



RSV – 13.02.EN
For Units Built After December 2016

RSV – In-Line Vertical Multi-Stage, Ring Section Pump

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Part Number: _____

Serial Numbers: _____



These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, electrical connection and commissioning. It is imperative to comply with all other operating instructions referring to components of individual units.



This manual shall always be kept close to the unit's location of operation or directly on the pump set.

SERVICE RECORD PAGE

Service No. _____ Model _____ Size and Type _____

Customer Order No. _____ Date Installed _____

Installation Date	Location	Application

PUMP RATING

Capacity _____ Total Head _____

Suction Pressure _____ Speed (RPM) _____

Liquid pumped _____ Temperature _____

Specific Gravity _____ Viscosity _____

Service _____

PUMP MATERIALS

Casing _____ Impeller _____ Shaft _____

Gaskets _____ Bearing Frame _____

Mechanical Seal/Packing _____

MOTOR DATA

Motor _____ Make _____ Serial No. _____

Type _____ Frame _____ AC or DC _____

HP _____ RPM _____ Volts _____

Phase _____ Cycles _____

NOTES ON INSPECTION AND REPAIRS

INSPECTION DATE	REPAIR TIME	REPAIRS	COST	REMARKS

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

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I. GENERAL DESCRIPTION AND SAFETY PRECAUTIONS.

A. GENERAL INFORMATION. Carver RSV pumps are vertical, multi-stage, centrifugal water pumps. If properly installed, maintained, and operated, should provide maintenance-free operation and a long service life.



CAUTION

These instructions must always be kept close to the product's operating location or directly with the product.

This manual is designed to provide sufficient material to properly maintain the total pumping unit. The information presented should improve your knowledge and understanding of the RSV, Multi-Stage Water Pump, thus upgrading the reliability, service life, and quality of pump maintenance.

These operating instructions do not take into account local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation. Compliance with such laws relating to the proper installation and safe operation of the pumping equipment is the responsibility of the equipment owner and all necessary steps should be taken by the owner to assure compliance with such laws before operating the equipment. These instructions are intended to facilitate familiarization with the product and its permitted use to help satisfy safety requirements. Always coordinate repair activity with operations personnel, and follow all plant safety requirements and applicable safety and health laws/regulations.

Refer to the appropriate sectional assembly for the location of parts identified by item numbers. Variations do exist between configurations, not all parts described in the text may be on your configuration.



CAUTION

These instructions should be read prior to installing, operating, using and maintaining the equipment in any region worldwide and in conjunction with the main user instructions provided. The equipment must not be put into service until all the conditions relating to safety instructions have been met.

B. DISCLAIMER. Information in these User Instructions is believed to be reliable. In spite of all the efforts of Carver Pump Company to provide sound and all necessary information the content of this manual may

appear insufficient and is not guaranteed by Carver Pump Company as to its completeness or accuracy.

C. PERSONNEL QUALIFICATION AND TRAINING.

All personnel involved in the operation, installation, inspection and maintenance of the unit must be qualified to carry out the work involved. If the personnel in question do not already possess the necessary knowledge and skill, appropriate training and instruction must be provided. If required the operator may commission the manufacturer/supplier to provide applicable training.

Follow instructions in this manual carefully. Factory warranty applies only when pump operates under conditions as specified on order acknowledgment, and if pump is properly installed and maintained as recommended herein. A copy of this manual should be available to operating personnel. Additional copies of this manual are available upon request from Carver Pump Company and your local distributor. For comments and/or questions about information provided, please contact Carver Pump Company or your local distributor.

D. PUMP IDENTIFICATION. The type of pump, pump size, operating data, and serial number are all stamped on the nameplate attached to the pump. Pump specifications should be recorded upon receipt of the pumping unit. Record all necessary information on the pump service record page and inspection and repair record provided at the front of this manual. This information must be included in all correspondence regarding the unit. This will ensure that the correct pump and/or parts are ordered in a timely manner.

E. PARTS INVENTORY GUIDE. To avoid unnecessary delays for maintenance, spare parts should be readily available, purchase before and keep in stock, for normal service. Most conditions will be covered if this manual is followed.

F. PARTS ORDERING. When ordering replacement parts, please specify:

- Serial number of pump (located on nameplate)
- Part name (located on parts list)
- Quantity of parts needed

Carver Pump Company may ship an interchangeable part that is not identical in appearance or symbol. This is done only if the part has been improved. Examine parts carefully upon delivery before questioning factory or company representative. Never return parts to the factory without authorization from Carver Pump Company.

If an impeller is ordered, specify diameter across blade tips. Be sure diameter was NOT trimmed further than diameter shown on Carver Pump Company records.

If a driver or driver parts are ordered, specify name of manufacturer and all other data found on the driver nameplate.

G. SAFETY PRECAUTIONS. The manual is designed to provide adequate instructions for the safe and efficient installation, operation, or maintenance of the pump. Failure or neglect to properly install, operate, or maintain the pump may result in personal injury, property damage, or unnecessary damage to the pump. This manual must be read and understood both by the installing personnel and the responsible trained personnel/operators prior to installation and operation, and it must always be kept close to the location of the pumping unit for easy access.

G.1 Summary of Safety Marking.

The safety instructions contained in this manual whose non-observance might cause hazards to persons are specially marked with the symbol:



General hazard sign to ISO 7000 - 0434.

Notes highlight an operating or maintenance procedure, condition, or statement which is essential, but is not of known hazardous nature as indicated by DANGERS, WARNINGS and CAUTIONS.

The word "CAUTION" is used to introduce safety instructions whose non-observance may lead to damage to the machine and its functions.

The word "WARNING" is used to introduce safety instructions whose non-observance may lead to a potential hazard exists, capable of producing injury to personnel, if approved procedures are not followed.

The word "DANGER" indicates a location, equipment, or system where imminent hazards exist, capable of producing immediate injury or death to personnel, if approved procedures are not followed.

Instructions attached directly to the machine, e.g.

- Arrow indicating the direction of rotation
- Markings for fluid connections must always be complied with and be kept in a perfectly legible condition at all times.

Observe all notes, caution or danger tags attached to the equipment or included in this manual.

G.2 Non-compliance with Safety Instructions.

Non-compliance with safety instructions may result in personal injury, property damage, or unnecessary damage to the pumping unit. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages. Non-compliance, can for example, result in:

- Failure of important pumping unit functions.
- Failure of prescribed maintenance and servicing practices.
- Hazard to personnel by electrical, mechanical, and chemical effects as well as explosion.
- Hazard to the environment due to leakage of hazardous substances.

G.3 Safety Instructions for Maintenance, Inspection, and installation Work.

The operator is responsible for ensuring that all maintenance, inspection and installation work be performed by authorized, qualified personnel who are thoroughly familiar with the manual and pumping unit.

The pumping unit must have cooled down to ambient temperature, pump pressure must have been released and the pump must have been drained before working on any pumping unit.

Work on the pumping unit must be carried out during shutdown. The shutdown procedure described in the manual for taking the unit out of service must be adhered to.

Pumps handling fluids that are hazardous to personnel must be decontaminated prior to being worked on.

Immediately following completion of the work, all safety relevant and protective devices must be reinstalled and/or reactivated.

Please observe all instructions set out in the section on start-up before returning the pumping unit to service.

G.4 Unauthorized Modification and Manufacture of Spare Parts.

Modifications or alterations of the pumping unit supplied are only permitted after consultation with Carver Pump and to the extent permitted by Carver Pump. Original spare parts and accessories authorized by Carver Pump ensure safety. The use of other parts can invalidate any liability of Carver Pump for consequential damage and/or warranty.

G.5 Unauthorized Modes of Operation.

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

II. INSPECTION AND STORAGE.

A. INSPECTION. Upon receipt of the shipment, unpack and inspect the pumping unit and individual parts to insure none are missing or damaged. Carefully inspect all boxes and packing material for loose parts before discarding them. Immediately report any missing parts or damage incurred during shipment to the factory and to the Transportation Company and file your “damage and/or lost in shipment” claim with the carrier.

B. STORAGE OF PUMP. If the equipment is not to be immediately installed and operated, store it in a clean, dry, well-ventilated place, free from vibrations, moisture and rapid or wide variations in temperature.

NOTE

Storage requirements vary depending on climatic environment, length of storage and equipment. For storage periods of three months or longer, contact manufacturer for specific instructions. Improper storage could damage equipment and would result in non-warranty covered restoration of non-warranty covered product failures.

When storing the pump up to three months rotate the shaft for several revolutions at least once per month to coat the bearings with lubricant, retard oxidation and corrosion, and prevent possible false brinelling.

Consider a unit to be in storage when:

1. It has been delivered to the job site and is waiting to be installed.
2. It has been installed but operation is delayed pending completion of construction.
3. There are long (30 days or more) periods between operating cycles.
4. The plant (or department) is shut down for periods of longer than 30 days.

Measures to be taken for prolonged shutdown of installed pumping unit. If the pumping unit remains installed a periodic check of operation is in order to make sure that the pump is always ready for instant

start-up and to prevent the formation of deposits within the pump and the pump intake area. Start up the pumping unit regularly once a month or once every 3 months for a short time (approximately 5 minutes) during prolonged shutdown periods. Prior to operation check run ensure that there is sufficient liquid available for operating the pump.

III. INSTALLATION.

A. LOCATION. The pump assembly should be located in an area that will permit periodic inspection and maintenance.



CAUTION

Install the pump in a ventilated area protected from inclement weather or destructive elements (rain, frost, etc).

NOTE

The ambient temperature and altitude ranges are provided in Section 10.1.

Head room and access should be provided and all units should be installed in a dry location with adequate drainage. Place the pump away from walls, the ceiling or other obstacles so that the pump can be fastened, operated and serviced safely. The discharge piping should be direct with as few elbows and fittings as possible. Position the pump on a flat surface that is as close as possible to the water source. Leave enough space and ventilation around the pump to allow safe use and maintenance. There must be a minimum distance of 4 inches of “free space” in front of the cooling fan.

When storing the pump up to three months rotate the shaft for several revolutions at least once per month to coat the bearings with lubricant, retard oxidation and corrosion, and prevent possible false brinelling.

B. FASTENING DOWN THE PUMPING UNIT. Bolt the pump on to a concrete base or suitable metal structure. Use of anti-vibration supports is highly recommended in commercial buildings (with occupants) if the concrete base is an integral part of the reinforced concrete structure of buildings. When fastening, use a drill bit to center mark the 4 holes in the base of the pump on the surface it is due to be installed on. Use a drill to make 4 holes (dia. 12mm (15/32") for RSVS 1, 3, 5, 10, 15, 20 pumps and dia. 14mm (9/16") for RSV 32, 45, 64 pumps). Move the pump back into position, line it up with the pipes and tighten the screws all the way. The position of the fastening holes is also illustrated in section 15.6.

C. HANDLING. **WARNING**

RSV pumps with motor installed tend to be top heavy. Care should be taken in handling and transporting to prevent damage or injury caused by the pump falling over.

 **CAUTION**

Use a hoist with adequate lifting capacity.

Do not pick up the complete unit by the motor or the pump shafts or motor lifting eyes.

If the pumping unit slips out of the sling arrangement, it may cause injury to personnel and/or damage to the pumping unit.

Moving the unit requires proper preparation and handling. Always make sure that the pump cannot slip out of the transport suspension arrangement. The RSV pumps with motor installed tend to be top heavy; care should be taken in handling and transporting to prevent damage or injury caused by the pump falling over.

D. PRE-INSTALLATION PROCEDURES. **WARNING**

Remove the suction and discharge caps before hooking the product up to the lines.

1. Always check the pump label against the requirement to make sure you are installing the proper pumps specified for the job.
2. Make sure that the pump suction marked by a sticker, is connected to the liquid source and that the discharge, similarly marked, is connected to the discharge line.

 **WARNING**

Before work is performed on the RSV pump, care should be taken to ensure that the electrical power is disconnected to the motor to prevent electric shock or premature starting which could cause damage to persons, things or the pump.

 **CAUTION**

On three phase motor insulations, always check for proper motor rotation prior to starting by jogging the motor. Shaft rotation must turn clockwise when viewed from the top of the motor.

Make sure the motor is correctly wired; refer to instruction on the motor nameplate.

3. Make sure that the pump base is firmly secured to a solid flat surface and that the suction and discharge lines are aligned and properly supported to prevent pipe strain on the pump.
4. Ensure that the suction and discharge gaskets are properly installed to prevent leaks and that they do not restrict the flow to or from the pump. Standard ANSI mating flanges should be used to connect the pump to the piping. Suction and discharge piping should be no smaller than the respective pump port sizes.
5. Isolation valves should be installed on both the suction and discharge side of the pump in the event service of the pump is required.
6. Provide adequate space and ventilation around the pump for service and motor cooling.

 **WARNING**

Use standard plumbing practices to ensure unnecessary line losses, cavitation and prevent air lock.

7. If the installation of the motor is necessary, refer to Section VI, Paragraph A for instructions.

E. PIPING. All piping should be independently supported near the pump so that pipe strain will not be transmitted to the pumping unit. Refer to Figures 1 and 2.



WARNING

Suction and discharge piping must be sized to withstand the maximum working pressure of the pump.



CAUTION

All piping connections must be made with the pipe in a freely supported state. Do not apply vertical or side pressure to align the piping with the pump flange.

Suction and discharge piping must be sized to withstand the maximum working pressure of the pump.

Before connecting suction, discharge, and auxiliary piping, check to see that the piping is absolutely clean internally. Any debris in the piping will be drawn into the pump passageways and can cause extreme damage. The internal diameters of the suction and discharge lines must be equal to the internal diameters of the pump suction and discharge nozzles.

It is recommended a pressure gauge is installed on the discharge line before the non-return valve and isolating valve. If the pump is installed with a suction lift arrangement (liquid level lower than the pump) and it feeds an open circuit, install a foot valve at the end of the suction line and use a hose connected to the pump.



WARNING

Ensure that available NPSH is greater than NPSH required by the pump. Insufficient NPSH will result in cavitation, which reduces pump performance and may result in damage to the pump. Refer to the pump curves.

1. Use metal or rigid plastic pipes to avoid any strain or collapse due to possible force created at suction.
2. Support and align pipes so that they do not put any stress on the pump.
3. Avoid throttling caused by bending suction and discharge hoses.
4. Seal any piping connections: air infiltration in the suction pipe negatively affects pump operation.

5. Isolation valves should be installed on both the suction and discharge side of the pump in the event service of the pump is required; it is recommended that a bleed valve be installed in the discharge line to allow pressure in the pump to be relieved for service.



WARNING

Installing a bleed valve is especially necessary in hot water applications to prevent injury.

6. Fix the piping to the reservoir or to any fixed parts so that it is not supported by the pump.
7. Use minimal bends (goosenecks) and valves.
8. In suction lift installations, the suction pipe should be fitted with a foot valve and filter in order to prevent foreign matter from entering and its end should be immersed at a depth that is at least twice the diameter of the pipe; its distance from the bottom of the reservoir should also be one and a half times its diameter. For suction piping exceeding 13 feet use an oversized pipe (1/4" wider at suction) for improved efficiency.
9. Ensure that the pump suction, marked by a sticker, is connected to the liquid source and that the discharge, similarly marked, is connected to the discharge line.
10. Ensure that the suction and discharge gaskets are properly installed to prevent leaks and that they do not restrict the flow to or from the pump. Standard ANSI mating flanges should be used to connect the pump to the piping. Suction and discharge piping should be no smaller than the respective pump port sizes.

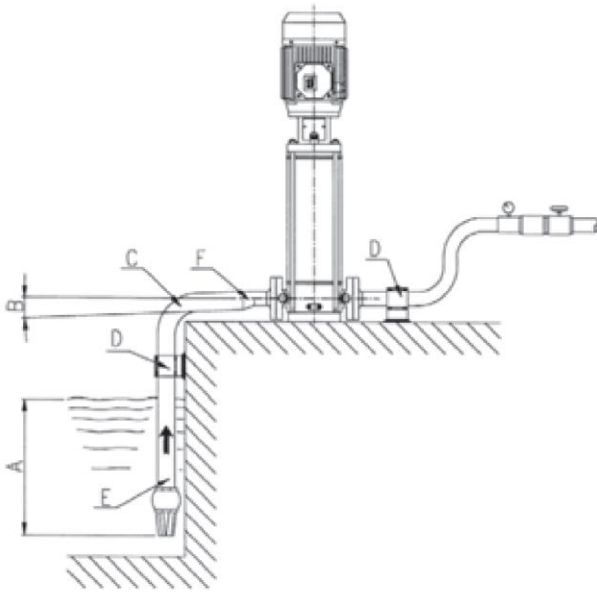


Figure 1. Correct Operation of RSV

- Good immersion
- Positive slope
- Wide-radius bend
- Pipework with independent supports
- Suction pipe diameter greater than pump port diameter
- Reducer coupling for eccentric pipes

F. AUXILIARY PIPING CONNECTIONS AND GAUGES. In addition to primary piping connections, the pump may require other connections such as gauges or drains. All these lines and gauges should now be installed.

