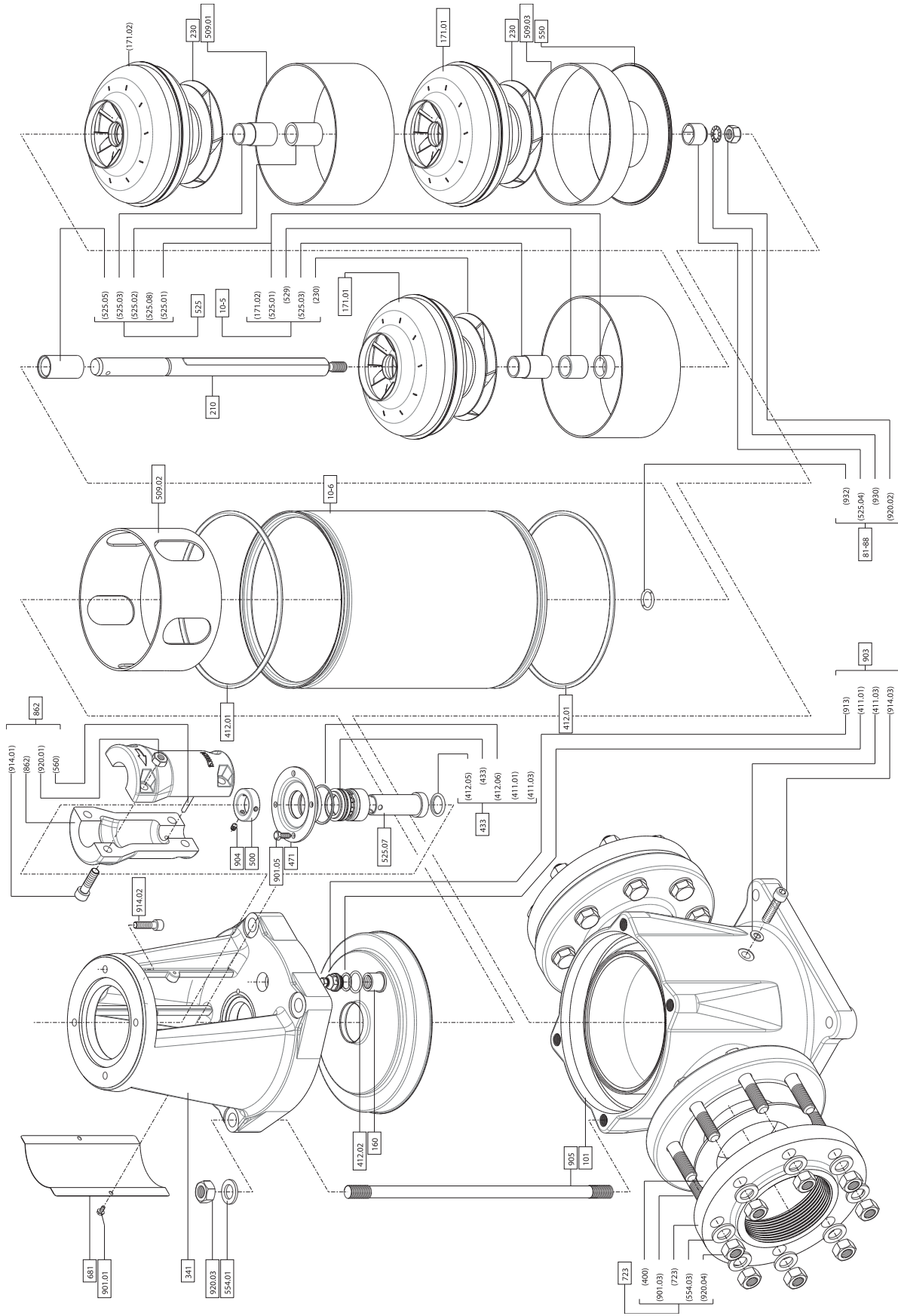
11.1.7 PARTS DRAWING VMSCF 32A/45A WITH CARTRIDGE SEAL



11.1.8 PARTS DRAWING VMSF 65A



11.1.9 PARTS DRAWING VMSCF 65A



11.2 TECHNICAL SPECIFICATIONS



ATTENTION

The motor data are only applicable for standard motors delivered with the pump and are not applicable for explosion proof motors.



ATTENTION

* motors are equipped with a PTC.

