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CARVER PUMP™
Built for purpose

855 – Filtrate Pump

SAFETY, 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.

EC Declaration of Conformity

MANUFACTURER: CARVER PUMP COMPANY
2415 PARK AVE.
MUSCATINE, IOWA, USA 52761

PRODUCT DESCRIPTION: 855-OH, 855-CC Filtrate Pumps

PART NUMBER:

SERIAL NUMBER:

DATE MANUFACTURED:

www.carverpump.com
Phone: 1-563-263-3410
Email: sales@carverpump.com

APPLICABLE EUROPEAN DIRECTIVES:

Machinery: The designated product complies with the following basic requirements of Directive 2006/42/EC:
Appendix I, section 1.1.2, 1.1.3., 1.1.5., 1.3.1., 1.3.2., 1.3.3., 1.3.4., 1.3.7., 1.3.8., 1.4.1., 1.4.2.1., 1.5.1., 1.5.8., 1.5.9., 1.5.13., 1.6.1., 1.6.4., 1.6.5., 1.7.

APPLICABLE HARMONIZED STANDARDS:

Machinery: EN ISO 12100:2010 EN ISO 13732-1:2008
EN 626-1:2008 EN ISO 13857:2008

Declaration of Incorporation of Partly Completed Machinery *(valid for 855 pumps supplied **without** a motor)*

The product described in this Declaration of Conformity complies with the Applicable European Directives, EHSRs and relevant sections of the Applicable International Standards "***as a Component***". The incorporation of this pump with Electric Motors that are marked to confirm that they comply with the Low Voltage Directive 2006/95/EC and all the necessary guards, must be declared in conformity by the assembler.

Declaration of Conformity of Completed Machinery *(valid for 855 pumps supplied complete **with** a motor)*

The product described in this Declaration of Conformity complies with the Applicable European Directives, EHSRs and relevant sections of the Applicable International Standards. Motors for CE marked pumps will have motors that are marked to confirm that they comply with the Low Voltage Directive 2006/95/EC.

The special technical documentation has been complied according to Annex VII Part B of Directive 2006/42/EC, and will be made available in electronic form to the authorities of the individual states upon justified request.

NOTE: The 855 pumps are NOT supplied or Declared to ATEX Directive 94/9/EC.

Person authorized to compile the technical documentation:
Kurt Doren, Quality/ISO Manager, Carver Pump Company, 2415 Park Ave, Muscatine Iowa, USA 52761

Authorized Signature: KURT DOREN Date: March 2015
Kurt Doren
Quality/ ISO Manager

Important safety information is contained in the installation, operation and service manuals; read and understand this information prior to installing or using this equipment

This Document applies only to the equipment described above and is invalid if not reproduced in its entirety.

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 Pump Company products are carefully engineered and manufactured and, 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 Filtrate Pump, thus upgrading the reliability, service life, and quality of pump maintenance.

These operating instructions are intended to facilitate familiarization with the product. 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 Figures 15 and 16 to locate the pump parts by item number. 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. MACHINERY DIRECTIVE 2006/42/EC. This product is designed to Conform with Machinery Directive 2006/42/EC, Safety of Machinery EN ISO 12100:2010, EN ISO 13732-1:2008, EN 626-1:2008, EN ISO 13857:2008, and the EHSRs.

Complete Machinery for use in EU and EAA will have CE mark and Declaration of Conformity. Motors for CE marked pumps will have motors that are marked to confirm that they comply with the Low Voltage Directive 2006/95/EC.

CAUTION

Pumps assembled without a motor will have a Declaration of Incorporation and will not have a CE mark. When a motor is added, all guards must be installed, the motor must be CE marked and the completed machine reviewed for compliance for applicable EHSRs before a CE mark is attached.

NOTE

Since 29 December 2009 Directive 2006/42/EC has regulated the placing on the market, and the putting into service, of machinery in the EEA, replacing Directive 98/37/EC.

C. 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.

D. 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.

E. 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.

F. 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. For every one to three pumps, stock one spare set consisting of items listed in Table 9, Recommended Spare Parts. Part numbers correspond to Figures 15 and 16.

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

- Model of pump (located on nameplate)
- 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.

H. 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.

I. UNAUTHORIZED MODES OF OPERATION. The warranty relating to 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. SAFETY.

A. 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.

B. SUMMARY OF SAFETY MARKING. The safety instructions contained in this manual where non-observance of the instruction will cause a hazard is 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.

C. SCOPE OF COMPLIANCE.

Where Carver Pump has supplied only the bare shaft pump, the rating applies only to the pump. The party responsible for assembling the pump set shall select the coupling, driver, seal and any additional equipment, with the necessary EC Certificate/Declaration of Conformity establishing it is suitable for the area in which it is to be installed.

The output from a variable frequency drive (VFD) can cause additional heating affects in the motor and so, for pump sets with a VFD, the Certification for the motor must state that it covers the situation where electrical supply is from the VFD. This is particular requirement still applies even if the VFD is in a safe area.

D. SAFETY AWARENESS. It is imperative to comply with the safety instructions contained in this manual, the relevant national and international explosion protection regulations, health and safety regulations and the operator's own internal work, operation and safety regulations.

E. SAFETY INSTRUCTIONS FOR THE OPERATOR /USER.

- Any hot or cold components that could pose a hazard must be equipped with a guard by the operator.
- Guards which are fitted to prevent accidental contact with moving parts (e.g. coupling) must not be removed whilst the unit is operating.
- Leakages (e.g. at the shaft seal) of hazardous fluids (e.g. explosive, toxic, hot) must be contained so as to avoid any danger to persons or the environment. Pertinent legal provisions must be adhered to.
- Electrical hazards must be eliminated. (In this respect refer to the relevant safety regulations applicable to different countries and/or the local energy supply companies.)

F. 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 VIII on start up before returning the pumping unit to service.

G. GENERAL SAFETY INSTRUCTIONS.

- Various federal, state, and local laws affect installation, use, and operation of pumping equipment. Compliance with such laws relating to proper installation and safe operation of pumping equipment is the responsibility of the equipment owner.
- Prior to working on pump or driver, ensure all switches and circuit breakers have been locked in the open (off) position and tagged, "Out of Service."
- All circuits NOT known to be dead must be considered live at all times.
- Do NOT wear loose or torn clothing around rotating machines.
- While working near electricity, do NOT use metal rules, flashlights, metallic pencils, or any other objects having exposed conducting material.
- Make sure you are NOT grounded while adjusting electrical equipment or using measuring equipment.
- In general, use only one hand when servicing live electrical equipment.
- Make sure to de-energize all electrical equipment before connecting or disconnecting meters or test leads.
- For connecting a meter to terminals for measurement, use a range higher than the expected voltage.
- Check to make sure that the frame of the driver and starter panel are securely grounded before operating pumping unit or performing any tests or measurements.
- If a test meter must be held or adjusted while voltage is applied, ground case of meter before starting measurement. Do NOT touch live equipment while holding the meter. Some

moving vane-type meters should not be grounded nor held during measurements.

- Do NOT use test equipment known to be damaged or in poor condition.

H. 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.
- Hazard to the environment due to leakage of hazardous substances.

Avoid Possible Non-Compliance. The following specific safety precautions apply to the pumping unit:

- Do NOT exceed maximum discharge pressure on discharge case (100 psig/ 690 kpa).
- Do NOT operate pump without fluid to seal or packing.
- Do NOT run stuffing box dry for extended periods of time.
- Do NOT run pump against a closed discharge valve.
- Do NOT exceed the Maximum rated speed (2400 rpm).
- A check valve should be installed in the discharge line.
- Pumps assembled by Carver without a motor will have a Declaration of Incorporation and will not have a CE mark. When a motor is added, all guards must be installed, the motor must be CE marked and the completed machine reviewed for compliance for applicable EHSRs before a CE mark is attached.

III. EQUIPMENT DESCRIPTION.

A. PUMP HISTORY.

The Filtrate Pump line was designed in the late 1950's at the request of a large Original Equipment Manufacturer (OEM) of vacuum filtration equipment. The company had found that the typical centrifugal pump would not operate against the high vacuum in a filtrate receiver tank without the inclusion of a hydrostatic leg in order to provide enough Net Positive Suction Head Available (NPSHA) to prevent the pump from cavitating and destroying itself.

The receiver tank flange-mounted Filtrate Pump was designed to solve the OEM's problem and they have been used in pumping liquids under vacuum or with very low suction pressures ever since.

B. PUMP FEATURES.

The Filtrate Pumps do not require a hydrostatic leg, will operate against vacuums up to 660 mm Hg (26" Hg) on the suction side and if, on occasion, it pumps the receiver tank dry, or the inflow of process liquid into the tank is interrupted, it will continue to run, will maintain the vacuum in the system, and when the suction again becomes flooded it will prime itself and resume pumping the process liquid. An important aspect of the pump's operation is that it accomplishes all of the foregoing **without** the use of mechanical or electrical level controls on the receiver tank, thereby simplifying and enhancing the reliability of the entire system.

C. PUMP DETAILS.

Figure 1. Model 855-OH Pump

The line has two variations. The standard is the flange mounted Model 855-OH which features an overhead v-belt drive arrangement for varying the pump speed and

thereby the head/flow conditions delivered by the pump. This pump is also built in a close coupled (direct drive) configuration, the Model 855-CC, for use when the v-drive feature is not required.

Each of the models is built in six sizes: 1", 1 ½", 2", 2 ½", 3" and 4" discharges. The complete pumps are built with a CE stamp indicating compliance with European Common Market specifications.

Standard materials of construction are cast iron and CD4MCu. Other metallurgies are available, such as hard iron, monel, hastelloy, etc... Also available is a fully rubber lined version for abrasive and extremely corrosive application including the Flue Gas De-sulfurization (FGD) process with high chlorides.

The bare pump consists of following major parts and options. Please refer to Figures 15, 16 and 17, assembly drawings, for the location of parts identified by item numbers.

Item 1 - Casing. The casing houses the impeller (3) and consists of the discharge volute, and a tangent discharge nozzle, discharge flange, back cover, stuffing box and mounting bracket. The casing is fastened to the bearing frame (19) or motor (200) with capscrews (601). The casing bolts to the suction cover (10) and to the discharge piping with special flanges as shown in Figure 19.

Item 3 - Impeller. The filtrate pumps are equipped with semi-open impellers. The impeller is keyed to the shaft (6) by the impeller key (32) and is locked in place by the impeller bolt (26) and impeller washer (28).

Item 6 - Shaft. The shaft of the 855-OH pump is designed to provide stabilization to the rotor system when pump operates away from the best efficiency point. Drive belt(s) connect the pump shaft to the driver shaft.

Item 16 and 18 – Ball Bearings. Deep groove Conrad type, C-3 internal fit ball bearings (8"pumps) or double-row angular contact C-3 internal fit ball bearings (9"pumps) are housed in the bearing frame (19). The ball bearings are sealed and lubricated for life.