G. MOTOR. See motor vendor's manual for motor information and information on connecting to the power supply.



Connection to the power supply must be completed by a trained electrician only. Check available main voltage against the data on the motor rating plate and select appropriate start-up method.

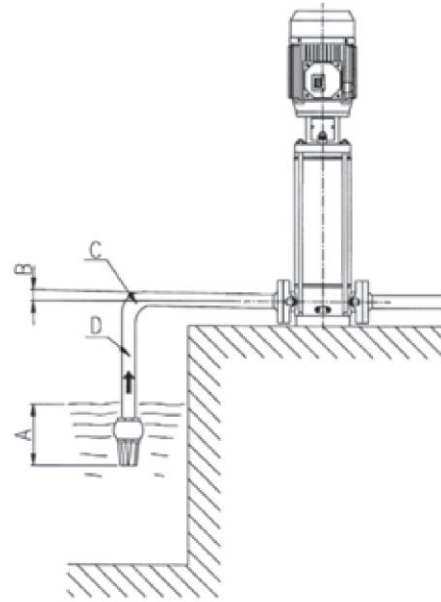


Figure 2. Incorrect Operation of RSV

- Insufficient immersion
- Negative slope, air pockets created
- Tight bend, pressure loss
- Pipe diameter less than pump port diameter, pressure loss

H. DIRECTION OF ROTATION. The standard direction of rotation, when viewed from the motor end, is clockwise.

The rotation arrow is located on the motor bracket, refer to Figure 3 for the rotation arrow location on the motor bracket. There is an arrow on both sides of the motor bracket.



Figure 3. Rotation Arrow

I. Disposal. The user is responsible for disposing of the equipment by taking it to a collection and recycling facility authorized to dispose of electrical waste. Please adhere to local waste disposal regulations should the product become dysfunctional and need to be “scrapped.” Completely empty the product of all fluids – do not leave any treated fluid inside it. EBARA pumps should not (typically) contain hazardous polluting material. For further information on equipment collection points, contact your local waste disposal authority.

IV. OPERATION.

A. PRE-START CAUTIONS.



WARNING

Before activating the pumping unit, check to make sure there are no personnel working on the unit. Serious injury or death to personnel could result if the unit is activated while being worked on.

1. Before starting or operating the pump, read this entire manual, especially the following instructions.
2. Observe all caution or danger tags attached to the equipment.



WARNING

Make sure that all cables, electrical connections and controls are in perfect working order and properly grounded. Improper installation can result in serious or even mortal accidents to persons.



CAUTION

Never run the pump dry. Close running fits within the pump are liquid lubricated. Dry running will result in pump seizure or damage.

3. The pumps are designed to operate at a temperature no higher than 104°F (40°C) and a level no higher than 3280 feet.
4. The pumps cannot be used in swimming pools or similar plants.
5. Prolonged operation with the discharge pipe closed can cause damage.



WARNING

RSV and RSVS pumps are designed for continuous and normal off/on operation. Rapid cycling may cause high heat and loading that can damage the motor or the pump.

6. Avoid switching the motor pump on and off too frequently (check motor specifications).
7. During power cuts, it is advisable to disconnect the power to the pump.

B. PRIMING. Dry running a centrifugal pump can result in extensive damage and possible seizing. It is, therefore, imperative that the pump be primed prior to initial start-up and that prime must be maintained through subsequent start-stop cycles.



WARNING

Extreme caution should be used if priming the pump in a hot water application



CAUTION

Never run the pump dry. Close running fits within the pump are liquid lubricated. Dry running will result in pump seizure or damage.

Filling pump in Suction Lift Arrangement. Follow the procedure listed below:

1. Completely prime the pump by removing the vent plug (212) (Larger plug) located above the outer jacket in front of the coupling guard (remove coupling guard if necessary).
2. Using a funnel, fill the pump body with water until it overflows and replace vent plug (212).
3. Areas that have become wet as a result of water leaks must be dried thoroughly.
4. Reinstall the coupling covers if they have been removed.
5. Alternatively for installations with positive suction heads, close the discharge valve and remove the vent plug (212).
6. Open suction valve until liquid flows out of the vent plug opening and then replace the vent plug securely and open the discharge valve.
7. It is recommended that a bleed valve be installed in the discharge line or in a line from the vent port to the reservoir. This will allow the pressure in the pump to be relieved for service.

 **CAUTION**

Installing a bleed valve is especially necessary in hot water applications to prevent injury.

8. Pipe, valves and fittings must have a pressure rating equal to or greater than the maximum system pressure.
9. A bypass or pressure relief valve should be installed in the discharge line if there is any possibility the pump may operate against a closed valve in the discharge line.
10. Minimum flow is required for proper cooling and lubrication of the pump without which, damage and premature failure will occur.

Filling pump in a Flooded Arrangement. Follow the procedure listed below:

1. Loosen the vent plug (small plug) several turns. Complete removal of the plug is not necessary to prime the pump.
2. Open the suction valve until the water flows out around the vent plug.
3. Retighten the vent plug back on until it is locked tight.

Table 1. Minimum Pumping Rate

Model	Minimum Flow Rate (GPM)
RSVS1	3
RSVS3	3.5
RSVS5	10.6
RSVS10	8
RSVS15	20
RSVS20	26.5
RSV32	66
RSV45	116
RSV64	158

C. STARTING THE PUMP.

 **WARNING**

DO NOT operate pumping unit against a closed discharge system. If pump has any chance of operation against a closed system, a bypass system allowing a minimum design flow should be installed. This bypass will be satisfactory for short periods of operation. For extended periods of operation the bypass should be sized for the minimum continuous flow required by the pump.

1. Check pump for proper motor rotation per Section III, Paragraph J, priming per Section IV, Paragraph B and installation per Section III, Paragraph D.
2. Starting – When the pump is up to operating speed, open discharge valve to obtain desired capacity or pressure.
3. Check to make sure that all electric connections are correct.

 **WARNING**

Operating the pump without the guards in place can cause physical injury.

4. Apply power to the motor. Check motor rotation. Rotation should be clockwise when viewed from the top of the motor. Rotation arrows are located on the motor brackets refer to Section III, Paragraph J for photo.
5. If it is rotating in the wrong direction (counterclockwise), shut off power and swap two of the motor's power phases in the electrical enclosure or terminal block.

 **WARNING**

RSV pumps are designed for continuous and normal off/on operation. Rapid cycling can cause high heat and loading that can cause damage to the pump or motor.

6. Please refer to the motor manufacturer specifications for starts per hour.
7. Start the pump two or three times to check system conditions.

8. Partially close, and then re-open the discharge line a few times to cause a rapid pressure increase.
9. Check that noise, vibration, pressure, voltage, and amps levels are at normal levels.

D. **STOPPING THE PUMPING UNIT.**



WARNING

DO NOT operate pumping unit against a closed discharge system. If pump has any chance of operation against a closed system, a bypass system allowing a minimum design flow should be installed. This bypass will be satisfactory for short periods of operation. For extended periods of operation the bypass should be sized for the minimum continuous flow required by the pump.

1. Gradually shut off water to the discharge line to avoid overpressure in the piping and pump.
2. Cut off the power supply.

V. **MAINTENANCE.**

Generally the pump does not need continuous supervision. The pump should always run quietly and smoothly, without vibration. Regularly scheduled maintenance should not be necessary. However, periodic inspection is recommended to ensure the pump is running properly. Periodic checks and preventive maintenance will reduce sudden or significant problems and repairs. Data should be recorded for each pump to keep track of maintenance which has been performed and to note operational problems. A sample maintenance record sheet is provided for this purpose at the front of this manual. Common maintenance operations include:

- Replacement of mechanical seals
- Replacement of grommets
- Replacement of bearings
- Replacement of capacitors.

Although subject to typical wear, correct operation of the pump will prolong the service life of these parts. If the pump will not be operated and inactive for a long period, it should be emptied completely, with the discharge and fill caps removed, then washed and rinsed carefully with clean water. Avoid leaving residual water inside the pump. These steps should be followed if installation occurs where a chance of frost is possible in order to avoid the breakdown of the pump components.

Daily Inspection:

- Visually inspect unit.

Weekly Inspection:

- Check power (amps) readings.
- Check pump discharge pressure.

Monthly Inspection:

- Check foundation bolts.

Semi-annual Inspection:

- If stand-by pumps are installed, it is advisable to operate pumps on a rotation system to give each pump a certain duty. This ensures that stand-by pumps will always be in good condition for instant start-up.

A. LUBRICATION OF MOTOR. See motor manufacturer's instructions to be sure motor bearings are properly lubricated.

B. TORQUE VALUES. Refer to Table 2 for recommended tightening torque values. Clean and properly lubricate threads and bearing face of the fastener to obtain the proper fastener loading from these torque values. Fasteners should be tightened evenly and in stages. Refer to your torque wrench manual for the proper use of your wrench.

C. FLANGE LOADING. Refer to Table 3 for allowable strain on the flange and Table 4 for allowable torque on the flange. Refer to Figure 4 for flange loading illustration.

Table 2. Recommended Flange Tightening Torque Values

Models			Flange		Bolt Size	No. of Bolts	Tightening Torque	
							[lb-ft]	[Nm]
RSVS	1-3-5	F	ANSI	1-1/4"	5/8"	4	52	70
RSVS	1-3-5	L	ANSI	1-1/4"	5/8"	4	52	70
RSVS	1-3-5	N	-	1-1/4"	M10	2	22	30
RSVS	10-15-20	F	ANSI	2"	5/8"	8	26	35
RSVS	10-15-20	L	ANSI	2"	5/8"	8	26	35
RSVS	10-15-20	N	-	2"	M12	2	37	50
RSV	32	F	ANSI	2-1/2"	5/8"	4	59	80
RSV	32	F	ANSI	2-1/2"	3/4"	8	59	80
RSV	45	F	ANSI	3"	5/8"	4	59	80
RSV	45	F	ANSI	3"	3/4"	8	59	80
RSV	64	F	ANSI	4"	5/8"	8	59	80
RSV	64	F	ANSI	4"	3/4"	8	74	100

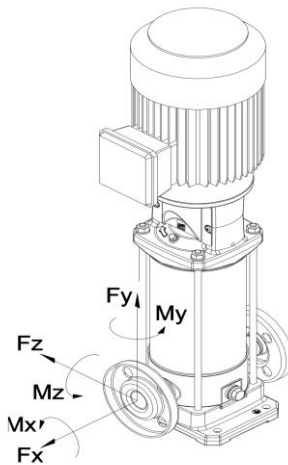


Figure 4. Flange Loading

Table 3. Allowable Strain on the Flange

Models			Flange		Strain X		Strain Y		Strain Z	
					[lb]	[N]	[lb]	[N]	[lb]	[N]
RSVS	1-3-5	F	ANSI	1-1/4"	61	270	52	230	47	210
RSVS	1-3-5	L	ANSI	1-1/4"	61	270	52	230	47	210
RSVS	1-3-5	N	-	1-1/4"	61	270	52	230	47	210
RSVS	10-15-20	F	ANSI	2"	110	490	101	450	90	400
RSVS	10-15-20	L	ANSI	2"	110	490	101	450	90	400
RSVS	10-15-20	N	-	2"	110	490	101	450	90	400
RSV	32	F	ANSI	2-1/2"	472	2100	416	1850	382	1700
RSV	32	F	ANSI	2-1/2"	236	1050	208	925	191	850
RSV	45	F	ANSI	3"	562	2500	506	2250	461	2050
RSV	45	F	ANSI	3"	281	1250	253	1125	230	1025
RSV	64	F	ANSI	4"	753	3350	674	3000	607	2700
RSV	64	F	ANSI	4"	377	1675	337	1500	303	1350

Table 4. Allowable Torque on the Flange.

Models			Flange		Torque X		Torque Y		Torque Z	
					[lb-ft]	[Nm]	[lb-ft]	[Nm]	[lb-ft]	[Nm]
RSVS	1-3-5	F	ANSI	1-1/4"	170	230	207	280	140	190
RSVS	1-3-5	L	ANSI	1-1/4"	170	230	207	280	140	190
RSVS	1-3-5	N	-	1-1/4"	170	230	207	280	140	190
RSVS	10-15-20	F	ANSI	2"	251	340	310	420	221	300
RSVS	10-15-20	L	ANSI	2"	251	340	310	420	221	300
RSVS	10-15-20	N	-	2"	251	340	310	420	221	300
RSV	32	F	ANSI	2-1/2"	885	1200	1106	1500	811	1100
RSV	32	F	ANSI	2-1/2"	442	600	553	750	406	550
RSV	45	F	ANSI	3"	959	1300	1180	1600	848	1150
RSV	45	F	ANSI	3"	479	650	590	800	424	575
RSV	64	F	ANSI	4"	1069	1450	1291	1750	922	1250
RSV	64	F	ANSI	4"	535	725	645	875	461	625

VI. SERVICE AND REPAIR.

For service and repair for each specific RSV model, please refer to the following paragraphs and the Figures following.

A. COUPLING TO THE MOTOR. The pump and motor are connected by a coupling. The base aligns the pump and motor. No further alignment is necessary. The motors to be coupled to the RSVS and RSV pumps must meet NEMA standards.



DANGER
Check that all power is off and that the motor is disconnected from the power supply prior to ANY work performed on the pump and/or motor.

It is strongly suggested to perform a start-up test run following coupling to check operation. If possible, it is suggested to perform coupling once the pump has been fastened down in its working position and connected to the suction and discharge pipes.

B. ASSEMBLING THE MOTOR TO THE PUMP.



DANGER
Check that all power is off and that the motor is disconnected from the power supply prior to ANY work performed on the pump and/or motor.

Before attempting to disassemble the pump, the electrical power supply to the driver must be locked and tagged in the "OFF" position to prevent injury or death to personnel servicing the pumping unit.



WARNING
When lifting the pump/motor, use appropriate crane (or hoist), check position and tightness of lift system so that weight of the pump is not unbalanced. Failure to observe this precaution can result in serious accidents.

RSVS1 to RSVS20 [- A -] and RSV32-1 1.

1. Position and secure the pump vertically on a flat, rigid surface. 2. Unscrew the 4 coupling guard screws, then remove the two coupling guards.
2. Loosen the four coupling screws.
3. **RSVS only:** Evenly loosen the three set screws in the seal holder (shaft locking collar) by one full turn.
4. **RSVS only:** Remove the motor key from the motor and install the half-key.

**WARNING**

The half-key should not protrude from the slot in the motor shaft.

5. Set the motor vertically with its shaft downwards and place it over the pump. For RSVS, the half-key must face away from the gap between the coupling halves.
6. Insert and evenly tighten down the 4 motor bolts to the torque specified on page 14.
7. Use a suitable lever to pry the coupling upward until it stops against the end of the motor shaft.
8. With the coupling raised, tighten the four coupling bolts evenly to the torque specified on page 14.
9. Rotate the coupling by hand and use a feeler gauge to check that the gap between the coupling halves is even. If not, repeat from step 9.
10. **RSVS only:** Evenly tighten the three set screws on the seal holder to the torque specified on page 15.

**WARNING**

The seal holder set screws must be tightened prior to operation or damage to the pump may occur.