Table 22: Technical specifications of pumps with 2-pole, 1 phase, 50 Hz motors

P [kW]	P [HP]	η [%]	L_p [dB(A)]	Max. starts [h ⁻¹]	n [min ⁻¹]	C [μ F]	I max [A]		
							220V	230V	240V
0.37	0.5	63	64	10	2750	16	2.9	2.9	2.9
0.55	0.75	64	64	10	2750	20	4.5	4.5	4.5
0.75	1	63	67	10	2750	20	6.9	6.9	6.9
1.1	1.5	64	67	10	2750	30	8.7	8.7	8.7
1.5	2	67	67	10	2750	40	11	11	11
2.2	3	74	71	10	2820	60	15.2	15.2	15.2

Table 23: Technical specifications of pumps with 2-pole, 3 phase, 50 Hz motors

P [kW]	P [HP]	η [%]	L_p [dB (A)]	Max. starts [h ⁻¹]	n [min ⁻¹]	I max [A]								
						Δ			\blacktriangle					
						Δ			\blacktriangle					
						220V	230V	240V	380V	400V	420V	660V	692V	725V
0.37	0.5	76	60	50	2865	2.5	2.4	2.3	1.5	1.4	1.3			
0.55	0.75	82	60	50	2880	2.7	2.6	2.5	1.6	1.5	1.4			
0.75	1	80	60	50	2865	3.9	3.7	3.6	2.2	2.1	2			
1.1	1.5	83	60	50	2890	5.9	5.8	5.5	3.4	3.3	3			
1.5	2	84.1	69	30	2880	7.6	7.6	7.6	4.4	4.4	4.4			
2.2	3	85.6	72	30	2875	10.4	10.4	10.4	6	6	6			
3*	4	83.6	67	20	2915	13.3	13.3	13.3	7.7	7.7	7.7	4.4	4.4	4.4
4*	5	87.3	69	20	2935	16.8	16.8	16.8	9.7	9.7	9.7	5.6	5.6	5.6
5.5*	7.5	86	74	15	2890	20.8	20.8	20.8	12	12	12	6.9	6.9	6.9
7.5*	10	86.8	70	12	2880	26.8	26.8	26.8	15.5	15.5	15.5	8.9	8.9	8.9
11*	15	89.3	74	10	2950	52.8	52.8	52.8	30.5	30.5	30.5	17.6	17.6	17.6
15*	20	90.5	74	10	2920	54.9	54.9	54.9	31.7	31.7	31.7	18.3	18.3	18.3
18.5*	25	91	74	10	2930	70.1	70.1	70.1	40.5	40.5	40.5	23.4	23.4	23.4
22*	30	90.6	87	10	2920	77.1	77.1	77.1	44.5	44.5	44.5	25.7	25.7	25.7
30*	40	93	74	6	2960	102.3	97.5	93.4	59.2	56.3	53.6	34.0	32.4	N-A
37*	50	93	74	6	2960	118.7	113.5	108.8	68.7	65.3	62.2	39.7	37.8	N-A

Table 24: Technical specifications of pumps with 4-pole, 3 phase, 50 Hz motors

P [kW]	P [HP]	η [%]	L_p [dB (A)]	Max. starts [h ⁻¹]	n [min ⁻¹]	I max [A]								
						Δ			\blacktriangle			\blacktriangle		
						Δ			Δ			\blacktriangle		
						220V	230V	240V	380V	400V	420V	660V	692V	725V
0.55	0.75	73	58	50	1450	4.7	4.5	4.3	2.7	2.6	2.5			
0.75	1	74	58	50	1450	6	5.7	5.5	3.8	3.3	3.1			
1.1	1.5	76.7	60	30	1405	5.2	5.2	5.2	3	3	3			
1.5	2	79	58	30	1410	7.1	7.1	7.1	4.1	4.1	4.1			
2.2	3	82	61	20	1425	9	9	9	5.2	5.2	5.2			
3*	4	78.4	64	20	1430	14	14	14	8.1	8.1	8.1	4.7	4.7	4.7
4*	5	85	65	20	1445	17.2	17.2	17.2	9.9	9.9	9.9	5.7	5.7	5.7
5.5*	7.5	85.9	64	15	1450	20.8	20.8	20.8	12	12	12	6.9	6.9	6.9
7.5*	10	87	64	10	1450	27.7	27.7	27.7	16	16	16	9.2	9.2	9.2