Item 19 - Bearing Frame. The principal function of the bearing frame is to carry the loads from the liquid end of the pump to the base and to transport power from the motor (200) to the impeller (3). The bearing frame has an outboard ball bearing (16) and an inboard ball bearing (18). This bearing frame is designed to be belt driven by an overhead (OH) mounted motor

Item 23 - Motor Plate. An adjustable motor plate is designed to provide adequate support for the pump and motor (200) so the pump can be operated without excessive deflection, excessive vibration, or resonance. The bearing frame (19) is connected to the motor plate with threaded rods (632) and jam nuts (616). The motor is bolted to the motor plate with bolts (604) and hex nuts (618).

Item 53 – Optional Swing-out. Pumps may be equipped with an optional swing-out to facilitate servicing the pump and to aid in inspecting for debris.

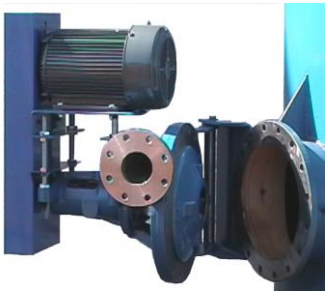


Figure 2. Optional Swing-out

Item 90 – Mechanical Seal. A mechanical seal may be supplied in place of a packed stuffing box when specified by the customer. Many variations of types and materials are available.

Item 180 - Packing. Pumps equipped with packing have a lantern ring (29) which is located inside the flush water connection on the stuffing box.

Item 276 – Belt Drive. The Model 855-OH is supplied with belts (276) and sheaves (277). The belts and shaeves should be sized to obtain the desired pump shaft speed for the given motor.

IV. EFFECTS OF FLUIDS.

A. <u>NET POSITIVE SUCTION HEAD (NPSH).</u> Any liquid, hot or cold, must be pushed into the impeller of the pump by some absolute pressure, such as the atmosphere or the vessel pressure from which the pump takes its action.

The head in feet of liquid necessary to maintain the required flow into the pump is called the Net Positive Suction Head (NPSH). This value is measured above the vapor pressure of the liquid at the pumping temperature.

NPSH is commonly expressed in two ways: the NPSH required by the pump, and shown on the pump curve, is the head needed to cover the losses in the pump suction and the energy required to enable the liquid to climb onboard the leading edge of the impeller vane. The NPSH available is that inherent in the system, taking into account friction losses in suction piping, valves, fittings, etc. In all cases, the NPSH available,

measured above vapor pressure, must exceed the NPSH required in order to push the liquid into the pump.

B. CHANGING PUMP SPEED. Changing the speed of a centrifugal pump affects the capacity, total head, NPSH required and the brake horsepower. In general the capacity will vary in a direct ratio with the speed, whereas the total head and NPSH required will vary as the ratio of the speed squared. The brake horsepower will vary as the ratio of the speed cubed.

NOTE

Pump speeds for close coupled (Model 855) units are generally limited to 1750 RPM. Pump speeds for belt driven (Model 855-OH) units are limited to 2400 RPM.

C. EFFECTS OF VISCOSITY. The pump is designed to deliver rated capacity at rated head for a liquid with a particular viscosity. When pump is handling heavy viscous liquid, the viscosity of the liquid must allow it to be pumped easily. The liquid may have to be heated prior to starting the pump. When contemplating operation at some viscosity other than that for which the pump was originally designed, check with Carver Pump Company.

D. EFFECTS OF SPECIFIC GRAVITY. The capacity and total head in feet of liquid developed by a centrifugal pump are fixed for every point on the curve and are always the same for the same speed. Neither capacity nor total head will be affected by a change in the specific gravity of the liquid pumped. However, since the discharge pressure in Pounds per Square Inch (PSI) and the brake horsepower required driving the pump are functions of the specific gravity of the liquid, both will be affected in direct proportion by any change in specific gravity. Therefore, an increase in specific gravity will raise the discharge pressure and is dangerous as it might overload the pump's driver, or exceed the pump casing allowable pressure.

V. TECHNICAL DATA.

Specifications and operating limits should be recorded on a Service Record Page; an example is located in the front matter of this manual. Record the necessary information upon receipt of the pumping unit. See Figures 18 and 19 for mating flange information and weights.

Sound Characteristics. Table 1 shows the estimated Sound Pressure levels for the Filtrate Pump. These values are typical, actual values will vary with motor used, pump size, condition of service, belt adjustment, bearing condition, etc. Actual values for specific units must be determined by testing.

Stuffing Box. The stuffing box, Figure 3, is where the packing or mechanical seal is located.

Materials of Construction. The listed material specifications in Table 2 are referenced for standard catalog options.

Mechanical Data. The Key Mechanical data in Table 3 lists the maximum allowable horsepower at the maximum allowable pump shaft speed (2400 rpm). Dimensions and diameters are reference and given in inches.

Table 1. Estimated Noise Characteristics

Rated Power Input PN (kw)	Estimated Sound Pressure Level L pA (dB)*			
	Pump with Motor		Pump Only	
	1750	1450	1750	1450
1.5	61.5	58.5	52	52
2.2	63.5	60.5	53	53
3.0	65.5	62.5	55	55
4.0	67	64	57	57
5.5	68.5	65.5	57.5	57.5
7.5	70	67	58.5	58.5
11.0	72	69	60.5	60.5
15.0	73	70	61.5	61.5
18.5	73.5	70.5	62.5	62.5
22.0	74	71	63.5	63.5

* Measured at a distance of 1 m from the pump outline. Room and foundation influences have not been included. The tolerance for these factors is 1 to 2 dB.

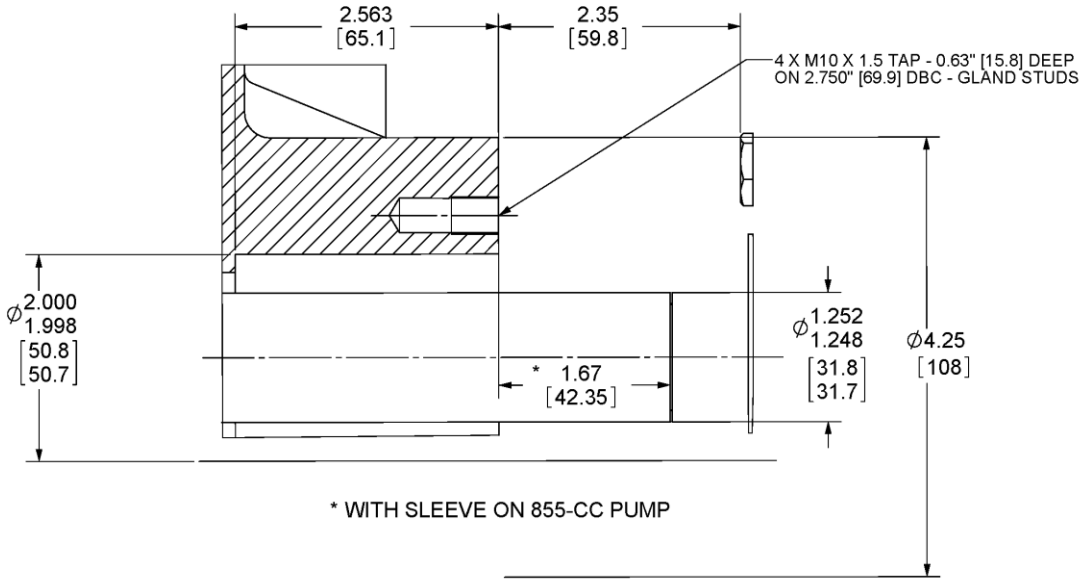


Figure 3. Stuffing Box Dimensions

Table 2. Key Component Materials

Component	Material	Specification
Bearing Frame	Ductile Iron	ASTM A536
Casing	Rubber Lined C.I.	Natural Rubber ASTM A48, Class 30
	CD4MCu	ASTM A890
	Cast Iron	ASTM A48, Class 30
Impeller	Cast Iron	ASTM A48, Class 30
	CD4MCu	ASTM A890
Shaft	17-4PH	ASTM A564
	Duplex	ASTM A276

Table 3. Key Mechanical Data

Item	Bearing Frame		
	KFA	KFB	KFC
Max power (BHP) @ 2400 RPM	20	30	33
Maximum Speed - RPM	2400	2400	2400
Pump Size(s)	1"	1-1/2, 2" & 2-1/2"	3"& 4"
Maximum Discharge Pressure	100 psig / 690 kPa		
Bearing type - radial bearing	6307	5307	5308
- thrust bearing	6307	5307	5308
Lubrication method (standard)	Sealed for life (Grease)		
L10 bearing life (hrs) - radial	50,000	50,000	50,000
- thrust	100,000	100,000	100,000
Radial to thrust bearing C/L (in.)	5.83	5.83	5.83
Shaft diameters (in.) @ sheave	1.26	1.26	1.26
@ impeller hub	0.875	0.875	0.875
@ radial bearing	1.378	1.378	1.378
@ thrust bearing	1.378	1.378	1.378
@ stuffing box	1.250	1.250	1.250
Rotor WR2 (lb. - in.)	31.81	31.81	31.81

VI. 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. Check to make sure the shipment complies with the purchase order. 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. PACKING FOR RETURN. If the pumping unit is sent back to Carver Pump Company for repair, drain the unit, and re-seal all flanges and connections that were covered or plugged. Ship the pump(s) in an assembled condition to prevent damage to sealing faces of individual components. A Return Goods Authorization (RGA) and a Material Safety Data Sheet (MSDS) is required on all returned pumps. Copies of MSDS records should be kept and maintained by the customer. The customer is responsible for cleaning and flushing the pump before it is returned to the factory. Make sure to specify the fluid used in the service.

C. 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.

The motor bearings should be prepared for storage according to the motor manufacturer's instructions, in the motor manufacturer's maintenance manual, which should come with the motor.

CAUTION

A pump which is made of iron or steel that sits in extreme heat, high humidity, or full or partially full water over 30 days will rust and will most likely seize. If the pump rusts and/or seizes, a complete overhaul and repair may be necessary to refurbish the pump.

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.

Interim Storage (Indoors)/Preservation. When the unit is temporarily put into storage, only the wetted low alloy must be preserved. Commercially available preservatives can be used for this purpose. Please observe the manufacturer's instructions for application/removal.

The unit/pump should be stored in a dry room where the atmospheric humidity is as constant as possible.

If stored outdoors, the unit and crates must be covered by waterproof material to avoid any contact with humidity.

Protect all stored goods against humidity, dirt, vermin and unauthorized access!

All openings of the assembled unit components are closed and must only be opened when required during installation.

All blank parts and surfaces of the pump are oiled or greased (silicone-free oil and grease) to protect them against corrosion.

VII. INSTALLATION.

A. LOCATION. The pump assembly should be located in an area that will permit periodic inspection and maintenance. Head room and access should be provided and all units should be installed in a dry location with adequate drainage. The discharge piping should be direct with as few elbows and fittings as possible.