11. Temporarily connect the suction and discharge lines, and then open the discharge valve.
12. Fill the pump with water as described in Section 9.
13. Reinstall the two coupling guards (4 screws).
14. Connect the motor to its power supply.
15. Check motor rotation. Rotation should be clockwise when viewed from the top (fan end) of the motor.
16. Run the pump for a few minutes.
17. Check that running noise and vibration are not excessive.
18. Shut off power to the motor and wait for the coupling to come to a stop.
19. Unscrew the 4 screws and remove the two coupling guards.
20. Inspect the interior of the mount for water. If you find any water, drain the pump and reposition the coupling. Repeat the process from step 4.
21. Reinstall the two coupling guards (4 bolts)

22. Permanently connect the suction and discharge lines. Flange torque values are listed on page 9.
23. The pump is now installed

RSV32-3-2 to 32-10-1, RSV45 and RSV64 all sizes

1. Position and secure the pump vertically on a flat, rigid surface.
2. Attach a strong sling or chains to the motor lifting lugs or eyebolts to ensure that the motor is balanced when lifted.
3. Set the motor vertically with its shaft downwards and place it over the pump.
4. Insert and evenly tighten down the 4 motor bolts: 1/2" - 58.3 Nm (43 lb-ft), 5/8" – 124.8 Nm (92 lb-ft)
5. Temporarily connect the suction and discharge lines, then open the discharge valve.
6. Fill the pump with water as described in Section 9.
7. Connect the motor to its power supply.
8. Check motor rotation. Rotation should be clockwise when viewed from the top (fan end) of the motor.
9. Run the pump for a few minutes.
10. Check that running noise and vibration are not excessive.
11. Permanently connect the suction and discharge lines. Flange torque values are listed on page 9.
12. The pump is now installed

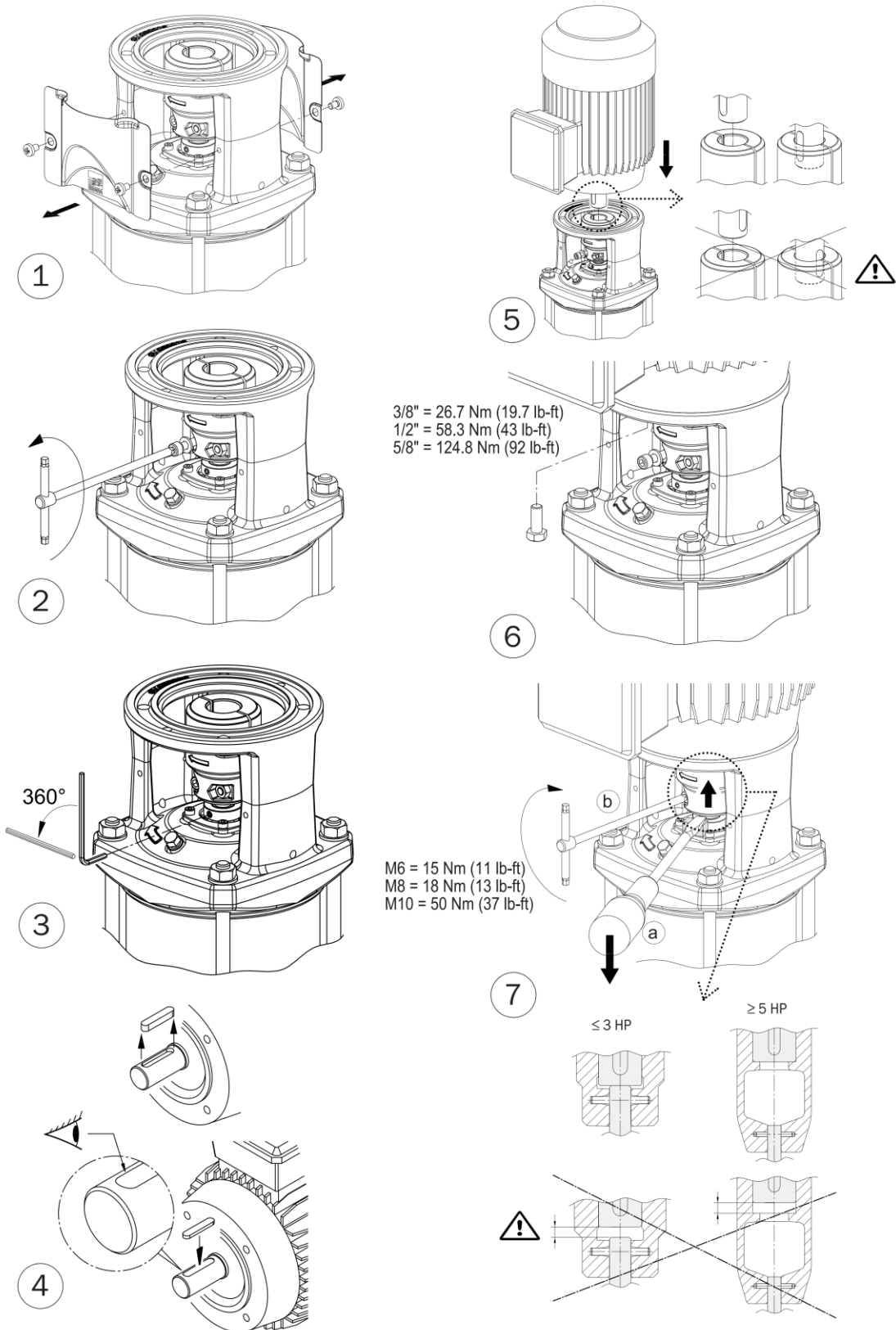


Figure 5. Assembling the Motor to the Pump – RSVS1 to RSVS20 [-A-] (Sheet 1)

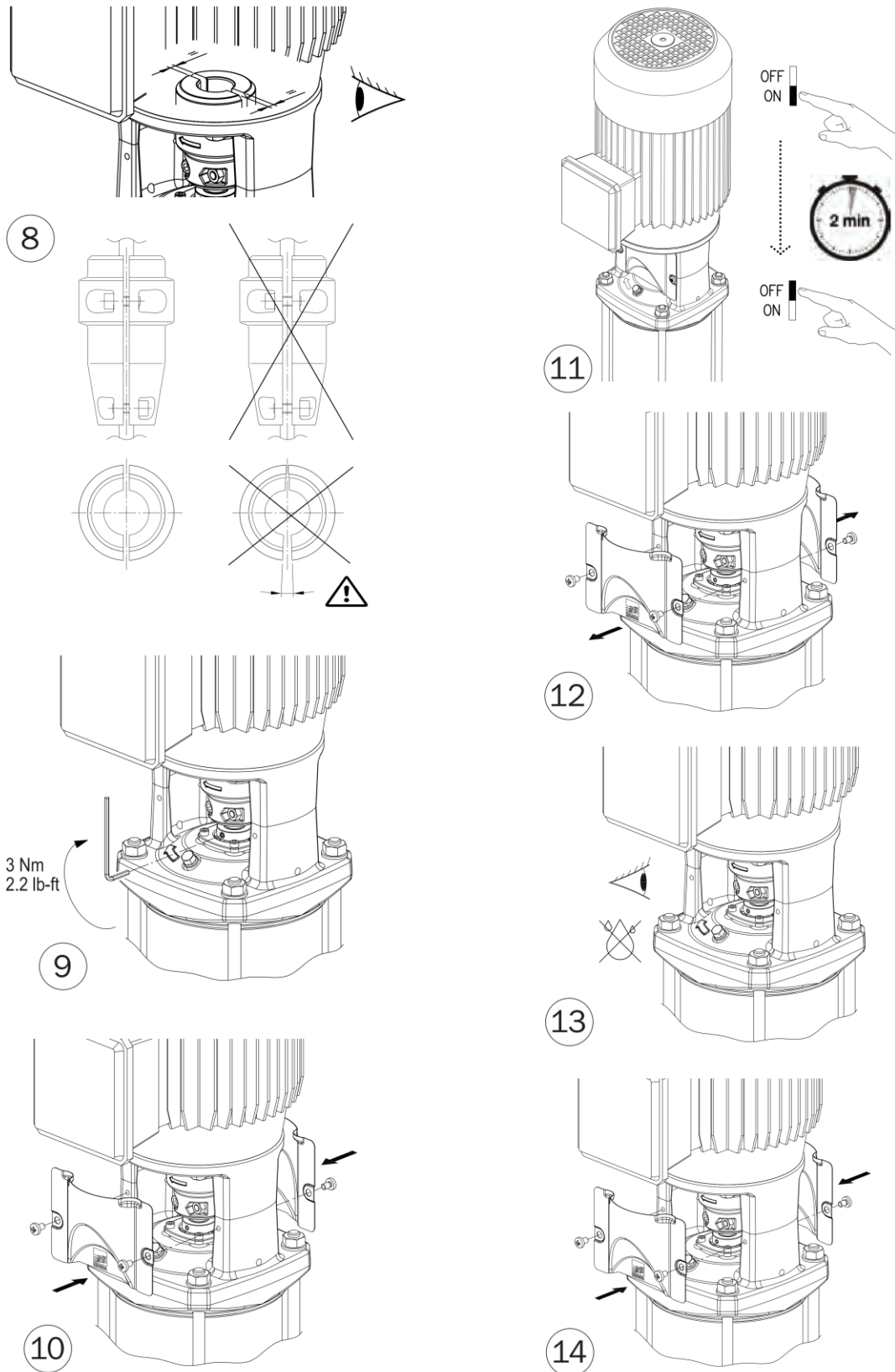


Figure 5. Assembling the Motor to the Pump – RSVS1 to RSVS20 [-A-](Sheet 2)

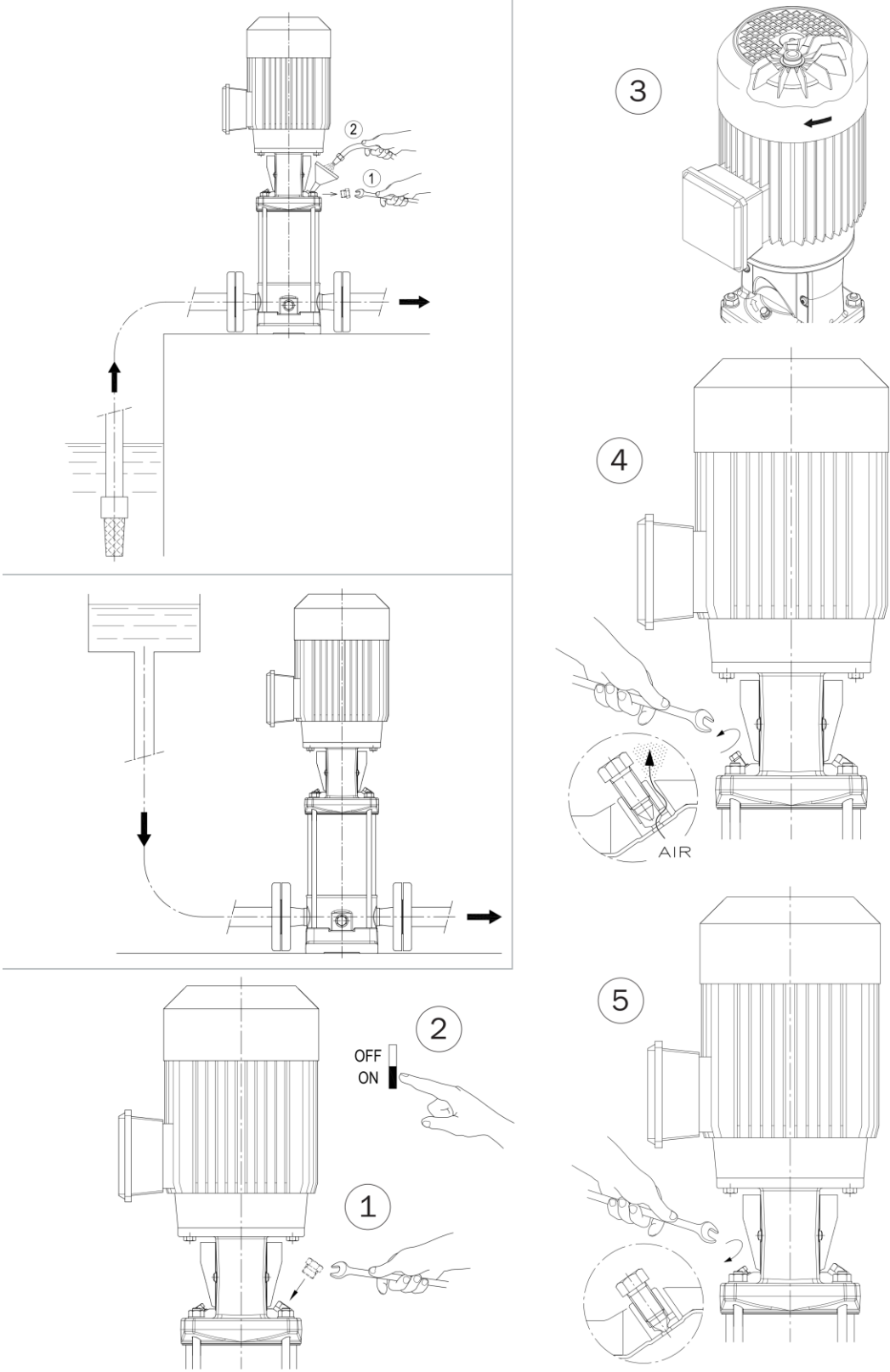


Figure 6. Use, Starting and Running – [-B-]

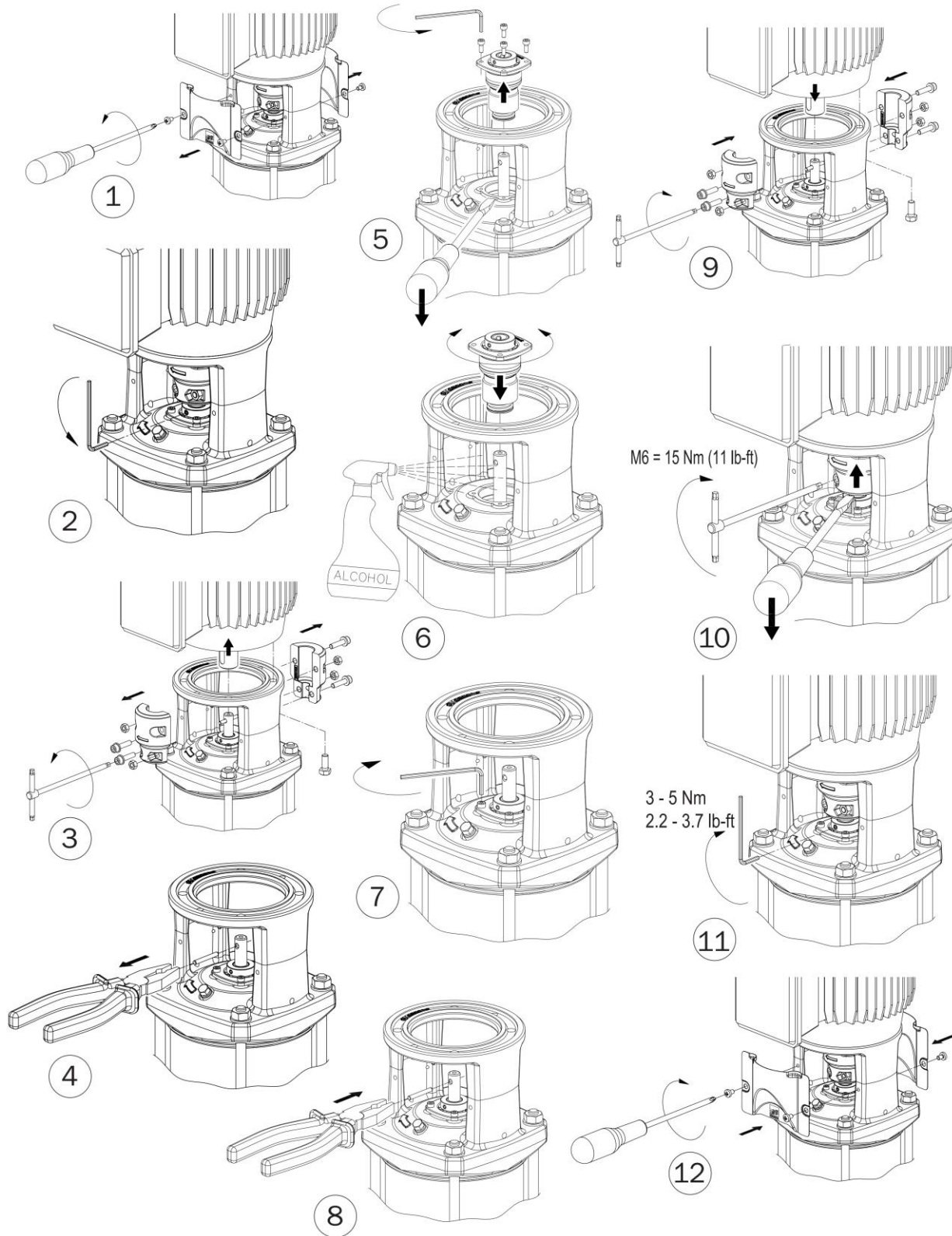


Figure 7. Replacement of Shaft Seal RSVS 1-3-5-10-15-20 Non-Spacer Coupling [-C-]