Table 25: Technical specifications of pumps with 2-pole, 3 phase, 60 Hz motors

P [kW]	P [HP]	η [%]	L_p [dB (A)]	Max. starts [h ⁻¹]	n [min ⁻¹]	I max [A]								
						Δ			\blacktriangle			\blacktriangle		
						Δ			Δ			\blacktriangle		
						220V	240V	280V	380V	420V	480V	660V	725V	797V
0.37	0.5	76.0	60	50	3430	2.5	2.3	2.0	1.5	1.3	1.2			
0.55	0.75	82.0	60	50	3460	2.7	2.5	2.1	1.6	1.4	1.2			
0.75	1	80.0	60	50	3430	3.9	3.6	3	2.2	2	1.8			
1.1	1.5	82.0	60	50	3470	5.9	5.5	4.3	3.4	3	2.7			
1.5	2	84.1	69	30	3455	7.8	7.8	7.8	4.5	4.5	4.5			
2.2	3	85.6	72	30	3450	10.9	10.9	10.9	6.3	6.3	6.3			
3*	4	83.6	67	20	3495	13.6	13.6	13.6	7.9	7.9	7.9	4.6	4.6	4.6
4*	5	87.3	69	20	3520	17.2	17.2	17.2	9.9	9.9	9.9	5.7	5.7	5.7
5.5*	7.5	86	74	15	3465	21	21	21	12.1	12.1	12.1	7	7	7
7.5*	10	86.8	70	12	3455	26.8	26.8	26.8	15.5	15.5	15.5	8.9	8.9	8.9
11*	15	89.3	74	10	3540	53.7	53.7	53.7	31	31	31	17.9	17.9	17.9
15*	20	90.5	74	10	3500	56.3	56.3	56.3	32.5	32.5	32.5	18.8	18.8	18.8
18.5*	25.0	91	74	10	3515	72.1	72.1	72.1	41.6	41.6	41.6	24	24	24
22*	30.0	90.6	87	10	3500	78.8	78.8	78.8	45.5	45.5	45.5	26.3	26.3	26.3
30*	40.0	93	74	6	3552	102.3	93.4	N/A	59.2	53.6	N/A	34	N/A	N/A
37*	50.0	93	74	6	3552	118.7	108.8	N/A	68.7	62.2	N/A	39.7	N/A	N/A

Table 26: Technical specifications of pumps with 4-pole, 3 phase, 60 Hz motors

P [kW]	P [HP]	η [%]	L_p [dB (A)]	Max. starts [h ⁻¹]	n [min ⁻¹]	I max [A]								
						Δ			Δ			Δ		
						220V	240V	280V	380V	420V	480V	660V	725V	797V
0.55	0.75	73	58	50	1740	4.7	4.3	3.7	2.7	2.5	2.2			
0.75	1	74	58	50	1740	6	5.5	4.7	3.8	3.1	2.8			
1.1	1.5	76.7	60	30	1685	4.8	4.8	4.8	2.8	2.8	2.8			
1.5	2	79	58	30	1690	6.5	6.5	6.5	3.7	3.7	3.7			
2.2	3	82	61	20	1710	8.4	8.4	8.4	4.9	4.9	4.9			
3*	4	78.4	64	20	1715	14.5	14.5	14.5	8.4	8.4	8.4	4.9	4.9	4.9
4*	5	85	65	20	1725	17.5	17.5	17.5	10.1	10.1	10.1	5.8	5.8	5.8
5.5*	7.5	85.9	64	15	1740	19.8	19.8	19.8	11.5	11.5	11.5	6.6	6.6	6.6
7.5*	10	87	64	10	1740	27	27	27	15.6	15.6	15.6	9	9	9

Table 27: Technical specifications PTC STM 140 EK

	Value
t_n [°C]	140
$R_{20\text{ °C}}$ [Ω]	~ 20
$R_{t_n-20\text{ °C}}$ [Ω]	~ 250
$R_{t_n-5\text{ °C}}$ [Ω]	< 550
$R_{t_n+5\text{ °C}}$ [Ω]	> 1330
$R_{t_n+15\text{ °C}}$ [Ω]	> 4000
U_n [VDC]	$2.5 < U < 30$

11.3 TORQUES OF COUPLING BOLTS - POS 914.01

Material	Dimensions	Torques [Nm]
Steel	M6	16
Steel / Cast iron	M8	30
Aluminium	M8	22
Cast iron	M10	70

11.4 CE DECLARATION OF CONFORMITY

Armstrong Fluid Technology

Wenlock Way

Manchester, M12 5JL, UK

Tel: +44 (0) 8444 145 145

Hereby declares as manufacturer entirely on his own responsibility, that the products:
Vertical multi-stage centrifugal pumps, series: VMSV

Serial number: 01/2010 700000 - 52/2014 999999

In case the pump is delivered without motor:

IIB to which this declaration refers, is in accordance with the following standard: **EN 809: 1998+A1:2009** according to the provisions of the harmonized norm for pumps and which implies the regulations of **Machine directive 2006/42/EG** in the most recent form

In case the pump is delivered with an electromotor:

IIA to which this declaration refers, is in accordance with the following standard: **EN 809: 1998+A1:2009** according to the provisions of the harmonized norm for pumps and which implies the regulations of **Machine directive 2006/42/EG, EMC directive 2004/108/EG, and Low voltage directive 2006/95/EG** in the most recent form

The pump is subject to this declaration of conformity as a stand alone product.

Make sure the appliance or installation in which the pump is built in, has got a declaration of compliance with the directives listed above, for its complete assembly.



Manchester, UK
07-07-2011

Authorized representative
R, Strode Managing Director.

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