The pump assembly should be installed as close to the fluid as possible. A short, direct suction pipe can be used to keep suction losses at a minimum. If possible, locate the pump so fluid will flow by gravity to the suction opening. The discharge piping should be direct with as few elbows and fittings as possible. The total NPSHA, which includes the suction lift and pipe friction losses, must be greater than the Net Positive Suction Head Required (NPSHR) by the pump.

B. HANDLING.

CAUTION

Use a hoist with adequate lifting capacity. See pump nameplate for weights.

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 or the pumping unit while being moved cannot slip out of the transport suspension arrangement. Use a sling for pumps without baseplates, refer to Figures 4 and 5. To lift a complete unit, a hoist or suitable lifting device should be attached to the motor plate, refer to Figure 6. The individual motor may be lifted using proper eyebolts provided by the manufacturer, but these should not be used to lift the assembled unit.

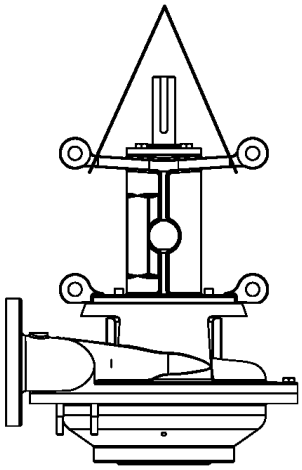


Figure 4. Transport of the bare pump

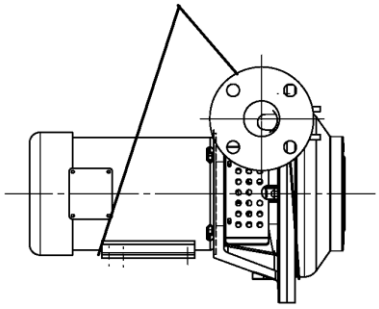


Figure 5. Transport of close-coupled pump

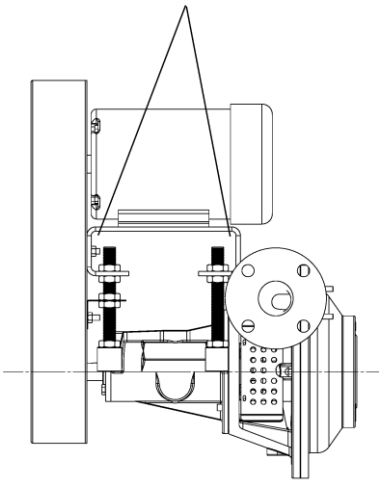


Figure 6. Transport of the complete unit

C. PRE-INSTALLATION PROCEDURES.

CAUTION

Use a hoist with adequate lifting capacity. See pump nameplate for weights.

1. The Filtrate Pumps are design for the suction side of the pump to mount directly to a flange on a receiver tank, refer to Figure 18.

NOTE

The pump is shipped with flange covers to protect flange face and to prevent foreign matter from entering pump. Flange covers should remain intact until suction and discharge piping are connected to pump flanges.

2. Remove the flange covers from the flange faces.
3. Connect the piping.

D. PIPING. All piping should be independently supported near the pump so that pipe strain will not be transmitted to the pumping unit.

The Filtrate Pump tank-mounted pumps are designed to operate under vacuum conditions up to 660 mm Hg (26" Hg). These units are used on tanks equipped with a special mounting flange and require no suction piping. Refer to Figure 18 for mounting flange dimensions.

Discharge Position: The pumps are built for top horizontal/bottom horizontal discharge position, provided the small hole (vent port) in the suction cover (10) is always located at the 12 o'clock position, i.e. at the very top. Refer to Figure 18 for mounting flange dimensions.

Discharge Piping: Discharge piping may be installed with an increaser to reduce pipe friction losses. A check valve is to be installed in the discharge line to prevent reverse flow and loss of vacuum when the pump loses prime. Lack of a check valve can allow the tank to overfill. A shut-off valve is recommended after the check valve to isolate the pump. Horizontal discharge lines should be installed with a continuous upward slope away from the pump. Refer to Figure 19 for the discharge flange dimensions.

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.

Before connecting the 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.

NOTE

The discharge flanges are designed to mate with both ANSI Class 125/150 flanges and DIN PN10 flanges without adapters while meeting the discharge pressure requirements of the pump. Refer to Figure 19 for the discharge flange dimensions.

The pump is shipped with flange covers to protect flange faces and to prevent foreign matter from entering the pump. Flange covers should remain intact until suction and discharge piping are connected to pump flanges.

E. 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. Refer to vendor mechanical seal drawing for seal line connections to the mechanical seal.

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

DANGER

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

G. DIRECTION OF ROTATION. Direction of rotation for 855OH pumps is clockwise as viewed from belt end of pump shaft. Direction of rotation for 855CC pumps is clockwise as viewed from fan end of motor.

VIII. OPERATION.

A. PRE-START CAUTIONS.

DANGER

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.
3. Rotate both the pump and driver shafts by hand to assure all moving parts are free.
4. Check motor for correct rotation before connecting the belts.
5. If necessary, recheck belt tension and alignment.
6. Before starting the pump, install closed guards around all exposed rotating parts.
7. Check to make sure that fluid in the pump is free of debris.

WARNING

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

8. Before starting the pump turn on the stuffing box flush line, and confirm the it is at sufficient pressure. Running without fluid in the stuffing box will result in packing/mechanical seal failure.
9. Pumps are shipped with Lube-For-Life bearings and no additional oil or grease is required in the bearing frame.
10. If excessive vibration or noise occurs during operation, shut the pump down and rotate shaft by hand. If excessive vibration or noise continues, consult a Carver representative.

B. STARTING THE PUMP.

CAUTION

DO NOT operate pumping unit against a closed discharge system. If pump has any chance of seeing 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. Confirm pumping unit is ready to start. Complete Section VIII, Paragraph A.
2. If unit is equipped with mechanical seal cooling lines, confirm that the mechanical seal cooling water is turned on.
3. Open discharge valves slightly, about 1 to 1 ½ turns if pump is being started for the first time or from being turned off for overhaul.
4. Open valves to pressure gauges in the system.
5. Start electrical power supply to driver. Start the pump.
6. Slowly open system valves in discharge line and adjust pressure and flow to the appropriate operating conditions. Refer to pump nameplate and system operating procedures for design point condition.

C. OPERATING CHECKS.

1. Check for undue vibration or noise. If any occurs and does not stop within a short period of time, turn off the pump. For determination of the cause and its remedy refer to Troubleshooting in Section IX or consult Carver Pump Company.
2. Check mechanical seals or packing rings for leakage.
3. Check for adequate lubricating liquid flow to the seal or packing.
4. Check that pump is operating within design criteria and perimeters. Check and record flow and pressure readings. The flow and pressure readings should be within the operating system guidelines and similar to number stamped on the pump nameplate.
5. Check and record bearing temperature. It should not exceed 70ºC (160º F). Both inboard (18) and outboard (16) ball bearing temperatures should be measured and recorded

at a minimum of 15 minute intervals until the ball bearing temperatures stabilize. Stabilization of ball bearing temperature can be defined as the results of three consecutive readings at approximately 15 minute intervals with no temperature rise.

6. Check and record power input to the motor.
7. Check and record vibration.

D. STOPPING THE PUMP.

WARNING

When pump is handling hazardous fluid, extreme care must be taken to ensure safety of personnel when attempting to drain pump. Suitable protection devices should be used and/or protective clothing should be worn.

1. Stop the pumping unit in accordance with the directions on the electrical power supply.
2. Tagout and lockout power to motor according to OSHA Standard 1910.147.
3. Close discharge and suction valves and any auxiliary fluid lines.
4. The pumping unit is now off.

E. INDEFINITE SHUTDOWN.

Stop the pumping unit per Section VIII, Paragraph D. Remove casing plug to drain casing. Drain all piping if there is a possibility of liquid freezing. Provide pump and driver with a protective cover.

IX. TROUBLESHOOTING OPERATING PROBLEMS.

If you have followed the installation and starting procedures outlined in this manual, the pump should provide reliable service and long life. However, if operating problems do occur; significant time and expense can be saved if you refer to Table 4 to eliminate the most common causes of those problems.

NOTE

Immediate action to be taken before proceeding with corrective actions in Table 4 is to stop the pump, refer to Section VIII, Paragraph D.

Table 4. Pumping Unit Troubleshooting

SYMPTOM	IMMEDIATE ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
Pump does not deliver rated capacity or rated head.	1. Stop the pump, refer to Section VIII, Paragraph D.	1. Excessive system pressure.	1. Check GPM and head against design conditions; Consult local distributor or Carver Pump Company.
		2. Speed to low, motor speed incorrect, belts slip, or line voltage to low.	1. Correct motor speed. 2. Adjust belt tension. 3. Check electrical supply and correct as necessary. 4. Incorrect sheave size or pump and motor sheaves reversed.
		3. Valves are not fully open or plugged discharge line.	1. Open valves and if necessary, lock valves open to prevent accidental closure. 2. Inspect and clean discharge.
		4. Clogged impeller.	1. Disassemble pump and clean impeller, if necessary
		5. Reverse rotation.	1. Direction of rotation for 855OH pumps is clockwise as viewed from belt end of pump shaft. Direction of rotation for 855CC pumps is clockwise as viewed from fan end of motor.
		6. Motor running on two phases only.	1. Replace defective fuse. 2. Check electrical cable connections.
		7. Excessive wear of internal parts.	1. Disassemble pump, inspect and replace worn parts
		8. Liquid level in tank to low.	1. Increase liquid level in tank.
		9. Vent in suction cover plugged.	1. Clean vent.
Leakage at case joints.	1. Stop the pump, refer to Section VIII, Paragraph D.	1. Gaskets damaged.	1. Disassemble pump and replace gaskets.

Table 4. Pumping Unit Troubleshooting - Continued

SYMPTOM	IMMEDIATE ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
Bearings run hot.	1. Stop the pump, refer to Section VIII, Paragraph D.	1. Bearing setting incorrect.	1. Correct bearing axial clearance.
		2. Worn bearings.	1. Replace bearings.
Pump discharge pressure excessive.	1. Stop the pump, refer to Section VIII, Paragraph D.	1. Excessive speed.	1. Check speed precisely. Decrease speed.
		2. Pump is pumping fluid with specific gravity in excess of that specified. (If temperature of fluid is lower, then specified specific gravity will be higher.)	1. If prescribed fluid temperature or specific gravity cannot be attained, one or more of the following measures can be taken: a. Partially close discharge valve, reducing pump capacity to a point where driver is not overloaded. b. Install more powerful driver. Consult Carver Pump Company specifying exact operating conditions.
Pump overloads motor.	1. Stop the pump, refer to Section VIII, Paragraph D.	1. Speed too high.	1. Check pumps RPM and determine correct sheave and belts for proper speed. Consult local distributor or Carver Pump Company.
		2. Pump discharge pressure is lower than design point, therefore pump's volume too high (check pump nameplate).	1. Partially close discharge valve until pressure at discharge flange is as specified. Decrease speed if driver remains overloaded.
		3. Same as 2 under “Pump Discharge Pressure Excessive.”	1. Same as 2 under pump discharge pressure excessive.
		4. Wrong port width.	1. Consult Carver Pump Company specifying exact operating conditions.