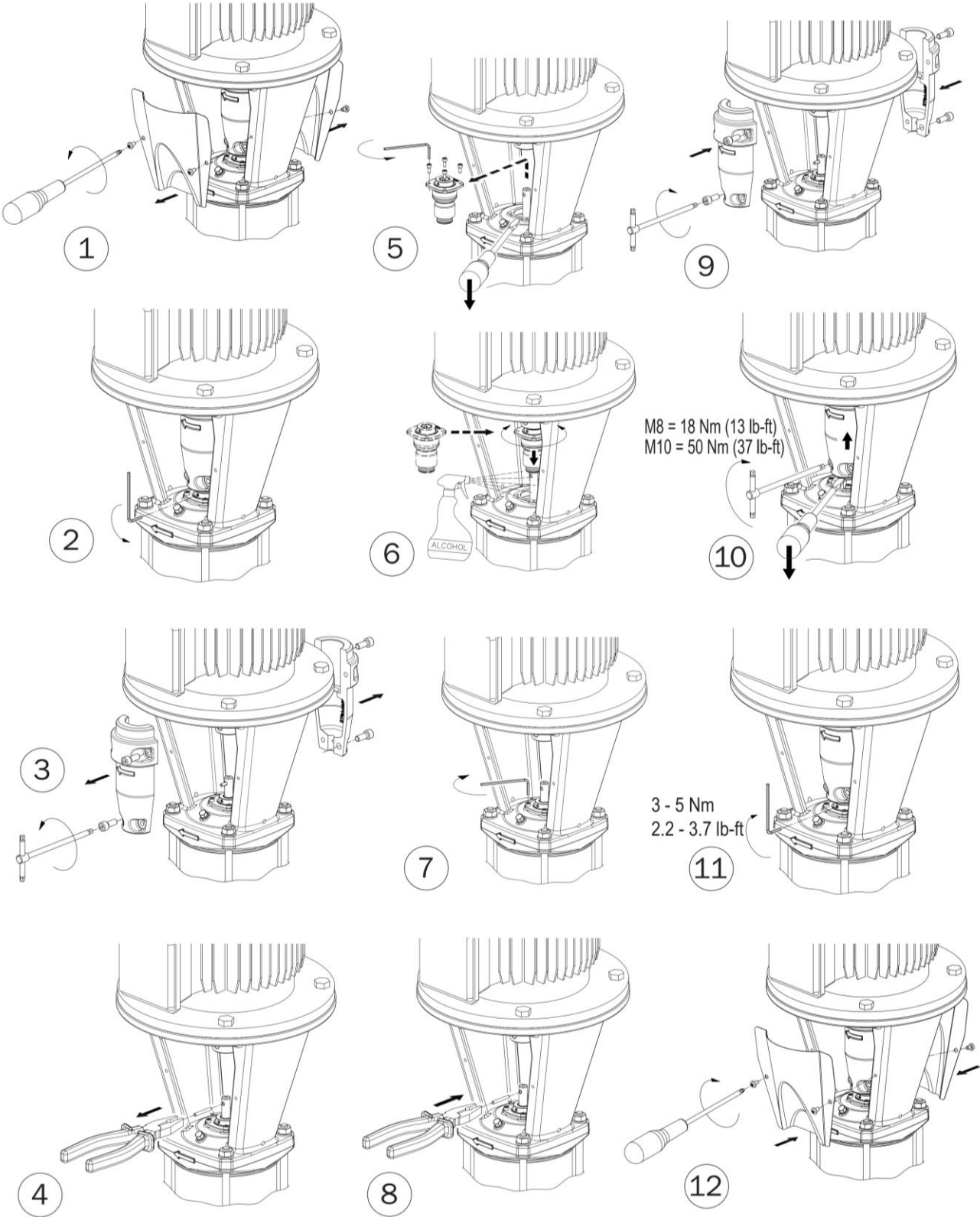


Figure 8. Replacement of Shaft Seal RSVS 1-3-5-10-15-20 Spacer Coupling [-C-]

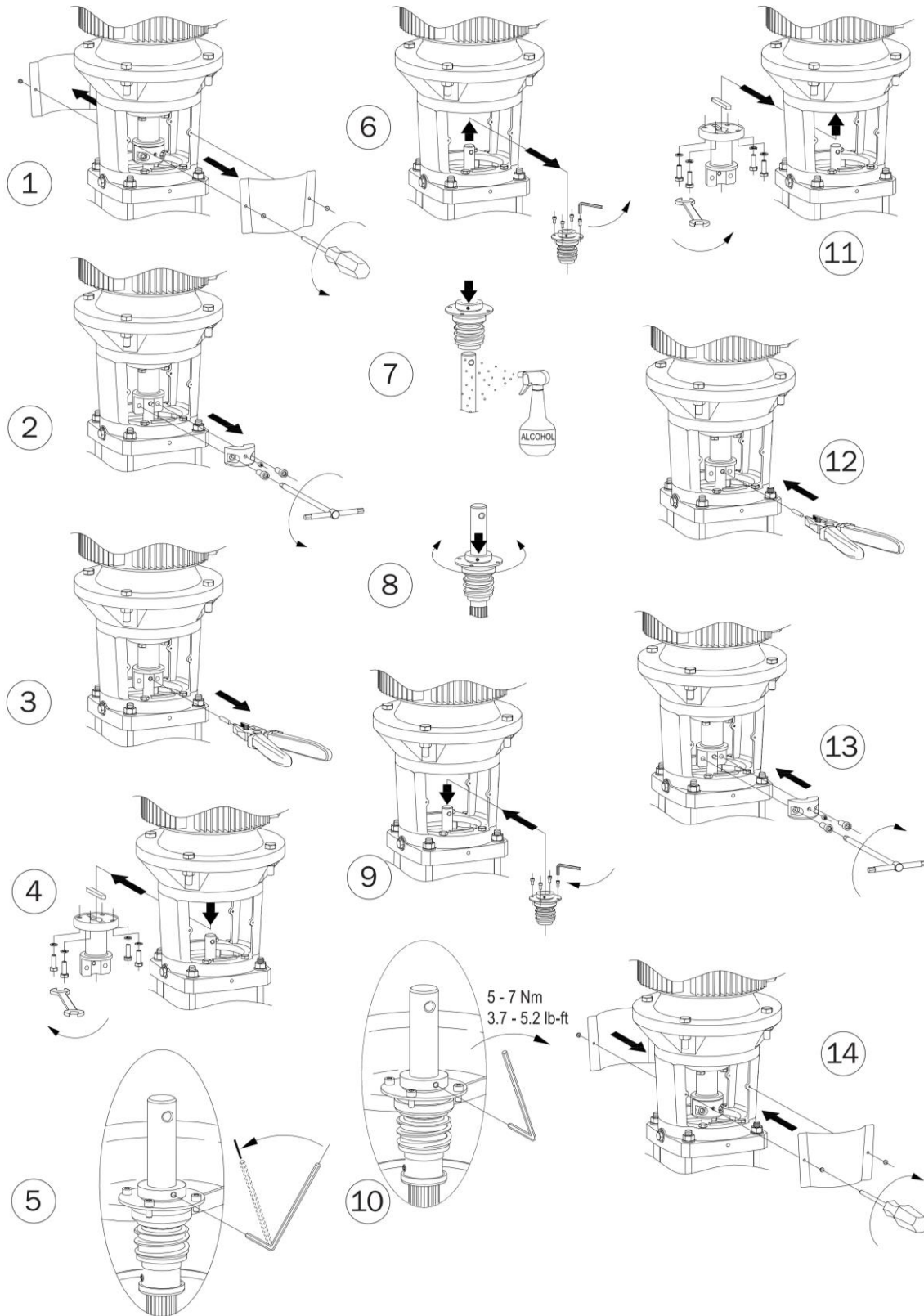


Figure 9. Replacement of Shaft Seal RSV 32-45-64 with Bearing [-C-]

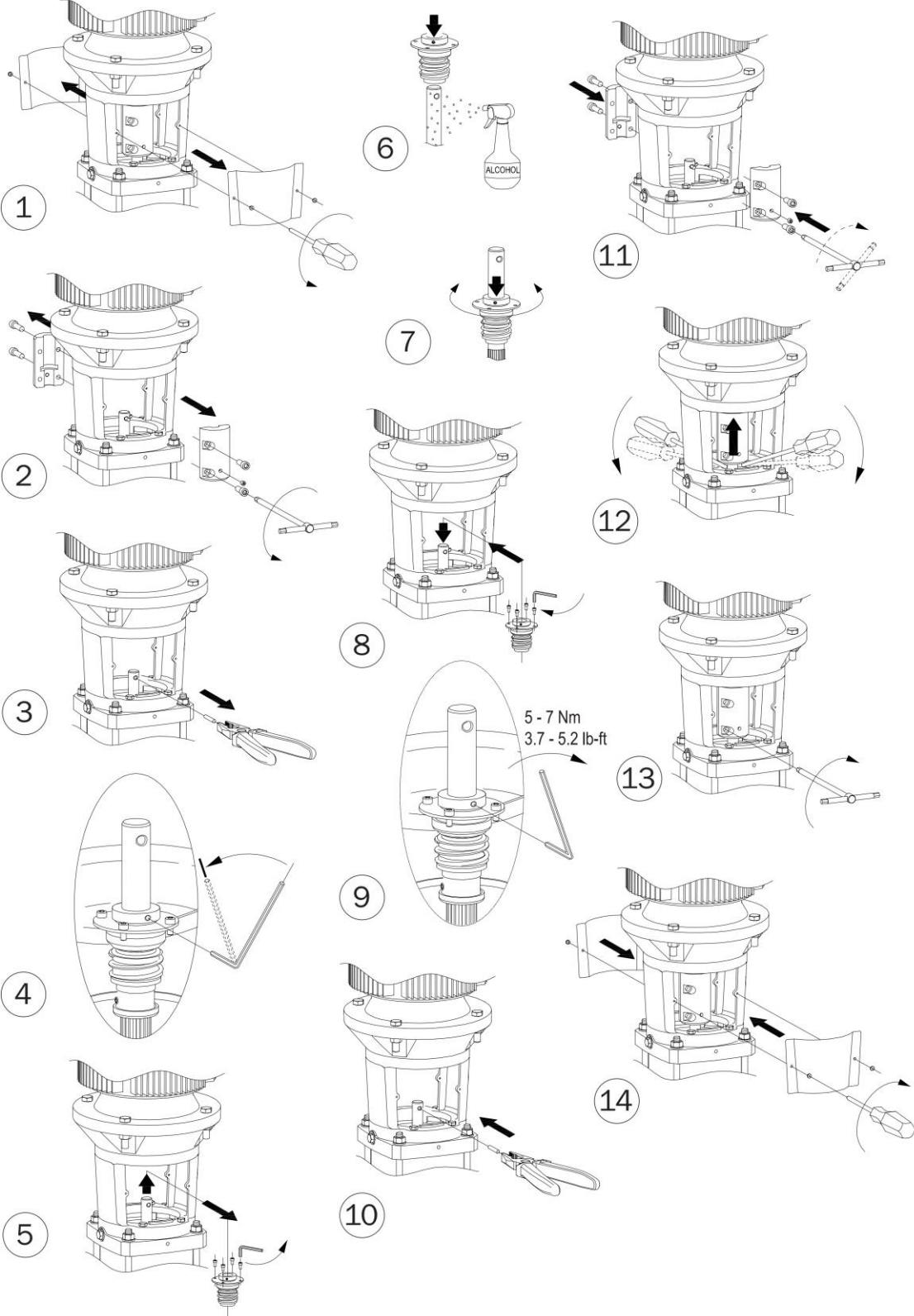
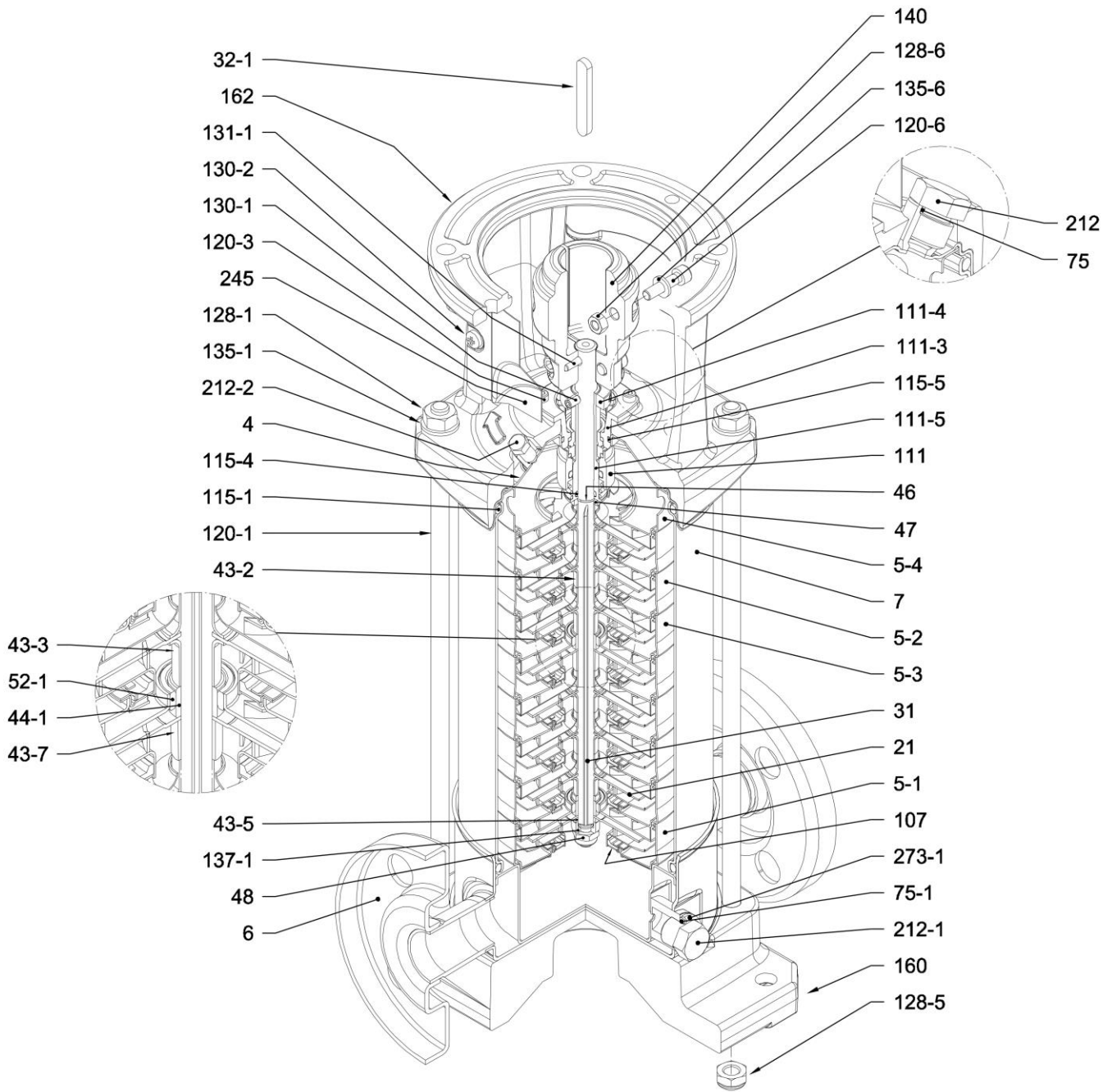


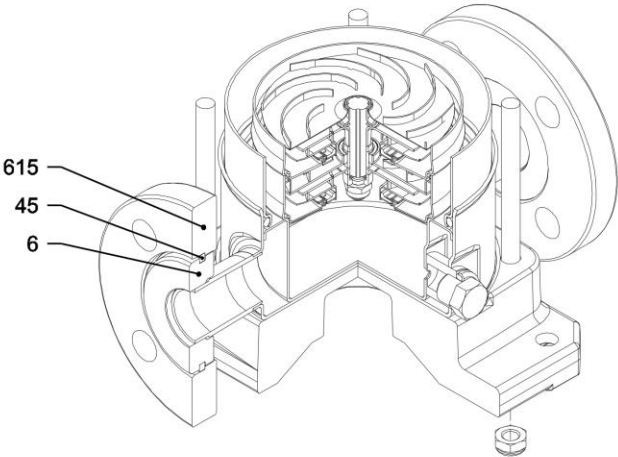
Figure 10. Replacement of Shaft Seal RSV 32-45-64 without Bearing [-C-]



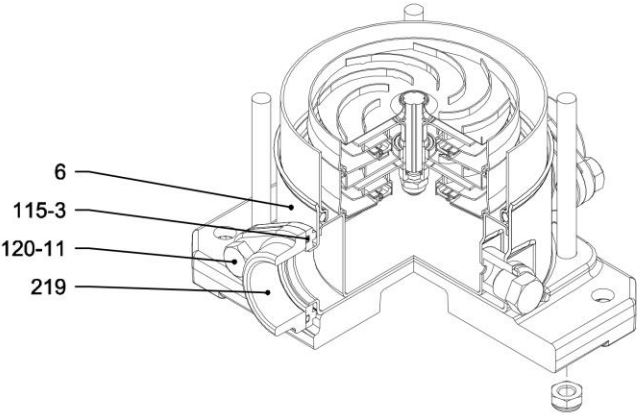
with Round (ANSI Compatible) flange (F)

Refer to Table 5 for part description.

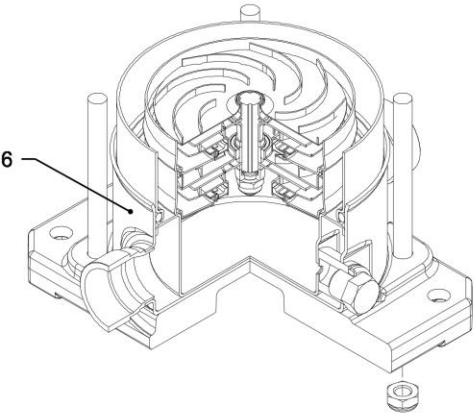
Figure 11. Sectional View – RSVS(L)1



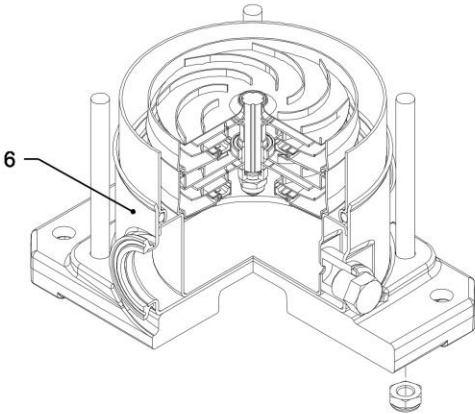
with Loose round ANSI compatible flange (L)



with Oval flange (N)



with victaulic connection (V)



with Clamp connection (C)

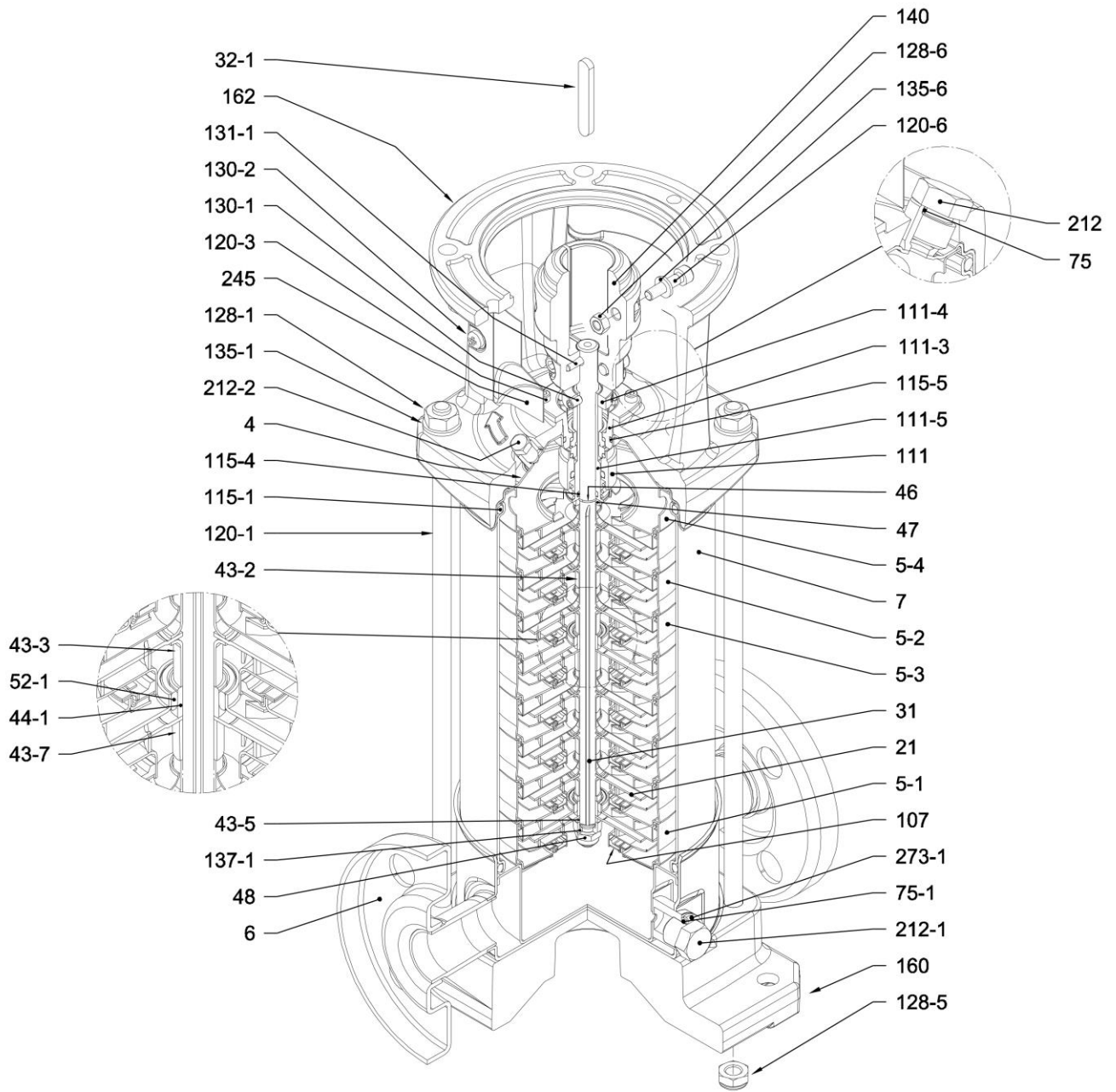
Refer to Table 5 for part description.

Figure 12. Pipe Connection – RSVS(L)1

Table 5. Sectional View – Part Reference Model RSVS(L)1

(For reference only, see pricing for part availability.)

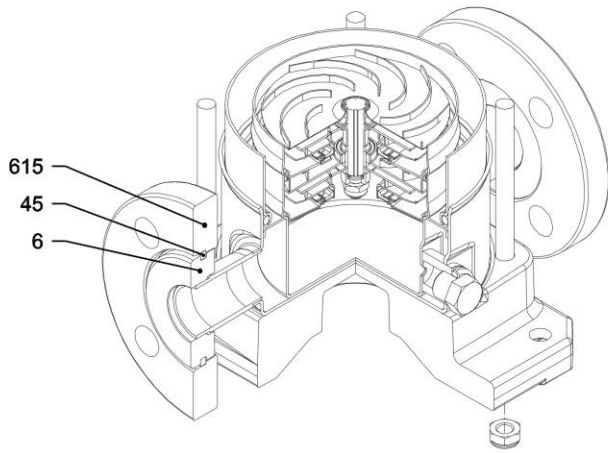
Part Number	Part Description	Part Number	Part Description
4	Casing Cover	115-1	O-Ring (Outer Casing)
5-1	Suction Casing	115-3	O-Ring
5-2	Intermediate Casing	115-4	O-Ring (Cartridge Sleeve)
5-3	Intermediate Casing Bearing	115-5	O-Ring (Seal Cover)
5-4	Discharge Casing	120-1	Tie Rod
6	Bottom Casing	120-3	Screw
7	Outer Casing	120-6	Screw for Coupling
21	Impeller	120-11	Screw for Counter Flange
31	Shaft	128-1	Nut for Tie Rod
32-1	Adjuster Key	128-5	Nut for Tie Rod
43-2	Shaft Sleeve (Intermediate)	128-6	Nut for Coupling
43-3	Shaft Sleeve (Bearing)	130-1	Set Screw
43-5	Shaft Sleeve (Last Stage)	130-2	Screw for Coupling
43-7	Spacer	131-1	Pin for Shaft
44-1	Shaft Sleeve (Bearing)	135-1	Washer
45	Flange Holder	135-6	Washer
46	Ring (Mechanical Seal)	137-1	Impeller Spacer
47	Ring Holder	140	Coupling up to 5 HP
48	Impeller Nut	160	Base
52-1	Bearing	162	Motor Bracket
75	O-Ring (Plug)	212	Plug
75-1	O-Ring (Plug)	212-1	Plug
107	Liner Ring	212-2	Venting Plug
111	Mechanical Seal	219	Counter Flange
111-3	Mechanical Seal Seat	245	Coupling Guard
111-4	Seal Holder	273-1	Plug Washer
111-5	Mechanical Seal Cartridge	615	Flange



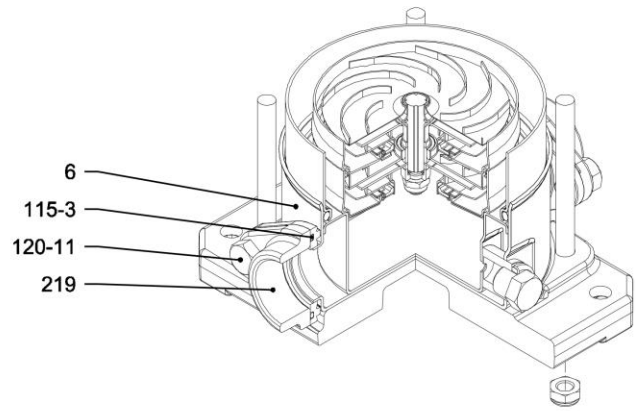
with Round (ANSI Compatible) flange (F)

Refer to Table 6 for part description.

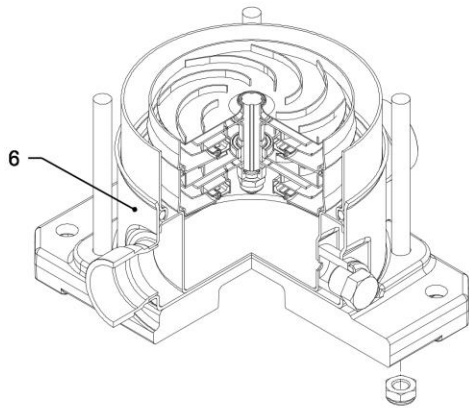
Figure 13. Sectional View– RSVS(L)3



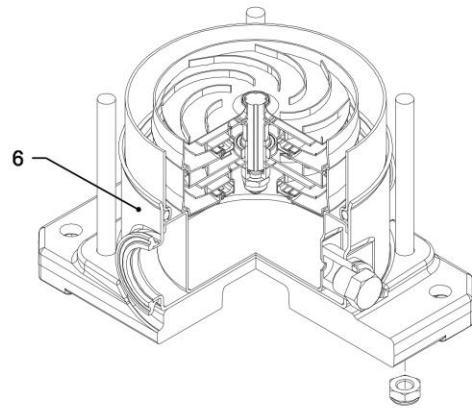
with Loose round ANSI compatible flange (L)



with Oval flange (N)



with victaulic connection (V)



with Clamp connection (C)

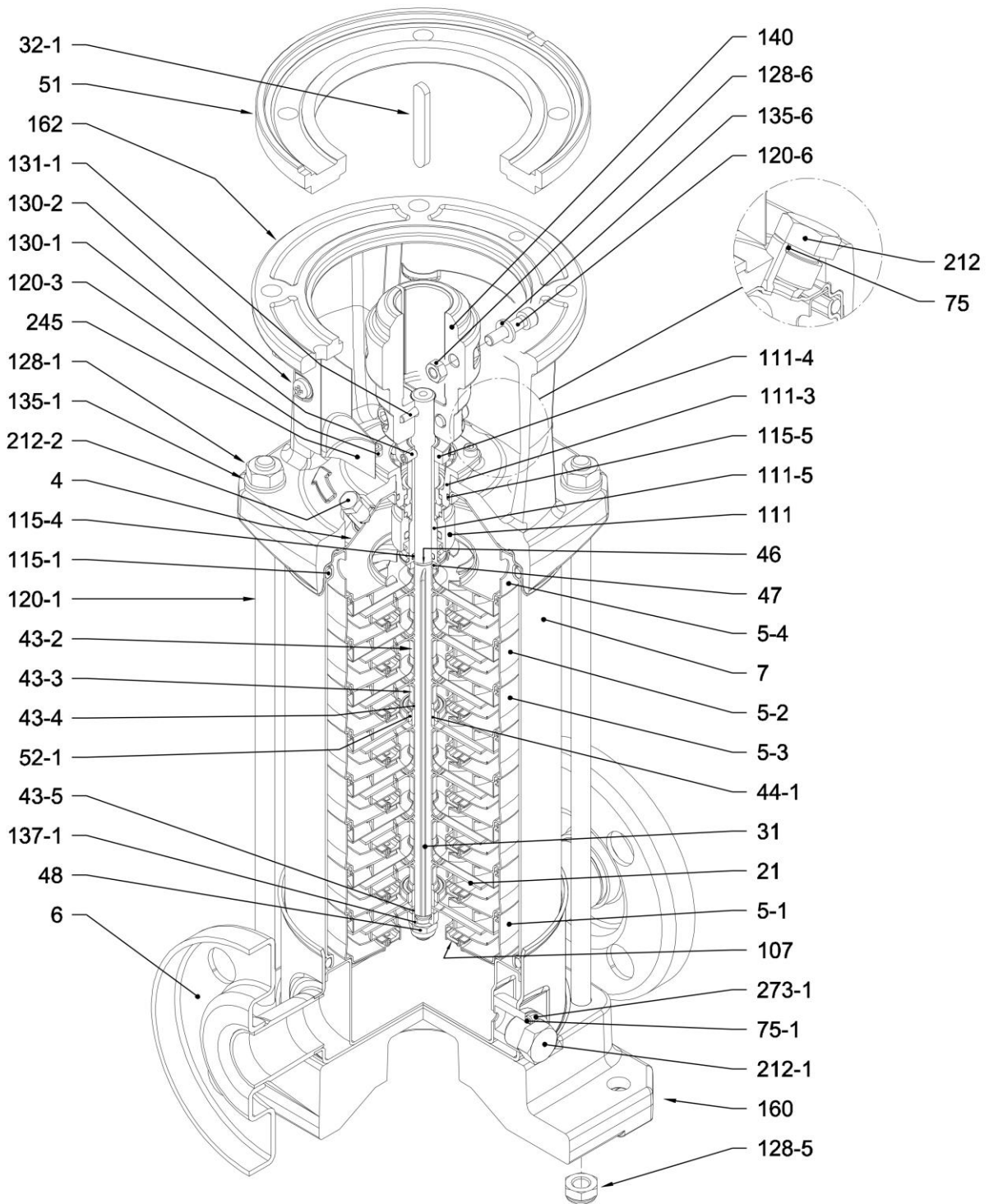
Refer to Table 6 for part description.

Figure 14. Pipe Connection – RSVS(L)3

Table 6. Sectional View – Part Reference Model RSVS(L)3

(For reference only, see pricing for part availability.)