X. MAINTENANCE.

Generally the pump does not need continuous supervision. The pump should always run quietly and smoothly, without vibration. Regular checks of the pump running noises will prevent the risk of excessive temperatures as a result of bearings running hot or defective bearing seals. To ensure such operation, the following maintenance schedule should be applied at regular intervals during operation of the pump. Occasional visual checks are recommended. Data should be recorded periodically 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.

NOTE

Regular inspection and service are essential for safe operation of the pump. Any auxiliary systems installed must be monitored, if necessary, to make sure they function correctly.

Parts marked with * are options or vary by pump.

Daily Inspection:

- Visually inspect unit.
- Check bearing temperatures.
- Check for leakage at mechanical seal.

Weekly Inspection:

- Check power (amps) readings.
- Check pump discharge pressure.
- Check vibration on pump and driver bearings. Vibration should NOT exceed 3.0 of overall displacement (unfiltered) peak to peak mils (0.001”) at 1750 RPM.

Monthly Inspection:

- Check belt condition and alignments.

Semi-annual Inspection:

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

12,500 Hours - Overhaul

- For pump overhaul, complete Section XI, Service and Repair.

A. LUBRICATION OF PUMP BEARINGS. The ball bearings are installed "Greased-For-Life". Always replace the roller bearings when disassembling unit for seal service.

B. LUBRICATION OF MOTOR BEARINGS. See motor manufacturer’s instructions to be sure motor ball bearings are properly lubricated.

C. TORQUE VALUES. Refer to Table 5, Recommended 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.

Table 5. Recommended Torque Values (ft-lbs)

Fastener Size	Torque Value (Foot Pounds)	Torque Value (n-M)
M10 x 1.50	18	25
M12 x 1.75	60	85
M20 x 2.50	295	400
Adjusting Jam Nut (3/4-10UNC)	80	110
Adjusting Jam Nut (7/8-9UNC)	100	135
Impeller Capscrew (3/8-16UNC)	18	25

Table 6. Recommended Equipment

Tools	Materials	Test Equipment
Spanner Wrench Rawhide or Wood Mallet Wooden Wedge Allen Wrench Set Socket, Open, & Box Wrench Set Vice Grips Torque Wrench Bearing Heater	Oil O-ring Lubricant Rust Solvent	Belt Alignment Gauges Volt-Amp Meter Belt Tension Gauge

XI. SERVICE AND REPAIR.

Refer to Figures 15 and 16 to locate the pump parts by item number and parts list Table 8. If a specific sectional assembly drawing exists for a particular pumping unit then that drawing should be referred to for service work.

A. PREPARATIONS FOR DISASSEMBLY OF PUMP.

During disassembly, match mark parts so they can be replaced in their original position. All parts should be thoroughly cleaned or replaced with new, if necessary. Sealing faces should be perfectly clean.

CAUTION

Factory authorized parts must be used to safely maintain your Carver Pump.

NOTE

To avoid damage to O-rings, check to make sure all parts are free of sharp edges or burrs.

All O-rings, ball bearings, shims, mechanical seals, lip seals, packing, and gaskets if disturbed from position should be replaced.

Variations do exist between configurations, not all parts described in the text may be on your configuration. Review what variations your pumping unit has before starting. Parts marked with * are options or vary by pump.

Close suction and/or discharge valves. The pump should be cooled down to ambient temperature. The casings must be empty and not under pressure.

After prolonged operation, components may not be easily removed from shaft. In such instances, rust solvent may be used and suitable extracting tools applied wherever possible. DO NOT use force under any circumstances. Refer to Table 6, Recommended Equipment, for proper tooling during disassembly and assembly. Refer to appropriate sectional drawing for location of parts followed by an item number.

Prepare the pumping unit for disassembly using the following list:

1. Read this entire section and study the applicable sectional view drawing and parts list before disassembling the pump.
2. Stop the pumping unit; refer to Section VIII, Paragraph D.

NOTE

Refer to cartridge seal (90*), refer to vendor instructions for proper mechanical seal removal procedure.

3. For cartridge mechanical seals (90*), reinstall seal clip.

WARNING

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.

When pump is handling hazardous fluid, extreme care must be taken to ensure safety of personnel when attempting to drain pump and piping before disconnecting the pumping unit. Suitable protection devices should be used and/or protective clothing should be worn. Applicable hazardous material procedures must be followed.

CAUTION

Fluid will remain in lower portion of casing and care must be taken to trap and dispose of this fluid in a safe and appropriate manner.

4. Drain pump by removing liquid at suction flange connection. If necessary, flush pump to remove corrosive or toxic pumpage. Collect and dispose of corrosive or toxic material appropriately.
5. Disconnect piping, gauge lines, and auxiliary connections, as necessary.

CAUTION

Use a hoist with adequate lifting capacity; refer to Section VII, Paragraph B for handling of the pump.

NOTE

For close-coupled units continue with step 9.

6. Relieve tension on belts by loosening adjustment jam nuts (616).
7. Remove guard cover screw (605) and guard retaining screw flat washer (642) from belt guard cover (131E). Remove the belt guard cover (131E).

NOTE

Bushings are tapered for achieving a kind of clamp fit between the hub of the sheave and the shaft. Use of an Allan key is required for removing bushings.

8. Remove the belt (276), sheave (277) and bushing (278) from pump and motor. Remove bushing keys (46 and 46X) from the pump and motor shafts.
9. Remove bolts (604) and hex nuts (618) from motor (200). Remove motor.
10. Remove guard bolt (603) and guard hex nuts (617) to remove guard (131D). The slide guard (131F) and slide guard screws (607) will remain attached to the guard.
11. Remove motor plate (23) and adjusting threaded rods (632). Belt guard bracket (133) will be removed with threaded rods.
12. Support pump; remove the bolts that hold the pump to the tank. Remove the pump from the tank. Refer to Section VII, Paragraph B for handling of the pump.
13. Move the pump to a suitable work area for disassembly.

B. DISASSEMBLY OF PUMP. The instructions that follow are an aid for properly trained personnel to service your Carver Pump. Refer to Figures 15 and 16 to locate the pump parts by item number and parts list Table 8. If a specific sectional assembly drawing exists for a particular pumping unit then that drawing should be referred to for service work. Read this entire section before disassembling the pump.

NOTE

Refer to Section II for Safety precautions before disassembling pump.

Variations do exist between configurations, not all parts described in the text may be on your configuration. Review what variations your pumping unit has before starting. Parts marked with * are options or vary by pump.

After completion of dismantling, all parts should be thoroughly cleaned or replaced by new ones if necessary. All gaskets and sealing faces should be perfectly clean. When cutting new gaskets, make sure they are exactly the same thickness as the old ones unless noted.

CAUTION

Use a hoist with adequate lifting capacity; refer to Section VII, Paragraph B, for lifting the complete unit.

When pump is handling hazardous fluid, extreme care must be taken to ensure safety of personnel when attempting to drain pump and piping before disconnecting the pumping unit. Suitable protection devices should be used and/or protective clothing should be worn. Applicable hazardous material procedures must be followed.

NOTE

Mark or number each component while dismantling according to sequence.

The individual components should be unscrewed or removed.

1. Complete Section XI, Paragraph A before continuing with disassembly.
2. Remove splash guard screw (606) and guard retaining screw flat washer (642). Remove the splash guards (131B/C).

NOTE

Refer to cartridge seal (90*), refer to vendor instructions for proper mechanical seal removal procedure.

3. Remove gland hex nuts (615) and the gland flat washers (641*) on studs (630). Slide back gland (17*) to release tension on mechanical seal (90*). Slide back and remove gland (17*) halves from packing rings (180*).

NOTE

If gaskets are disturbed from position replace with new.

4. Remove capscrew (600) and suction cover (10). Remove the tank suction gasket (73B) and suction casing gasket (73A), discard.
5. Remove impeller capscrew (26) and impeller washer (28). Pull impeller (3) from shaft (6). Impeller key (32) may come off with impeller, if not remove impeller key. Remove any impeller shims (15) that may be present and discard.

NOTE

Take special care during disassembly with the mechanical seal rotary and stationary elements when removing the casing off the shaft.

6. Remove capscrew (601) from casing (1) and remove casing from bearing frame (19) or motor (200) for close-coupled units.
7. Remove old packing (180*), lantern ring (29*) and packing retaining ring (63*) from casing (1).
8. Remove mechanical seal spacer (68*) from shaft (6).

NOTE

Refer to mechanical seal (90*) vendor instructions for proper mechanical seal removal procedure.

DO NOT remove rotating element of mechanical seal (90*) from shaft sleeve (14*), at this point, especially if mechanical seal is relatively clean and in good working condition. Model 855 CC will have a shaft sleeve (14*) upon which the seal operates.

9. If applicable, remove the shaft sleeve (14*) and rotating element of mechanical seal (90*) from shaft (6). Inspect rotating element of mechanical seal before removing from shaft sleeve. If replacement is required remove rotating element of mechanical seal from shaft sleeve.
10. If applicable, remove the gland (17*) and stationary element of mechanical seal (90*) from shaft (6).
11. Remove O-ring (89*) from shaft (6)
12. If the slinger (40) is damaged and needs replaced or it is necessary to replace the ball bearings (18) remove the slinger from the shaft (6).

NOTE

If lip seals or gaskets are disturbed from position replace with new.

13. Remove capscrews (602) fastening bearing caps (35) to bearing frame (19). Remove bearing caps from bearing frame. Remove lip seal (169) and gasket (73) from bearing caps. Do not remove shaft guard (131G) unless necessary.
14. Remove the shaft (6) (with radial and thrust ball bearing assemblies) from the bearing frame (19).

NOTE

If ball bearings are disturbed from position replace with new.