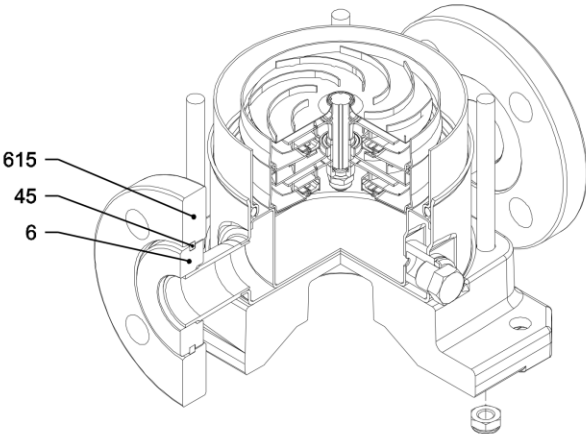
Part Number	Part Description	Part Number	Part Description
4	Casing Cover	115-1	O-Ring (Outer Casing)
5-1	Suction Casing	115-3	O-Ring
5-2	Intermediate Casing	115-4	O-Ring (Cartridge Sleeve)
5-3	Intermediate Casing Bearing	115-5	O-Ring (Seal Cover)
5-4	Discharge Casing	120-1	Tie Rod
6	Bottom Casing	120-3	Screw
7	Outer Casing	120-6	Screw for Coupling
21	Impeller	120-11	Screw for Counter Flange
31	Shaft	128-1	Nut for Tie Rod
32-1	Adjuster Key	128-5	Nut for Tie Rod
43-2	Shaft Sleeve (Intermediate)	128-6	Nut for Coupling
43-3	Shaft Sleeve (Bearing)	130-1	Set Screw
43-5	Shaft Sleeve (Last Stage)	130-2	Screw for Coupling
43-7	Spacer	131-1	Pin for Shaft
44-1	Shaft Sleeve (Bearing)	135-1	Washer
45	Flange Holder	135-6	Washer
46	Ring (Mechanical Seal)	137-1	Impeller Spacer
47	Ring Holder	140	Coupling up to 5 HP
48	Impeller Nut	160	Base
52-1	Bearing	162	Motor Bracket
75	O-Ring (Plug)	212	Plug
75-1	O-Ring (Plug)	212-1	Plug
107	Liner Ring	212-2	Venting Plug
111	Mechanical Seal	219	Counter Flange
111-3	Mechanical Seal Seat	245	Coupling Guard
111-4	Seal Holder	273-1	Plug Washer
111-5	Mechanical Seal Cartridge	615	Flange



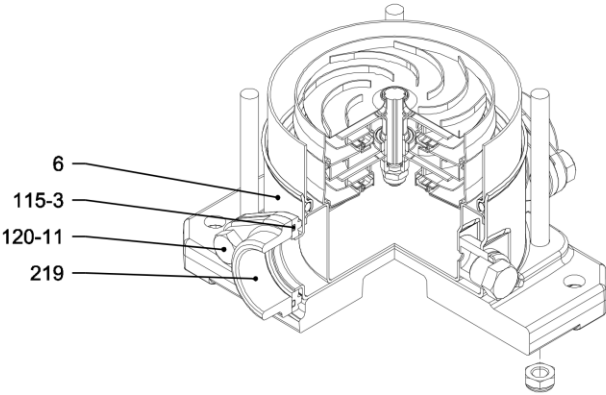
with Round (ANSI Compatible) flange (F)

Refer to Table 7 for part description.

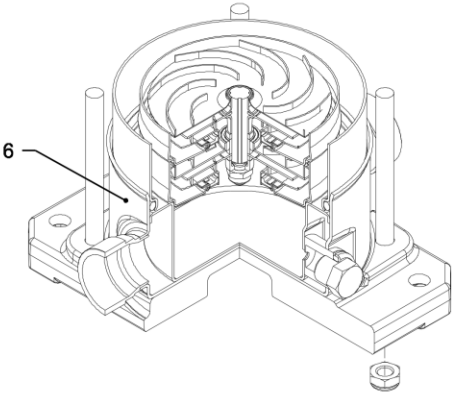
Figure 15. Sectional View– RSVS(L)5



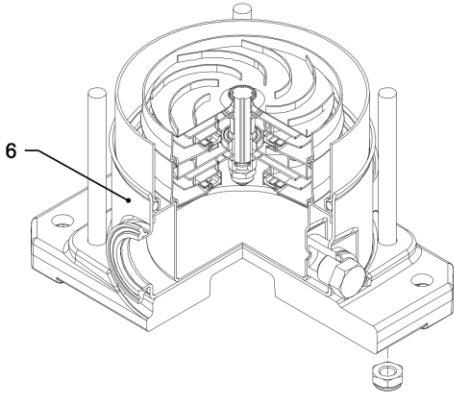
with Loose round ANSI compatible flange (L)



with Oval flange (N)



with victaulic connection (V)



with Clamp connection (C)

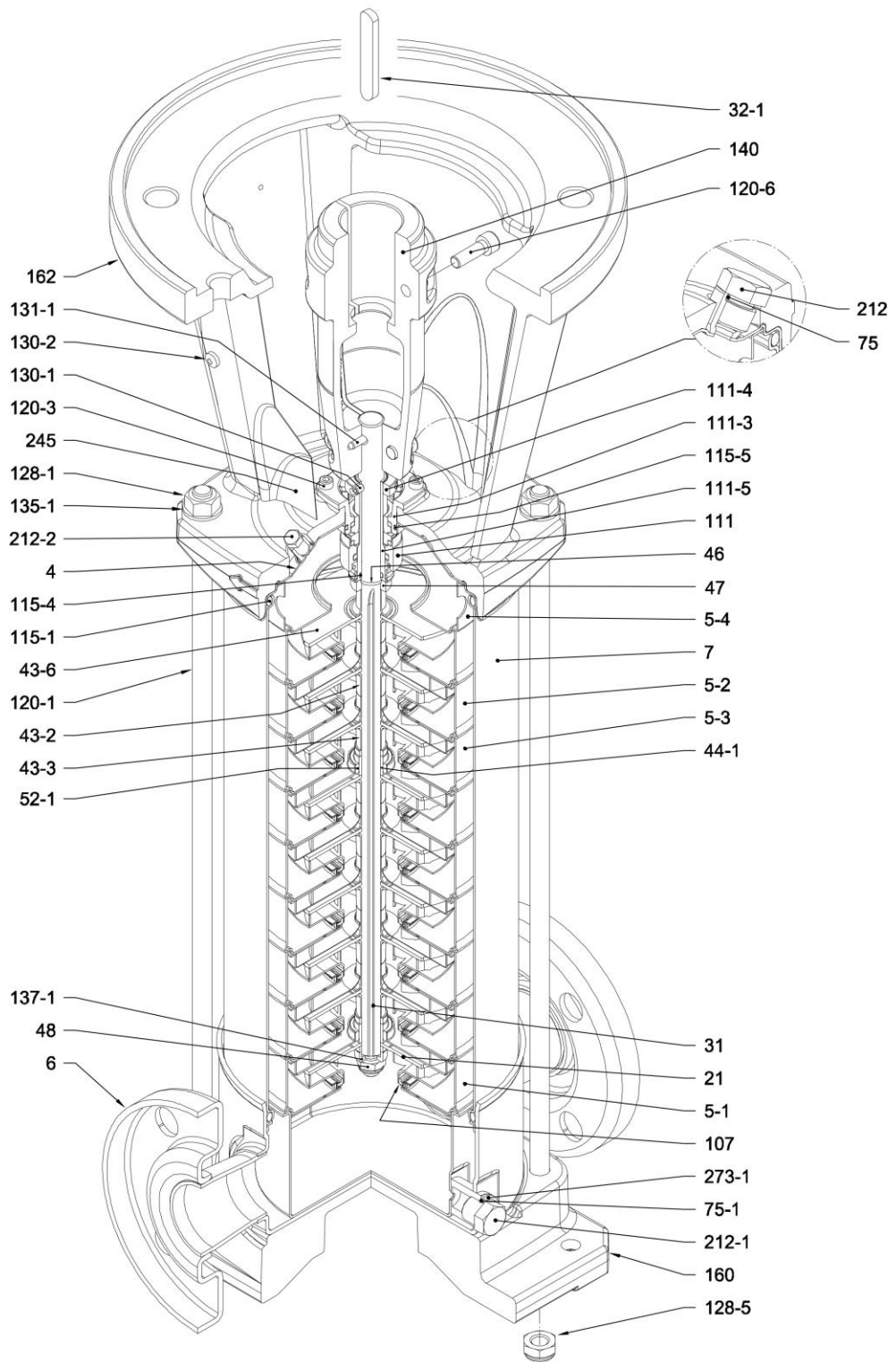
Refer to Table 7 for part description.

Figure 16. Pipe Connection – RSVS(L)5

Table 7. Sectional View – Part Reference Models RSVS(L)5

(For reference only, see pricing for part availability.)

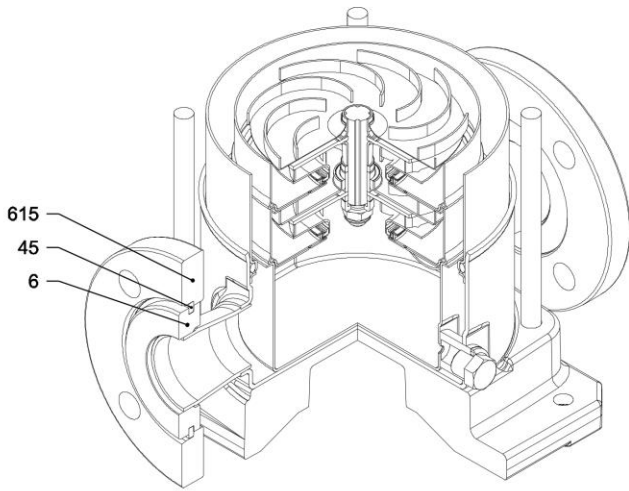
Part Number	Part Description	Part Number	Part Description
4	Casing Cover	115-1	O-Ring (Outer Casing)
5-1	Suction Casing	115-3	O-Ring
5-2	Intermediate Casing	115-4	O-Ring (Cartridge Sleeve)
5-3	Intermediate Casing Bearing	115-5	O-Ring (Seal Cover)
5-4	Discharge Casing	120-1	Tie Rod
6	Bottom Casing	120-3	Screw
7	Outer Casing	120-6	Screw for Coupling
21	Impeller	120-11	Screw for Counter Flange
31	Shaft	128-1	Nut for Tie Rod
32-1	Adjuster Key	128-5	Nut for Tie Rod
43-2	Shaft Sleeve (Intermediate)	128-6	Nut for Coupling
43-3	Shaft Sleeve (Bearing)	130-1	Set Screw
43-4	Shaft Sleeve (Adjustment)	130-2	Screw for Coupling
43-5	Shaft Sleeve (Last Stage)	131-1	Pin for Shaft
44-1	Shaft Sleeve (Bearing)	135-1	Washer
45	Flange Holder	135-6	Washer
46	Ring (Mechanical Seal)	137-1	Impeller Spacer
47	Ring Holder	140	Coupling
48	Impeller Nut	160	Base
51	Motor Adaptor	162	Motor Bracket
52-1	Bearing	212	Plug
75	O-Ring (Plug)	212-1	Plug
75-1	O-Ring (Plug)	212-2	Venting Plug
107	Liner Ring	219	Counter Flange
111	Mechanical Seal	245	Coupling Guard
111-3	Mechanical Seal Seat	273-1	Plug Washer
111-4	Seal Holder	615	Flange
111-5	Mechanical Seal Cartridge		



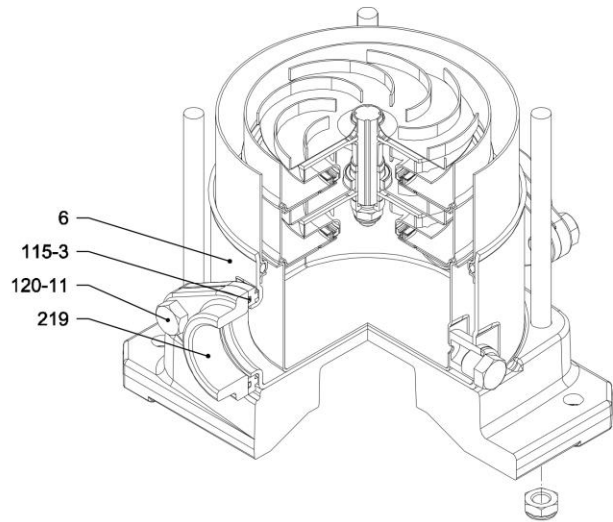
with Round (ANSI Compatible) flange (F)

Refer to Table 8 for part description.

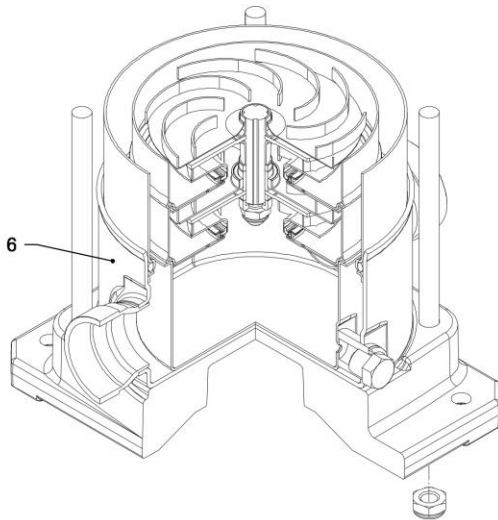
Figure 17. Sectional View– RSVS(L)10



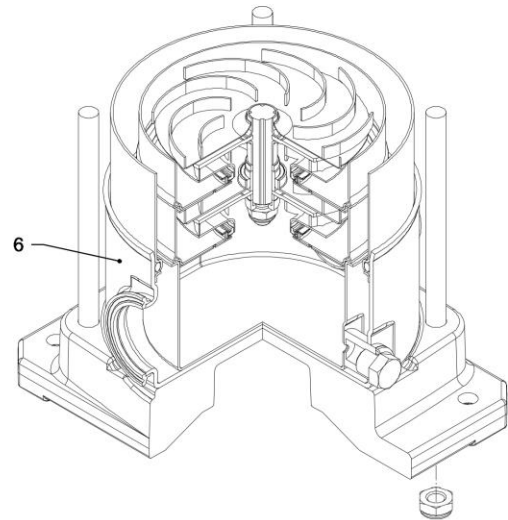
with Loose round ANSI compatible flange (L)



with Oval flange (N)



with victaulic connection (V)



with Clamp connection (C)

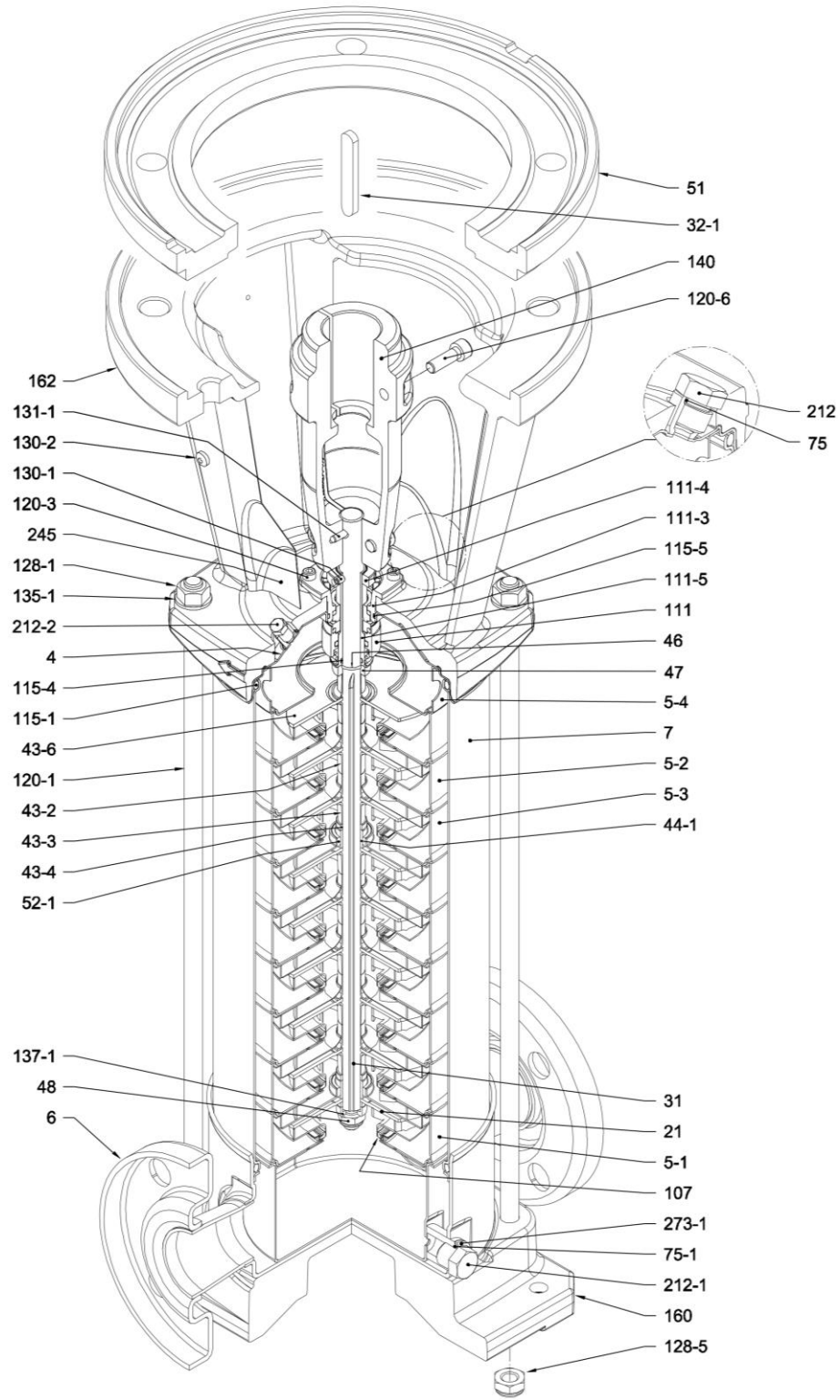
Refer to Table 8 for part description.