15. If desired, pull ball bearing (18) from shaft (6).
16. If desired, pull ball bearing (16) from shaft (6).

C. PARTS INSPECTION.

1. All parts should be thoroughly cleaned with a suitable solvent or replaced with new ones if necessary.
2. All sealing faces should be perfectly clean. All ball bearings, mechanical seals, gaskets, O-rings, lip seals, and locking devices with a nylock feature are to be replaced with new if disturbed from position.
3. Check shaft for runout, scratches, grooves, or any possible damage. Touch up scratches and grooves with a polishing cloth and inspect for remaining grooves or deep scratches. A bent or excessively damaged shaft should be replaced.
4. Inspect the casing for pitting, scoring, and erosion. The inside of the casing should be free of any pits or grooves. The maximum allowable depth is 1/8” (3mm). Replace the casing if any of these defects are present.
5. Inspect mechanical seal. Replace the mechanical seal that is disturbed from position or damaged.
6. Inspect the impeller and bushing keys for distortion and push fit into keyways. The keys should be square on all four edges. They should fit without having to be forced. The keys should not rock in keyway. Replace keys or shaft if necessary.
7. Check the shaft sleeves and spacer sleeves visually for score marks, scratches, pits, grooves or burrs. Touch up sleeves with polishing cloth and inspect for remaining grooves or deep scratches. Remove burrs with a file. Shaft sleeves and spacer sleeves should be replaced if any marks, pits or grooves are still visible after touching up.
8. Inspect tubing for kinking. Replace kinked tubing.
9. If the impeller shows excessive wear due to erosion or pitting, so that performance cannot be restored, it must be replaced. If a new impeller is installed, check to make sure that it is balanced and of the correct trim. If an impeller is restored or replaced check the dynamic balance of the rotor before reassembly of the pump.

D. REASSEMBLY OF PUMP. Read this entire section before reassembling the pump. The instructions that follow are an aid for properly trained personnel to assemble your Carver Pump. Refer to Figures 15 and 16 to locate the pump parts by item number and parts list Table 8. If a specific sectional assembly drawing exists for a particular job then that drawing should be referred to for assembly. Refer to Table 5 for recommended torque values. Assemble the pump in accordance with accepted rules of engineering practice. Coat individual components with a suitable lubricant before assembling. Assembly of unit should be performed on a clean, flat surface. During reassembly, install parts as applicable.

CAUTION

During reassembly, install new O-rings, ball bearings, lip seals, packing, mechanical seals and gaskets if disturbed from position. O-rings, ball bearings, lip seals, packing, mechanical seals and gaskets may have been damaged during disassembly.

While installing ball bearings, DO NOT unnecessarily hit ball bearings. If damage to ball bearings occurs, replace damaged ball bearings with new ball bearings.

After 12,500 hours of service, replace the ball bearings.

NOTE

To ensure proper seating of ball bearing parts, rotate the ball bearing while clamping the parts.

All parts should be thoroughly cleaned or replaced with new ones if necessary. All sealing faces should be perfectly clean, but do not scratch or alter surface finish on seal faces.

Variations do exist between configurations, not all parts described in the text may be on your configuration. Review what variations your pumping unit has before starting. Parts marked with * are options or vary by pump.

For close-coupled units start with step 6.

1. If removed, install ball bearings (16 and/or 18) onto shaft (6).

CAUTION

Handle lip seal (169) with care. Mishandling could damage faces of the lip seal.

2. Install the lip seals (169) in the bearing caps (35).
3. Install the shaft (6) in the bearing frame (19).
4. Install one paper gasket (73) on the impeller end bearing cap (35). Install impeller end bearing cap on bearing frame (19) securing it to the bearing frame with capscrews (602). Refer to Table 5 for recommended torque values.
5. For proper shaft endplay clearance to allow for thermal growth of the shaft, measure and install gasket(s) (73) on the shaft side of bearing frame as follows;
   a. Temporarily fit the bearing cap (35), with the shaft guard (131G) if shaft guard was not removed, over the shaft WITHOUT A GASKET. Snug it to the bearing frame (19) with two capscrews (602) in opposing screw holes – do not over tighten.
   b. Measure the gap between the bearing cap (35) and the bearing frame (19) with a feeler gage.
   c. Choose a gasket that is approximately 125µm (.005”) thicker than the feeler gage. Choose the closest gasket that is thicker.
   d. Remove the two capscrews (602) and install the gasket(s) (73) on the bearing cap (35).
   e. Install bearing cap (35) with shaft guard (131G) and secure with capscrews (602) Refer to Table 5 for recommended torque values. If removed, install shaft guard (131G).
   f. The shaft endplay clearance should now be 250 to 375 µm (.010 to .015 inches) to allow for thermal growth of the shaft.
6. If removed, install the slinger (40) on shaft (6).
7. Lubricate and install sleeve O-ring (89*) onto shaft (6).
8. As applicable, the stationary element of mechanical seal (90*) should be installed in the gland (17*) before the gland is installed, refer to Section XI, Paragraph F for procedures. Install gland on shaft (6), slide back towards slinger (40).
9. For units with packing (180*), install the packing retaining ring (63*) into the casing (1).

10. For units with packing (180*), install the lantern ring (29*) on the shaft (6) sliding the lantern ring back near the slinger (40).
11. Install casing (1) to bearing frame (19) or motor (200), clamping bracket (131A) with capscrew (601).
12. Slide sleeve (14*) over O-ring (89*) on shaft (6). Rotating element of mechanical seal (90*) if not being replaced will be on shaft sleeve (14*). (Shaft sleeve (14*) for close-coupled units, Model 855 CC.)

NOTE

For a cartridge seal, refer to mechanical seal vendor instructions for proper seal installation procedure.

13. If applicable, install cartridge mechanical seal (90*). DO NOT remove seal clip after pump assembly is complete.

NOTE

Refer to mechanical seal vendor instructions for complete seal installation procedure.

14. Install packing (180*) or mechanical seal (90*). Install packing per Section XI, Paragraph E. Install mechanical seal per Section XI, Paragraph F.
15. As applicable, install the mechanical seal spacer (68*) and packing retaining ring (63*) onto shaft (6).

NOTE

Follow Steps 16 through 20 to obtain the correct clearance between the impeller and the suction cover.

16. Install impeller key (32), impeller (3), impeller washer (28), and impeller capscrew (26).
17. Install suction casing gasket (73A) on casing (1).
18. Install suction cover (10), with vent hole to the top, secure suction cover to the casing (1) with capscrews (600).
19. Move the shaft (6) in the bearing housing toward the suction cover (10).
20. Insert a long feeler gauge between the impeller and suction cover, moving the gauge in a full circle to check the impeller clearance.
    a. Impeller clearance should be .015 to .020”.
    b. If the impeller (3) needs shimmed towards the suction cover (10), remove the suction cover and impeller and add impeller shims (15) behind the impeller as required to obtain the correct clearance.
    c. If the suction cover needs shimmed, remove the suction cover and add additional gaskets (73A) to obtain the correct clearance. The maximum number of gaskets (73A) to be used is 5. Consult with the factory if more than 5 are needed.
    d. Recheck the clearance and repeat the above steps as necessary to correct the clearance between the impeller (3) and the suction cover (10).
    e. Once the correct clearance and number of impeller shims (15) or gaskets (73A) is determined remove the suction cover (10) and impeller (3) and continue with reassembly.

NOTE

Put removable thread locker on impeller capscrew refer to Table 5 for recommended torque values.

21. Install impeller key (32), impeller shims (15) as necessary, impeller (3), impeller washer (28), and impeller capscrew (26).
22. Complete mechanical seal (90*) or packing (180*) installation. As applicable, ensure tap flush lines in gland (17*) is positioned so flush lines can be connected. Install gland (17*) on studs (630) and evenly tighten gland hex nuts (615) and gland flat washers (641*).
23. Confirm installation of suction casing gasket(s) (73A) on casing (1).
24. Install suction cover (10), with vent hole to the top, secure suction cover to the casing (1) with capscrews (600).
25. Check for smooth shaft rotation.

CAUTION

Use a hoist with adequate lifting capacity; refer to Section VII, Paragraph B, for lifting the pump.

26. Return assembly to installation site. Install suction casing gasket (73B) on suction cover

(10). Support pump; hold pump to tank and install the bolts that hold the pump to the tank.

27. Install adjusting threaded rod (632) and jam nuts (616) in bearing frame (19). If removed, install belt guard bracket (133), leaving nuts (616) loose.
28. Install motor plate (23) on adjusting threaded rod (632) between a pair of jam nuts (616). The belt (276) is tensioned by adjusting the motor plate using jam nuts (616).

NOTE

When installing the motor care is to be taken to keep the motor and pump shafts parallel.

29. Install motor (200) on motor plate (23), secure motor to motor plate with bolts (604) and hex nuts (618).
30. Confirm that the slide guard (131F) and the slide guard screws (607) are installed in guard (131D). Install guard with guard bolt (603) and guard hex nuts (617).
31. Install bushing key (46) in pump shaft (6) and bushing key (46X) in motor (200) shaft.

NOTE

Bushings are tapered for achieving a kind of clamp fit between the hub of the sheave and the shaft. Use of an Allan key is required for installing bushings.

32. Install bushings (278) and sheaves (277) on pump and motor shafts.
33. Install and align belt (276) refer to Section XI, Paragraph 10.4 for belt installation and maintenance and Section XI, Paragraph 10.5 for tension check for belts.
34. Install belt guard cover (131E) with guard retaining screw flat washer (642) and guard cover screw (605).
35. Install splash guards (131 B/C) and secure with guard retaining screw flat washer (642) and splash guard screw (606).
36. Reconnect piping, gauge lines, and auxiliary connections, as necessary.
37. Confirm water is turned on to external flush lines for pumps equipped with water cooling for either the packing or the mechanical seal.
38. Remove all tags from valves and switches.
39. Start pumping unit in accordance with Section VIII, Paragraph B.

E. REPLACEMENT OF PACKING. Pumps equipped with packing have a lantern ring which is located in line with the flush water connection on the stuffing box. Flow should be adjusted, typically to 20 to 30 drops per minute. Flush water pressure should be approximately 70 kPa (10 PSI) more than the pump discharge pressure to ensure flow of water through the packing. Use the following procedure when replacing the packing:

1. Ensure the new packing is of proper type and size.
   a. Typical is five rings, 6mm x 6mm (3/8" x 3/8").
   b. Standard shaft diameter is 32mm (1 1/4").
   c. Pre-cut sets of packing and lantern rings are available for stock from Carver Pump Company
2. Stop the pumping unit; refer to Section VIII, Paragraph D.
3. Carefully bleed off pressure.
4. Remove gland hex nuts (615) and the gland flat washers (641*) on studs (630). Slide back and remove gland (17*) halves.

CAUTION

Do not use system pressure to blow out (remove) packing.

5. Refer to Figure 7; remove all old packing rings (180) by using the proper size packing removal hook. The lantern ring (29) will remain on the shaft (6) and should be slid to near the slinger (40).

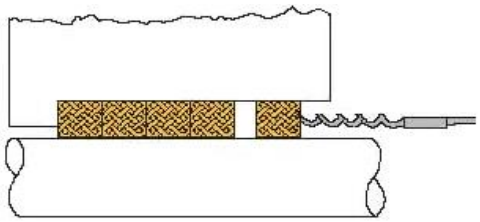


Figure 7. Removing Packing with Hook

6. Check the shaft (6) for nicks and score marks; repair or replace as necessary.
7. If required, clean the stuffing box bore.
8. Install the first ring of packing (180*) with joint at approximately the 1 o'clock position (30° right of vertical). Refer to Figure 8 for packing alignment.

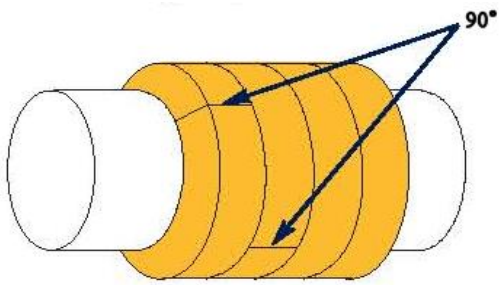


Figure 8. Packing Alignment

9. Twist the ring of packing (180*) slightly in an “S” shape and place it around the shaft (6).
10. Seat packing (180*) firmly against bottom of stuffing box using the gland (17*).
11. Repeat procedure as described in Steps 8 through 10. Packing (180*) ring joints should be staggered 90° apart.
12. Install enough rings (typically 2) until lantern ring will align with flush water port.
13. Slide lantern ring (29*) back up shaft (6) into position.
14. Install remaining packing (180*) as described in Steps 8 through 10 above.

NOTE

In tightening the gland (17*), nuts should be adjusted evenly to avoid cocking the gland and subjecting the packing (180*) to uneven pressure.

15. Seat final ring of packing (180*) firmly with the gland (17*) halves. Install the gland flat washers (641*) and gland hex nuts (615) on studs (630) using a wrench to tighten.
16. Ensure that lantern ring (29*) is still properly aligned with the flush port.
17. Loosen gland hex nuts (615) and retighten, using only fingers.
18. At minimum the gland (17*) should be into the stuffing box approximately 3 - 5mm (1/8” - 3/16").
19. The remaining exposed portion of gland (17*) follower should be at least 6mm (1/4”) to allow future gland adjustments.
20. Rotate shaft (6) by hand to ensure shaft is not binding.
21. Allow liberal leakage at start up.
22. Slowly adjust leakage to an acceptable level by tightening gland hex nuts (615) slowly and evenly. Final adjustments should be made by rotating gland hex nuts one flat at a time.

NOTE

If stuffing box is hot to the touch (approximately 65°C or 150°F), there is not enough flush water entering the stuffing box.

23. Packing (180*) may run warm during break-in period, one day or two.
24. Do not adjust the packing (180*) unless necessary.
25. If uncontrolled excessive leakage occurs, lantern ring (29*) is pushed out of alignment with flush water port, or gland (17*) follower cannot be tightened further; re-pack the pump.

F. <u>REPLACEMENT OF MECHANICAL SEAL.</u> A mechanical seal (90*) must be installed and serviced while the casing (1) is removed from the motor (855 CC) or bearing frame (855 OH).

Mechanical Seal Removal

NOTE

Refer to mechanical seal vendor instructions for proper mechanical seal removal procedure.

Model 855 CC will have a shaft sleeve (14*) upon which the seal operates.

Disassemble pump per Section XI, Paragraph B. steps 1 through 11. Take special care with the mechanical seal (90*) rotary and stationary elements when sliding the casing (1) off of the shaft (6).

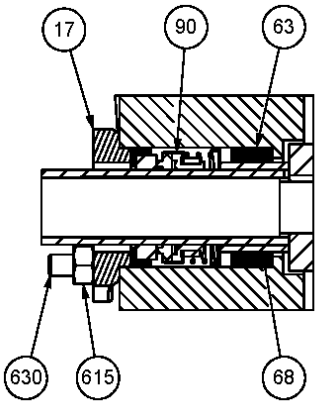


Figure 9. Mechanical Seal

Mechanical Seal Installation

1. Lubricate and install sleeve O-ring (89*) onto shaft (6).

NOTE

For a cartridge seal, refer to mechanical seal vendor instructions for proper seal installation procedure.

2. If applicable, install cartridge mechanical seal (90*). DO NOT remove seal clip until after pump assembly is complete.

NOTE

Refer to mechanical seal vendor instructions for complete seal installation procedure.

3. If stationary element of mechanical seal (90*) is to be replaced, clean, dry, and lubricate gland (17*). Lubricate stationary element of mechanical seal with suitable lubricant. Insert stationary element of mechanical seal into gland.
4. Install gland (17*) on shaft (6), slide back towards slinger (40).
5. Install casing (1) to bearing frame (19) or motor (200), clamping bracket (131A) with capscrew (601).
6. If removed, install rotating elements of mechanical seal (90*) onto shaft (6) (shaft sleeve (14*) for close-coupled units, Model 855 CC).
7. Slide sleeve (14*) over O-ring (89*) on shaft (6). Rotating element of mechanical seal (90*), if not being replaced, will be on shaft sleeve (14*).
8. Slide gland (17*) with stationary elements of mechanical seal (90*) onto studs (630) and secure finger tight with nuts (615). As applicable, ensure tap flush lines in gland (17*) is positioned so flush lines can be connected.
9. Reassemble pump per Section XI, Paragraph D, steps 15 through 39.

G. <u>BELT INSTALLATION AND ADJUSTMENT.</u> The Model 855-OH is supplied with belts, sheaves and bushings. The belts, sheaves and bushings should be sized to obtain the desired pump shaft speed for the given motor. Belts should be checked for proper belt tension as recommended by the belt manufacturer. Over-tight belts overload bearings and shorten their life. Loose belts cause slippage and excessive wear, as well as poor performance.

G.1 General

Belt driven pump sets must always be earthed (electrically grounded). The condition of the belts must be checked regularly. After fastening the unit to the tank flange and connecting the piping, the belt drive must be thoroughly checked and the belts re-tensioned, if required.

<u>CAUTION</u>

Reinstall and tighten all hardware and guards when adjusting the belts is completed and before the unit is energized.

G.2 Mounting the Motor

Use bolts (604) and hex nuts (618) to fasten the motor (200) on the motor plate (23). The belts (276) are tensioned by adjusting the motor plate using jam nuts (616). Care is to be taken to keep the motor and pump shafts parallel.

G.3 Mounting the Sheaves

General information on tapered bushings:

Tapered bushings are used for achieving a clamping fit between the hub of a sheave and the shaft. An Allan key or hex wrench is required for mounting and removing the tapered bushings. The same screws are used for clamping and removing.

Tapered bushings are cylindrical on the inside and tapered on the outside, and split along one side. On standard tapered bushings set screws are used between the bushing and the sheave. The set screw when tightened pulls the bushing into the sheave and clamps onto the shaft. On quick disconnect tapered bushings a collared tapered bushing is pulled into the sheave with hex bolts. When the hex bolts are tightened the tapered bushing pulls into the sheave and clamps onto the shaft. For wedge belt pulleys, the manner of fastening described above is generally sufficient for power transmission. A key connection is necessary to prevent slippage, where the operating torque of the pulley is higher than the corresponding slip torque of the bushing, and for shock loads. Therefore, all taper bushings are provided with a keyway.

NOTE

In some instances depending on the shaft length of the motor used, the bushing/sheave once aligned with the motor sheave, may extend off the end of the pump shaft causing an improper fit or misalignment. This will require the bushing and sheave to be installed reversed. (See Figure 16)

G.4 Belt Installation and Maintenance

CAUTION

Do not operate the pump without belt guards in place.

In normal design, the belts are suitable for ambient temperatures of -30°C to +70 °C.

Installation: Before commencing work at the belt, make sure that the pump is secured in such a way that it cannot be switched on accidentally.

NOTE

Multiple belt drives must be equipped with belts of the same length. When one belt fails, always replace the complete set. Old and new belts cannot be used in one set because belts tend to expand during operation.

Using belt wax or similar substances is not necessary. The performance of a belt drive is assured by correct tension.

Protect belts from oil mist, dripping oil and other chemicals. Sustained exposure to these substances will cause swelling or other failure of the belts.

1. The sheaves (277) must be properly aligned. Misalignment of the sheaves will result in the belts (276) being warped, thus causing increased wear on the flanks and generating a high running noise.
2. The sheaves (277) must be free from burs, rust and dirt. Dirty sheaves will cause premature destruction of the belts (276).

CAUTION

Belts must be properly tensioned. Insufficient tension will result in inadequate transmission of power and premature wear caused by excessive slip. Excessive tension will cause excessive expansion, unnecessary flexing work and high temperatures which will result in a reduced service life. Additionally, high tension creates an unnecessarily high load on the bearings of the shaft.

3. The belts (276) must be fitted by hand without using force. For this purpose, reduce the distance between the sheaves (277) by moving the motor plate (23) downwards. Pulling the belts under tension over the edges of the sheaves or using metal tools can cause invisible damage to the tissue which will substantially reduce the service life of the belts.
4. Check the belt (276) tension after a short break-in period and correct it, if necessary. Improperly tensioned belts will fail prematurely.

G.5 Tension check for Belts

To tension belts, adjust the center distance until the belts appear fairly taut. Run the drive for about 15 minutes to seat the belts, and apply full load. If the belts slip or squeal, apply more tension. When the drive is in motion, slight sag on the slack side is normal.

An alternate method of tensioning is to use the simplified **belt force/deflection adjustment method,** as follows:

1. Measure the span length “L” of your drive, refer to Figure 10.
2. At the center of the span, apply a force perpendicular to the belt. Measure the force required to deflect the belt 1/64" per inch of span length. For example, for a 100" span, the deflection would be 100/64", or approximately 1 1/2 inches.
3. Compare the force required to the recommended ranges refer to Table 7. Tighten or loosen the belt to bring it into the recommended range.
4. When you install new belts, tighten them to “initial tension” forces shown in the Table 7. This tension will drop during the run-in period.

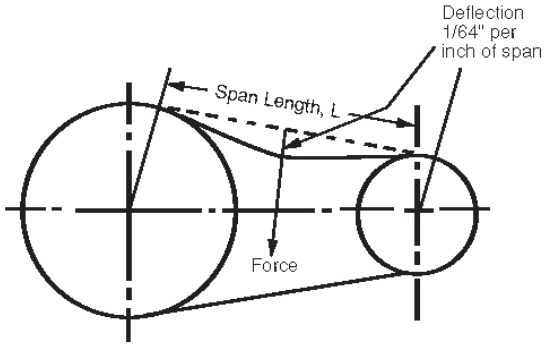


Figure 10. Belt Tensioning

Table 7. Belt Tensioning

V-Belt Cross Section	Small Sheave Diameter Range (Inches)	Recommended Deflection Force (Lbs.)		
		Initial Installation	Re-tensioning	
			Maximum	Minimum
3VX	2.2 - 2.5	4.8	4.9	3.2
	2.6 - 4.8	5.7	4.9	3.8
	5.0 - 6.5	7.2	6.2	4.8
5VX	- 2.2	15.0	13.0	10.0
	5.9 - 8.0	19.0	16.9	13.0
	8.5 - 10.9	21.0	18.2	14.0

H. OPTIONAL SWING-OUT MOUNT INSTALLATION.
The instructions that follow are an aid for properly trained personnel to install an optional swing-out mount on your Carver Pump. These instructions refer to Figure 16 as an example. The tank flange detail is shown in Figure 17. Refer to Figures 16 and 17 to locate the pump parts by item number and parts list Table 8.