Figure 18. Pipe Connection – RSVS(L)10

Table 8. Sectional View – Part Reference Model RSVS(L)10

(For reference only, see pricing for part availability.)

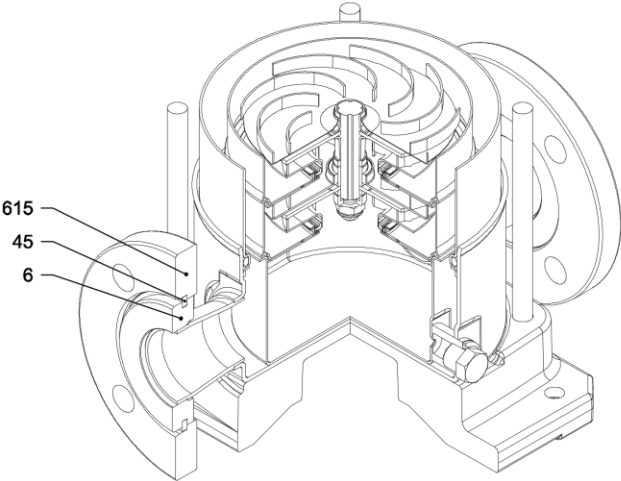
Part Number	Part Description	Part Number	Part Description
4	Casing Cover	111-5	Mechanical Seal Cartridge
5-1	Suction Casing	115-1	O-Ring (Outer Casing)
5-2	Intermediate Casing	115-3	O-Ring
5-3	Intermediate Casing Bearing	115-4	O-Ring (Cartridge Sleeve)
5-4	Discharge Casing	115-5	O-Ring (Seal Cover)
6	Bottom Casing	120-1	Tie Rod
7	Outer Casing	120-3	Screw
21	Impeller	120-6	Screw for Coupling
31	Shaft	120-11	Screw for Counter Flange
32-1	Adjuster Key	128-1	Nut for Tie Rod
43-2	Shaft Sleeve (Intermediate)	128-5	Nut for Tie Rod
43-3	Shaft Sleeve (Bearing)	130-1	Set Screw
43-6	Washer	130-2	Screw for Coupling Guard
44-1	Shaft Sleeve (Bearing)	131-1	Pin for Shaft
45	Flange Holder	135-1	Washer
46	Ring (Mechanical Seal)	137-1	Impeller Spacer
47	Ring Holder	140	Coupling
48	Impeller Nut	160	Base
51	Motor Adaptor	162	Motor Bracket
52-1	Bearing	212	Plug
75	O-Ring (Plug)	212-1	Plug
75-1	O-Ring (Plug)	212-2	Venting Plug
107	Liner Ring	219	Counter Flange
111	Mechanical Seal	245	Coupling Guard
111-3	Mechanical Seal Seat	273-1	Plug Washer
111-4	Seal Holder	615	Flange



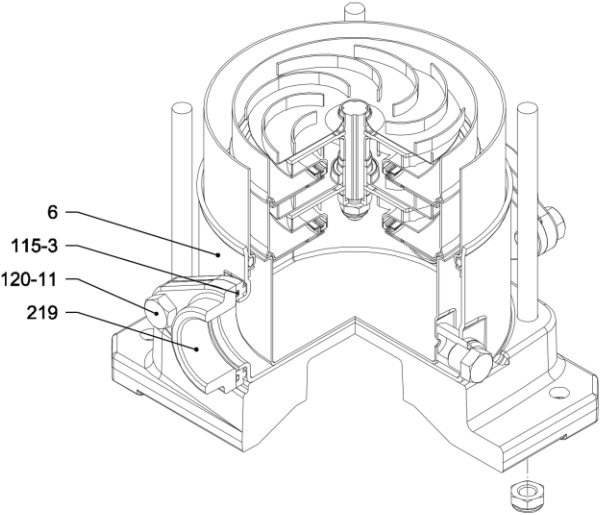
with Round (ANSI Compatible) flange (F)

Refer to Table 9 for part description.

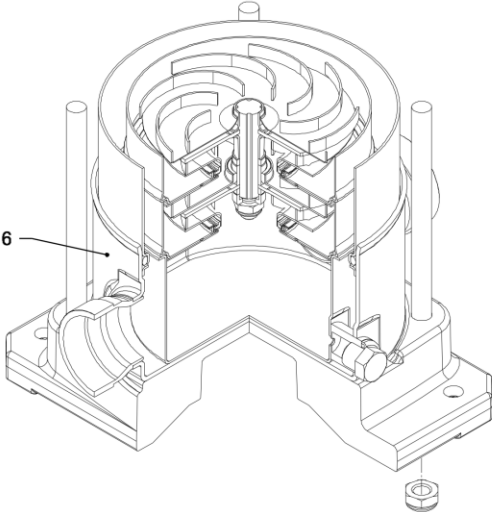
Figure 19. Sectional View– RSVS(L)15



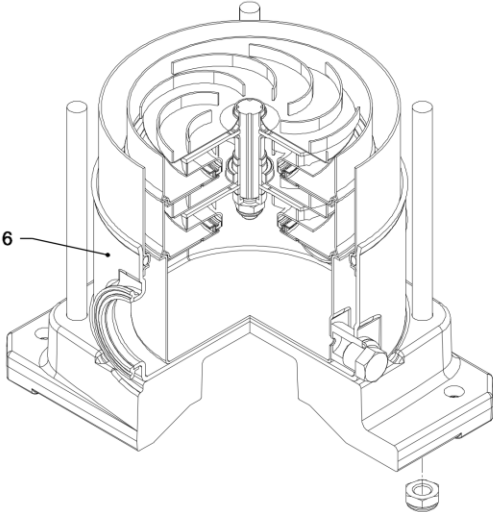
with Loose round ANSI compatible flange (L)



with Oval flange (N)



with victaulic connection (V)



with Clamp connection (C)

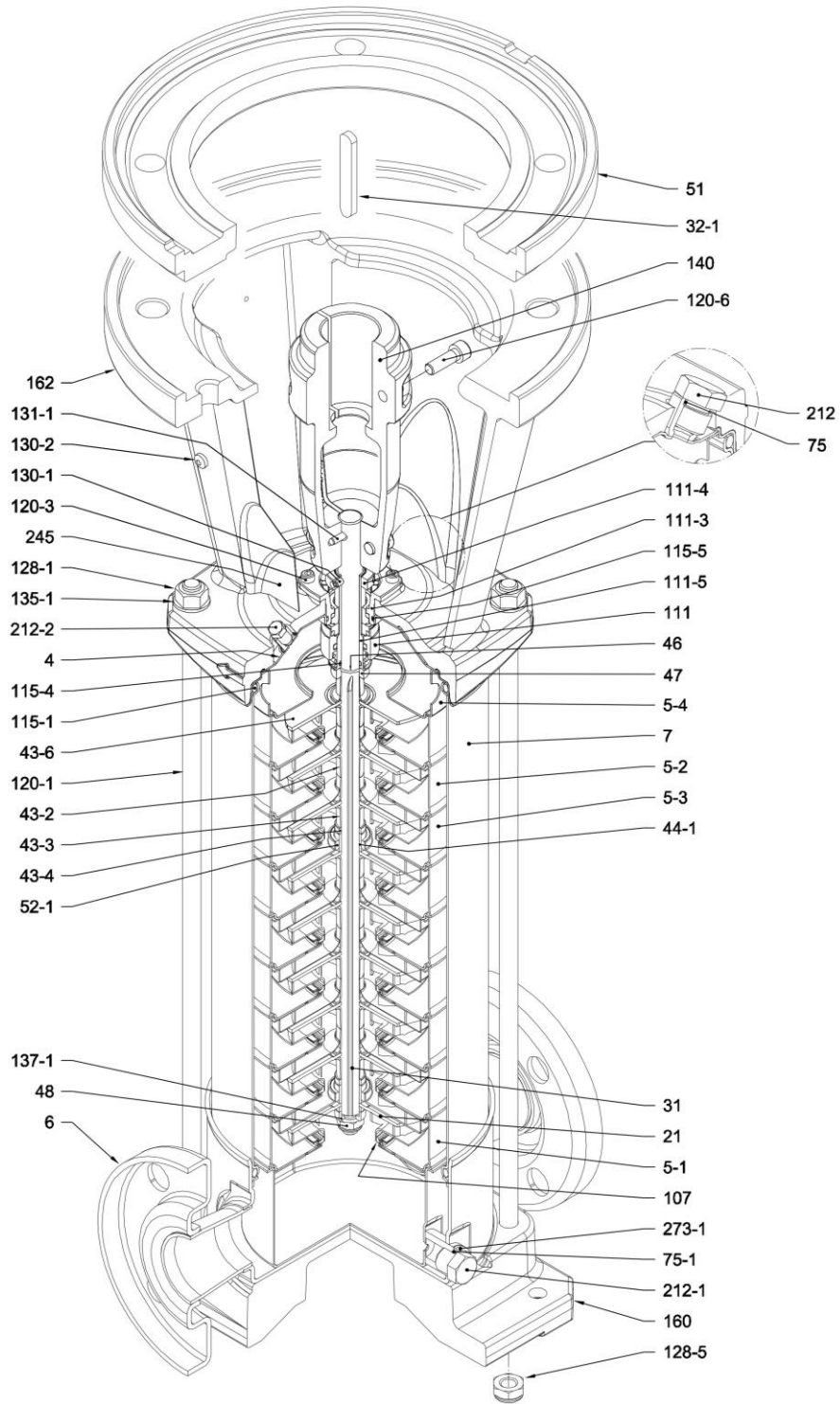
Refer to Table 9 for part description.

Figure 20. Pipe Connection – RSVS(L)15

Table 9. Sectional View – Part Reference Model RSVS(L)15

(For reference only, see pricing for part availability.)

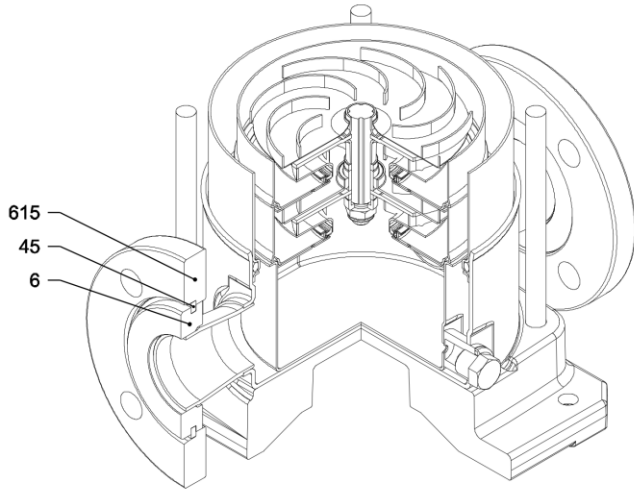
Part Number	Part Description	Part Number	Part Description
4	Casing Cover	111-5	Mechanical Seal Cartridge
5-1	Suction Casing	115-1	O-Ring (Outer Casing)
5-2	Intermediate Casing	115-3	O-Ring
5-3	Intermediate Casing Bearing	115-4	O-Ring (Cartridge Sleeve)
5-4	Discharge Casing	115-5	O-Ring (Seal Cover)
6	Bottom Casing	120-1	Tie Rod
7	Outer Casing	120-3	Screw
21	Impeller	120-6	Screw for Coupling
31	Shaft	120-11	Screw for Counter Flange
32-1	Adjuster Key	128-1	Nut for Tie Rod
43-2	Shaft Sleeve (Intermediate)	128-5	Nut for Tie Rod
43-3	Shaft Sleeve (Bearing)	130-1	Set Screw
43-4	Shaft Sleeve (Adjustment)	130-2	Screw for Coupling Guard
43-6	Washer	131-1	Pin for Shaft
44-1	Shaft Sleeve (Bearing)	135-1	Washer
45	Flange Holder	137-1	Impeller Spacer
46	Ring (Mechanical Seal)	140	Coupling
47	Ring Holder	160	Base
48	Impeller Nut	162	Motor Bracket
51	Motor Adaptor	212	Plug
52-1	Bearing	212-1	Plug
75	O-Ring (Plug)	212-2	Venting Plug
75-1	O-Ring (Plug)	219	Counter Flange
107	Liner Ring	245	Coupling Guard
111	Mechanical Seal	273-1	Plug Washer
111-3	Mechanical Seal Seat	615	Flange
111-4	Seal Holder		



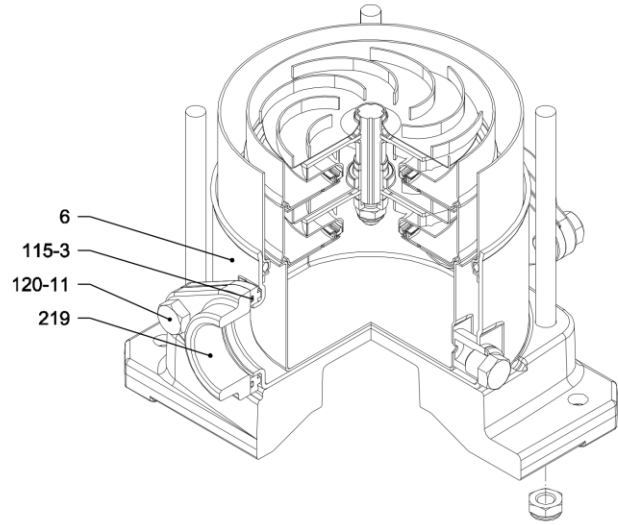
with Round (ANSI Compatible) flange (F)

Refer to Table 10 for part description.