Assembly Procedure:

1. If tank flange is not drilled and tapped for swing-out arm, use swing-out assembly as template for 4 new tapped holes (see Figure 12).
2. Mount lower hinge plate (53A) (with large holes) to back of tank flange, using three spacer plates (54A) between lower hinge plate and flange.

CAUTION

Use a hoist with adequate lifting capacity; refer to Section VII, Paragraph B, for lifting the complete unit.

3. Temporarily mount pump and spacer plates (54A) to tank flange for alignment to swing-out arm. DO NOT install the four fasteners on left side that will bolt through the swing-out arm (located approximately 7:30 – 10:30 o'clock positions).
4. Place adjuster bolts (54B) in top and bottom positions of lower hinge plate (53A).
5. Assemble hinge plates, lower and upper (53A and 53B) by inserting swing-out hinge bolt (608) through upper hinge plate (53B), adjuster bolts (54B), and lower hinge plate (53A). Secure with adjuster bolt snap ring (176) and swing-out hinge hex nut (619) on swing-out hinge bolt.
6. Adjust vertical and horizontal alignment of hinge plates, lower and upper (53A and 53B) by alternately rotating top and bottom adjuster bolts (54B) with adjuster wrench (54C), refer to Figures 13 and 14.
7. As needed, fit spacer plates (54A) (normally 3) between upper hinge plate (53B) and pump flange.
8. When holes on upper hinge plate (53B) align with holes on pump flange, alignment is complete. Use swing-out mounting studs (633), hex nuts (620) and swing-out mounting flat washers (640) to secure upper hinge plate (53B) to pump flange.

CAUTION

Use a hoist with adequate lifting capacity; refer to Section VII, Paragraph B, for lifting the complete unit.

9. Remove temporary pump mounting bolts (from step 3) from tank flange.
10. By rotating adjuster bolts (54B) on hinge plates, lower and upper (53A and 53B), check pump swing-out operation and adjust to suit.
11. When adjustments are complete, secure pump, spacer plates and swing-out assembly to tank flange (including all mounting bolts for pump).

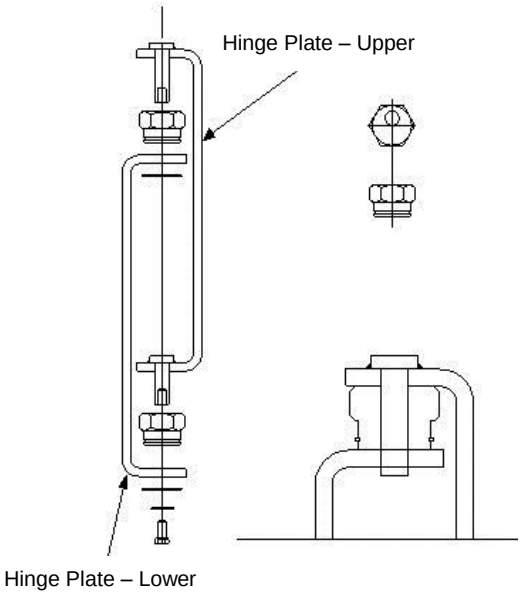


Figure 11. Swing-out Assembly

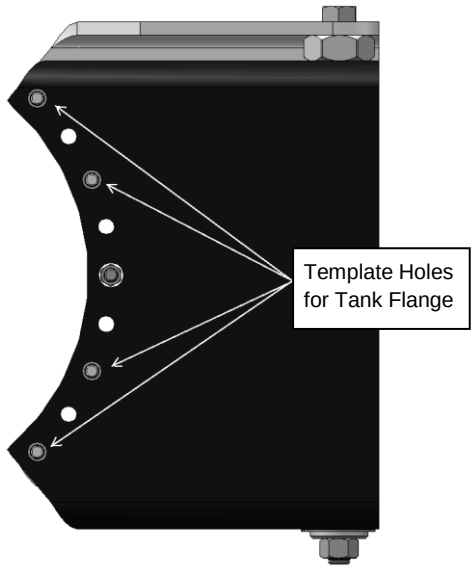


Figure 12. Drilling Tank Flange for Swing-out

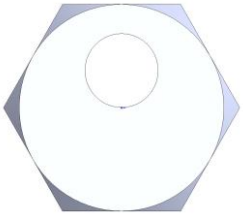


Figure 13. Adjuster Bolt (Closed position)

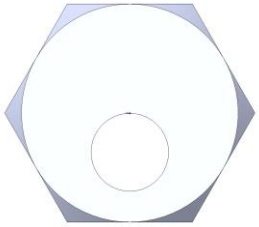


Figure 14. Adjuster Bolt (Open position)

I. **MOTOR.** The motor should be maintained in accordance with the manufacturer's instructions.

J. **CHECK VALVE.** If applicable, the check valve should be maintained in accordance with the manufacturer's instructions.

XII. PARTS LISTS AND DRAWINGS.

This section contains listings of parts and corresponding drawings. Table 9 notes the recommended spare parts for this pumping unit. Refer to Figures 15, 16, and 17, for the location of parts identified by item numbers.

Table 8. Parts List

Item Number	Description	Item Number	Description
1	Casing	131D	Belt Guard
3	Impeller	131E	Cover, Belt Guard
6	Shaft	131G	Shaft Guard
10	Suction Cover	133	Bracket, Belt Guard
*14	Shaft Sleeve	169	Lip Seal
15	Impeller Shim (not shown)	*176	Snap Ring - Adjuster Bolt
16	Ball Bearing	*180	Packing
*17	Gland	200	Motor
18	Ball Bearing	276	Belt
19	Bearing Frame	277	Sheave
23	Motor Plate	278	Bushing
26	Impeller Capscrew	537	Bushing - BSPT TO NPT
28	Impeller Washer	600	Capscrew – Casing/Cover
*29	Lantern Ring	601	Capscrew – Casing
32	Key, Impeller	602	Capscrew – Bearing Cap
35	Bearing Cap	603	Bolt – Guard
40	Slinger	**604	Bolt – Motor / Base
46	Key, Pump Bushing	605	Screw - Guard Cover
46X	Key - Motor Bushing	606	Screw - Splash Guard
*53A	Hinge Plate – Lower	607	Screw - Slide Guard
*53B	Hinge Plate – Upper	*608	Bolt – Swing-out Hinge
*54A	Spacer Plate	615	Hex Nut - Gland
*54B	Adjuster Bolt	616	Jam Nut - Adjustment
*54C	Adjuster Wrench	617	Hex Nut - Guard
*63	Retaining Ring - Packing	**618	Hex Nut - Motor
*63A	Throttle Bushing - Seal	*619	Hex Nut – Swing-out Hinge
*68	Spacer - Mechanical Seal	*620	Hex Nut – Swing-out Mounting
73	Gasket, Frame - Cap	630	Stud - Gland
73A	Gasket, Casing - Suction	631	Stud - Casing
73B	Gasket, Suction - Tank	632	Threaded Rod - Adjusting
*89	O-Ring, Sleeve	*633	Stud – Swing-out Mounting
*90	Mechanical Seal	*640	Flat Washer – Swing-out Mounting
131A	Bracket, Splash Guard	*641	Flat Washer - Gland
131B	Splash Guard, Right	642	Flat Washer - Guard Screw Retaining
131C	Splash Guard, Left		

* Parts are options that vary by pumping unit. ** Supplied by incorporator of motor ***Supplied by Pump Installer

Table 9. Recommended Spare Parts List

Item Number	Description	Item Number	Description
3	Impeller	46	Key, Pump Bushing
*14	Shaft Sleeve	*68	Spacer - Mechanical Seal
15	Impeller Shim (set)	73	Gasket, Frame - Cap (set)
16	Ball Bearing	73A	Gasket, Casing - Suction
*17	Gland	73B	Gasket, Suction - Tank
18	Ball Bearing (Impeller End)	*89	O-Ring, Sleeve
28	Impeller Washer	*90	Mechanical Seal
*29	Lantern Ring	*180	Packing
32	Key, Impeller		

*Parts are options that vary by pumping unit.