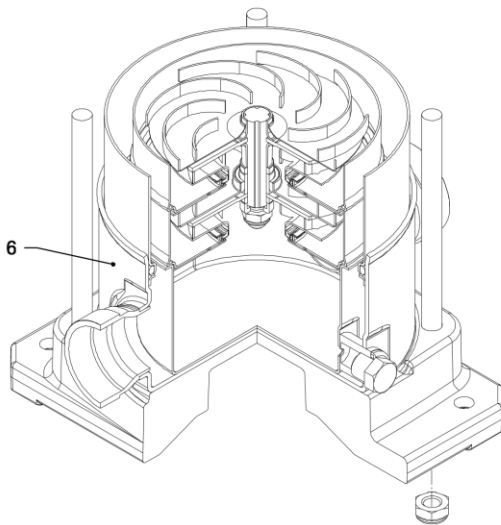
Figure 21. Sectional View– RSVS(L)20



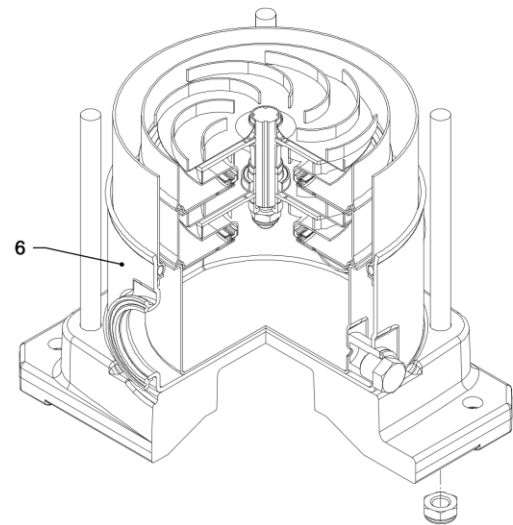
with Loose round ANSI compatible flange (L)



with Oval flange (N)



with victaulic connection (V)



with Clamp connection (C)

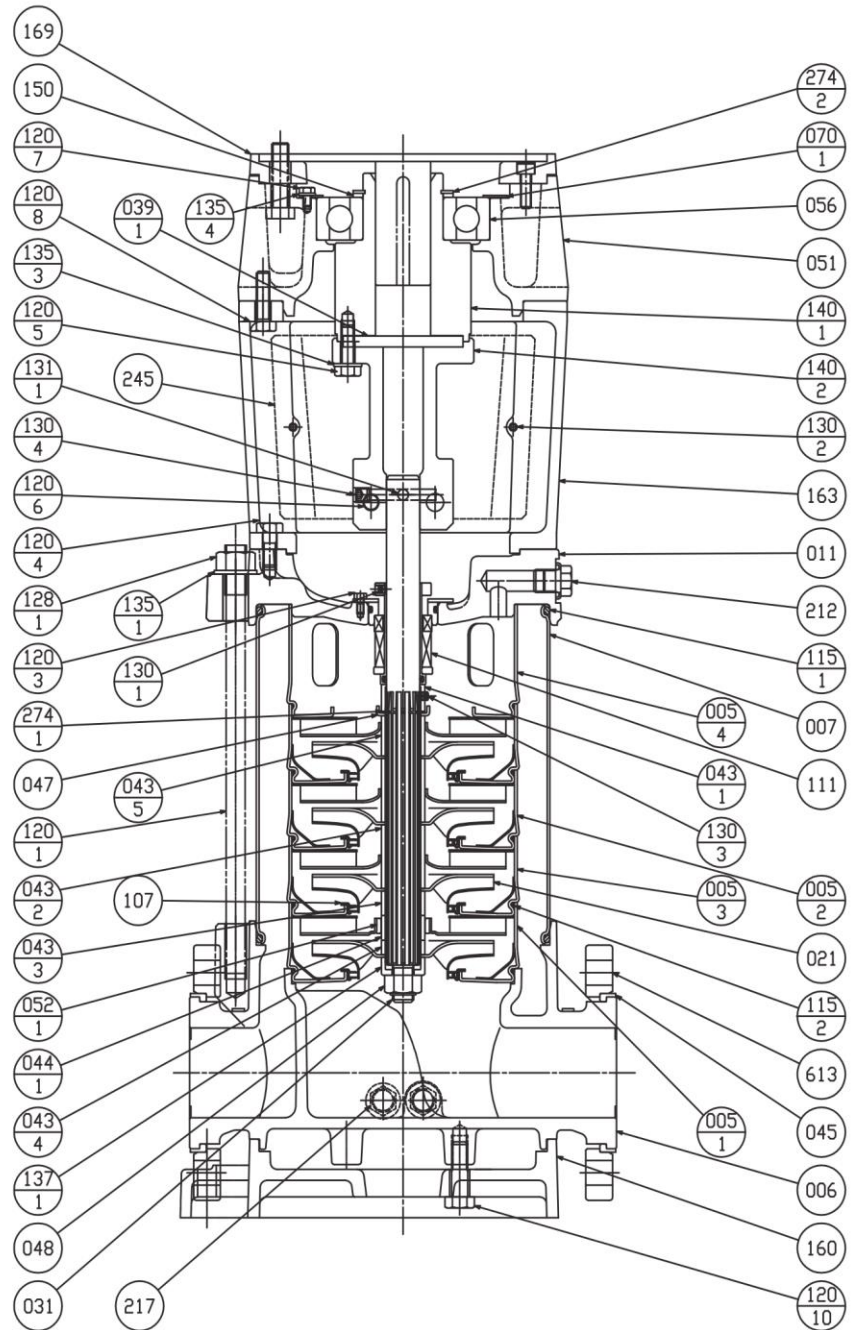
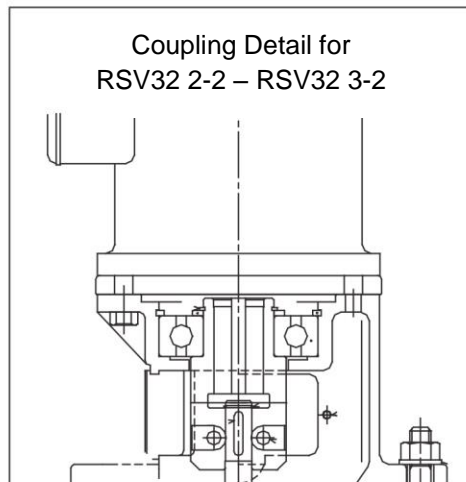
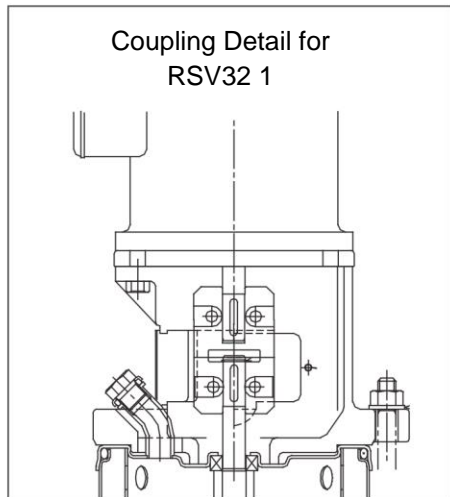
Refer to Table 10 for part description.

Figure 22. Pipe Connection – RSVS(L)20

Table 10. Sectional View – Part Reference Model RSVS(L)20

(For reference only, see pricing for part availability.)

Part Number	Part Description	Part Number	Part Description
4	Casing Cover	111-5	Mechanical Seal Cartridge
5-1	Suction Casing	115-1	O-Ring (Outer Casing)
5-2	Intermediate Casing	115-3	O-Ring
5-3	Intermediate Casing Bearing	115-4	O-Ring (Cartridge Sleeve)
5-4	Discharge Casing	115-5	O-Ring (Seal Cover)
6	Bottom Casing	120-1	Tie Rod
7	Outer Casing	120-3	Screw
21	Impeller	120-6	Screw for Coupling
31	Shaft	120-11	Screw for Counter Flange
32-1	Adjuster Key	128-1	Nut for Tie Rod
43-2	Shaft Sleeve (Intermediate)	128-5	Nut for Tie Rod
43-3	Shaft Sleeve (Bearing)	130-1	Set Screw
43-4	Shaft Sleeve (Adjustment)	130-2	Screw for Coupling Guard
43-6	Washer	131-1	Pin for Shaft
44-1	Shaft Sleeve (Bearing)	135-1	Washer
45	Flange Holder	137-1	Impeller Spacer
46	Ring (Mechanical Seal)	140	Coupling
47	Ring Holder	160	Base
48	Impeller Nut	162	Motor Bracket
51	Motor Adaptor	212	Plug
52-1	Bearing	212-1	Plug
75	O-Ring (Plug)	212-2	Venting Plug
75-1	O-Ring (Plug)	219	Counter Flange
107	Liner Ring	245	Coupling Guard
111	Mechanical Seal	273-1	Plug Washer
111-3	Mechanical Seal Seat	615	Flange
111-4	Seal Holder		



Refer to Table 11 for part description.

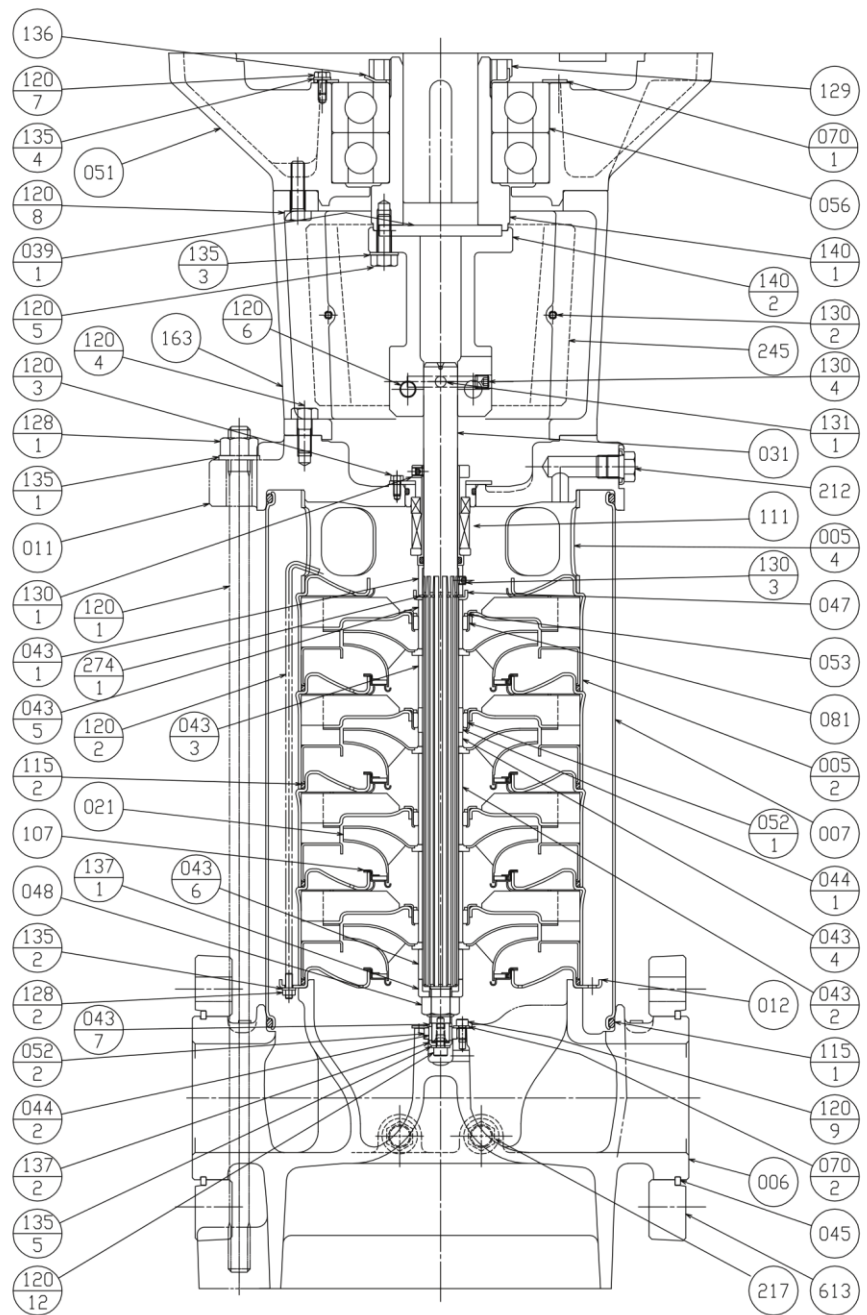
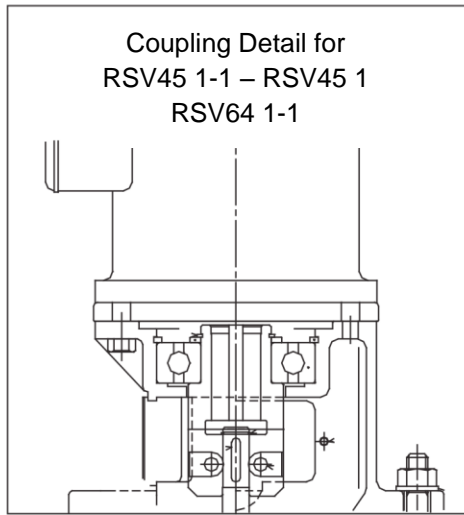
(For reference only, see pricing for part availability.)

Figure 23. Sectional View– RSV(G)32 & RSV(L)32

Table 11. Sectional View – Part Reference Models RSV(G)32 & RSV(L)32

(For reference only, see pricing for part availability.)

Part Number	Part Description	Part Number	Part Description
005-1	Stage Casing (Suction)	120-4	Bolt (Casing Cover)
005-2	Stage Casing	120-5	Bolt (Coupling M-Side)
005-3	Stage Casing (Bearing)	120-6	Bolt (Coupling P-Side)
005-4	Stage Casing (Top)	120-7	Bolt (Bearing)
006	Bottom Casing	120-8	Bolt (Bearing Housing)
007	Outer Sleeve	120-10	Bolt (Base Plate)
011	Casing Cover	128-1	Nut (Tie Rod Bolt)
021	Impeller	130-1	Screw (Mechanical Seal)
031	Shaft	130-2	Screw (Coupling Guard)
039-1	Key (Coupling)	130-3	Screw (Mechanical Seal)
043-1	Shaft Sleeve (Mechanical Seal)	130-4	Screw (Coupling Pin)
043-2	Shaft Sleeve (Stage)	131-1	Pin (Shaft)
043-3	Shaft Sleeve (Bearing/Upper)	135-1	Washer (Tie Rod Bolt)
043-4	Shaft Sleeve (Bearing/Lower)	135-3	Spring Washer (Coupling Bolt M-Side)
043-5	Shaft Sleeve (Top)	135-4	Spring Washer (Bearing)
044-1	Bearing Sleeve (Stage)	137-1	Shaft End Sleeve
045	Adjusting Ring	140-1	Coupling Upper Half
047	Split Ring Retainer	140-2	Coupling Lower Half
048	Friction Nut	150	Spacer (Coupling)
051	Bearing Housing	160	Base Plate
052-1	Bearing (Stage)	163	Motor Stool
056	Ball Bearing	169	Motor Liner
070-1	Bearing Holder	212	Vent Plug (With Seal Ring)
107	Wear Ring	217	Plug (With Seal Ring)
111	Mechanical Seal (Cartridge Assembly)	245	Coupling Guard
115-1	OOring (Outer)	274-1	C-Ring (Top)
115-2	O-ring (Stage)	274-2	C-Ring (Coupling)
120-1	Tie Rod Bolt	613	Pump Flange
120-3	Bolt (Mechanical Seal)		



Refer to Table 12 for part description.

(For reference only, see pricing for part availability.)

Figure 24. Sectional View – Models RSV(G)45, RSV(G)64, RSV(L)45 and RSV(L)64

Table 12. Sectional View – Part Reference Models RSV(G)45, RSV(G)64, RSV(L)45, and RSV(L)64

(For reference only, see pricing for part availability.)

Part Number	Part Description	Part Number	Part Description
005-2	Stage Casing	120-4	Bolt (Casing Cover)
005-4	Stage Casing (Top)	120-5	Bolt (Coupling M-Side)
006	Bottom Casing	120-6	Bolt (Coupling P-Side)
007	Outer Sleeve	120-7	Bolt (Bearing)
011	Casing Cover	120-8	Bolt (Bearing Housing)
012	Suction Cover	120-9	Bolt (Bottom Bearing)
021	Impeller	120-12	Bolt (Shaft End)
031	Shaft	128-1	Nut (Tie Rod Bolt)
039-1	Key (Coupling)	128-2	Nut (Stack Bolt)
043-1	Shaft Sleeve (Mechanical Seal)	129	Bearing Nut (Coupling)
043-2	Shaft Sleeve (Stage)	130-1	Screw (Mechanical Seal)
043-3	Shaft Sleeve (Bearing/Upper)	130-2	Screw (Coupling Guard)
043-4	Shaft Sleeve (Bearing/Lower)	130-3	Screw (Mechanical Seal)
043-5	Shaft Sleeve (Top)	130-4	Screw (Coupling Pin)
043-6	Shaft Sleeve (Suction)	131-1	Pin (Shaft)
044-1	Bearing Sleeve (Stage)	135-1	Washer (Tie Rod Bolt)
045	Adjusting Ring	135-2	Spring Washer (Stack Bolt)
047	Split Ring Retainer	135-3	Spring Washer (Coupling Bolt M-Side)
048	Friction Nut	135-4	Spring Washer (Bearing)
051	Bearing Housing	135-5	Spring Washer (Shaft End)
052-1	Bearing (Stage)	136	Bearing Washer
052-2	Bearing	137-1	Shaft End Sleeve
053	Bush Holder	137-2	Shaft End Sleeve
056	Ball Bearing	140-1	Coupling Upper Half
070-1	Bearing Holder	140-2	Coupling Lower Half
070-2	Bearing Holder (Bottom Bearing)	150	Spacer (Coupling)
081	Bush	163	Motor Stool
107	Wear Ring	212	Vent Plug (With Seal Ring)
111	Mechanical Seal (Cartridge Assembly)	217	Plug (With Seal Ring)
115-1	OOring (Outer)	245	Coupling Guard
115-2	O-ring (Stage)	274-1	C-Ring (Top)
120-1	Tie Rod Bolt	613	Pump Flange
120-3	Bolt (Mechanical Seal)		



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