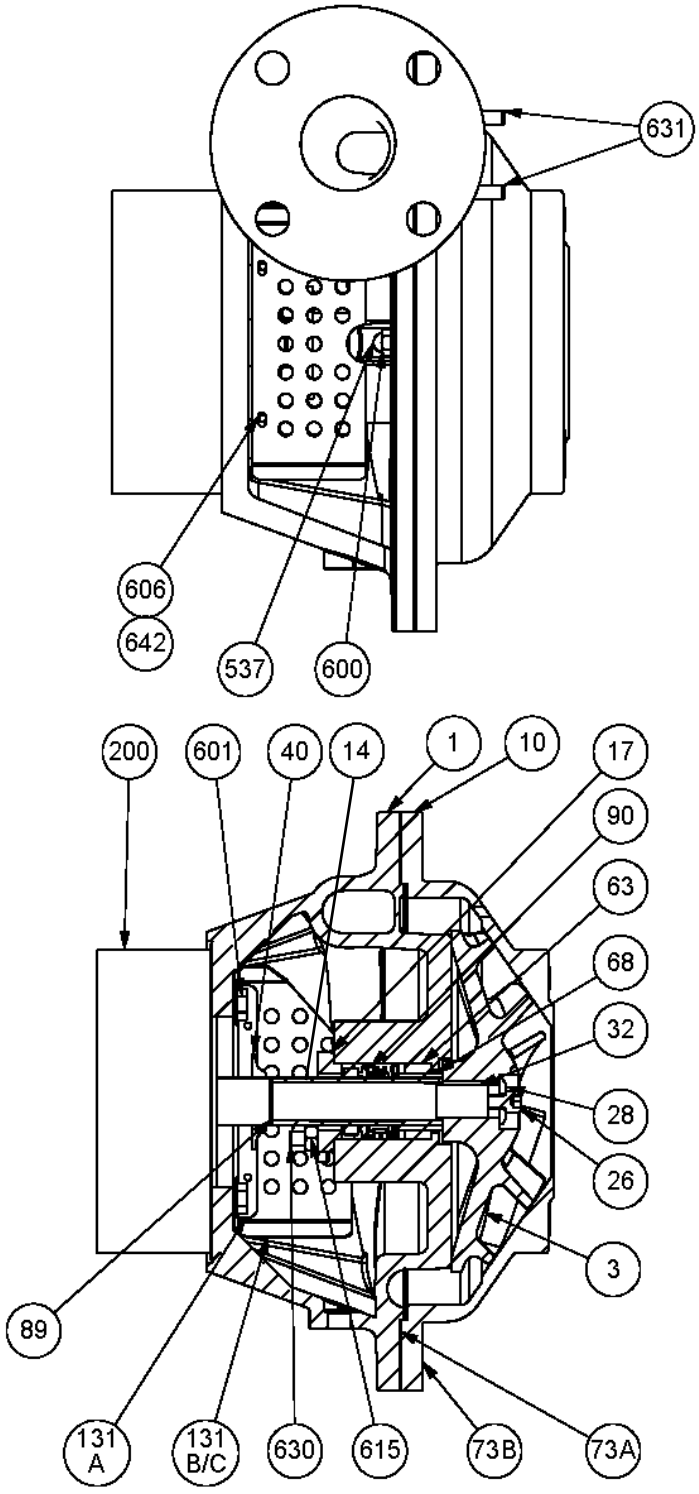
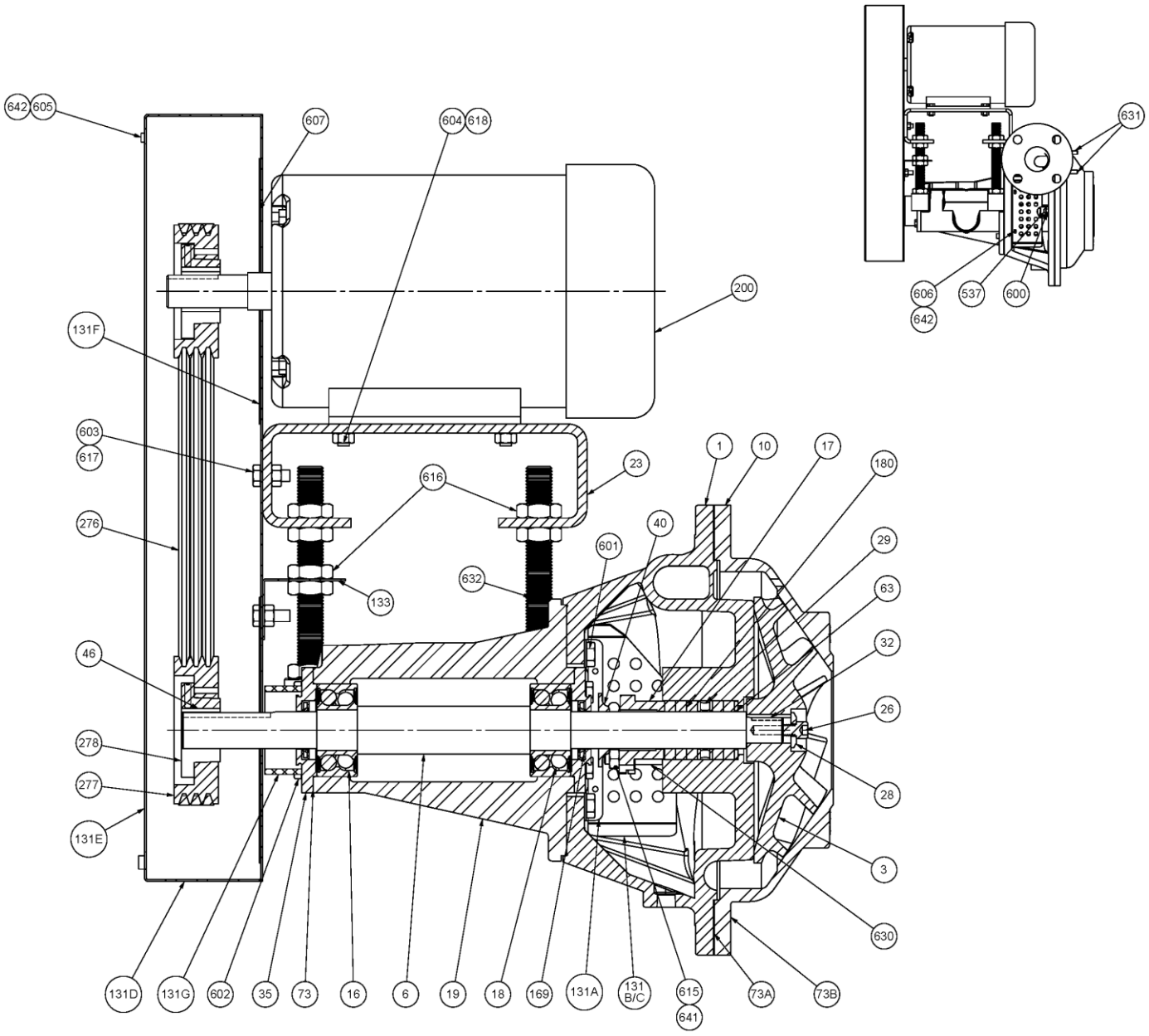
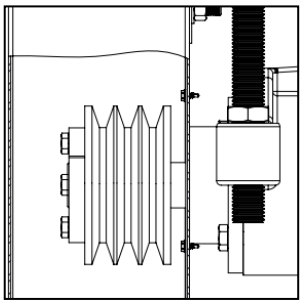
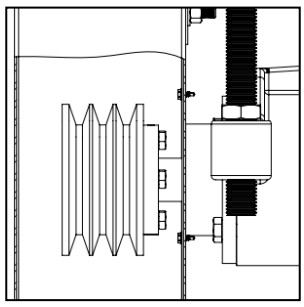


Figure 15. Sectional Assembly – Close-Coupled Pump (Shown with Mechanical Seal)





Standard Install of Bushing/Sheave



Reverse Install of Bushing/Sheave

NOTE

In some instances depending on the shaft length of the motor used, the bushing/sheave once aligned with the motor sheave, may extend off the end of the pump shaft causing an improper fit or misalignment. This will require the bushing and sheave to be installed reversed.

Figure 16. Sectional Assembly with Overhead Drive (Shown with Packing)

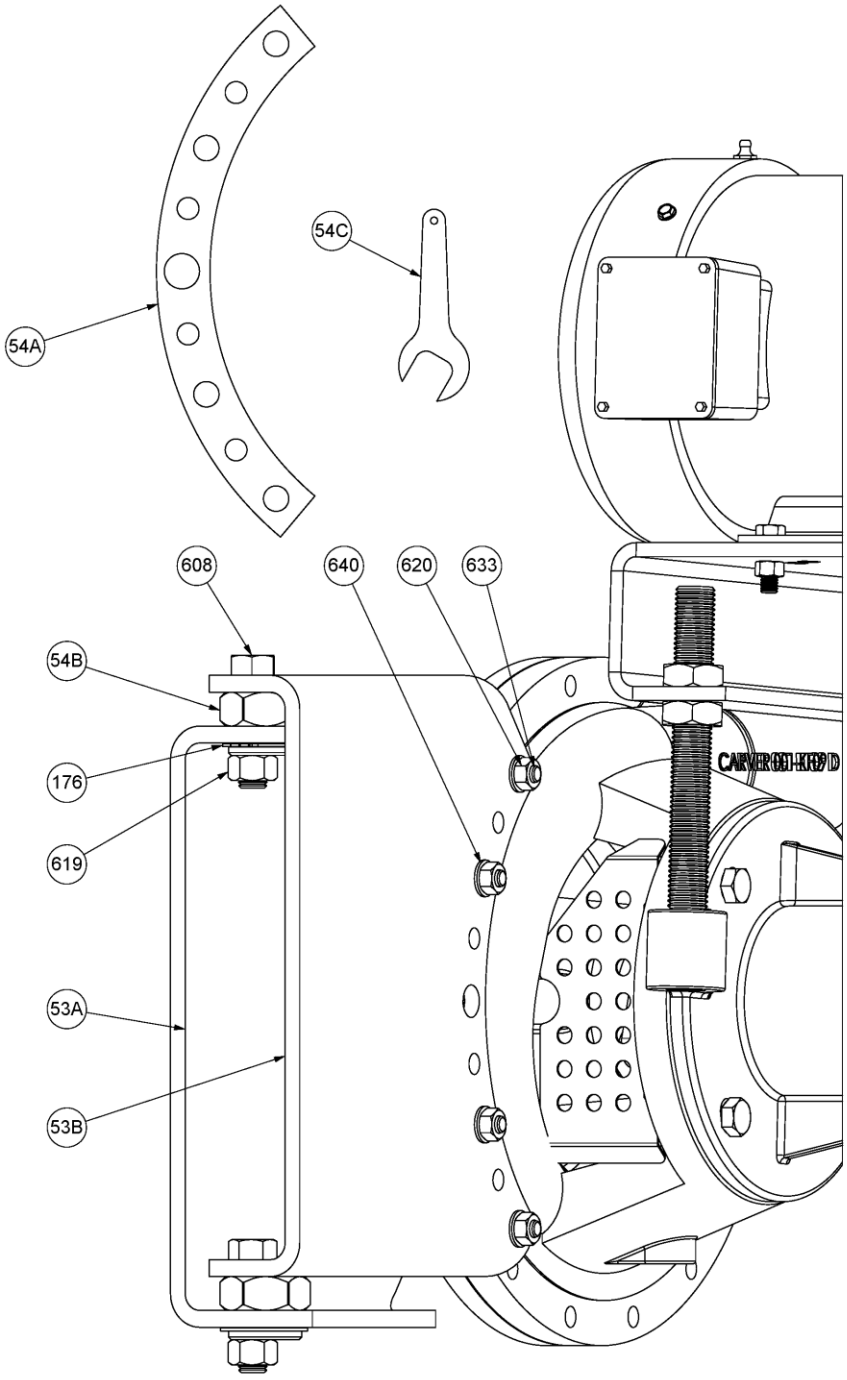


Figure 17. Optional Swing-out Assembly

250-KF-005

U.S.CUSTOMARY

Pump Size	Max. Wt, lbs.	Discharge		Dimensions (inch)								Flange Mounting Bolts		
		Size	Connection	A	B	D	E	H	PW**	T	TT	Diameter	Pitch	Length
1x8	340	1	Flanged ANSI 125# FF	13.50	10	11.75	4.00	0.47	0.25	0.375	1.500	M10	1.5	50
1½x9	400	1 1/2	Flanged ANSI 125# FF	15.25	12	14.25	4.25	0.47	0.25	0.375	1.750	M10	1.5	60
2x9	550	2	Flanged ANSI 125# FF	15.25	12	14.25	4.50	0.47	0.25	0.375	2.000	M10	1.5	65
2½x9	550	2 1/2	Flanged ANSI 125# FF	15.25	12	14.25	4.50	0.47	0.25	0.375	2.000	M10	1.5	65
3x9	750	3	Flanged ANSI 125# FF	20.50	15	18.75	5.25	0.88	0.25	0.375	2.250	M20	2.5	85
4x9	760	4	Flanged ANSI 125# FF	20.50	15	18.75	5.25	0.88	0.25	0.375	2.250	M20	2.5	85

METRIC

Pump Size	Max. Wt, kg.	Discharge		DIMENSIONS (mm)								Flange Mounting Bolts		
		Size	Connection	A	B	D	E	H	PW**	T	TT	Diameter	Pitch	Length
1x8	150	25	Flanged DIN PN10	343	254	298	100	12	6	10	38	M10	1.5	50
1½x9	190	40	Flanged DIN PN10	387	300	362	110	12	6	10	44	M10	1.5	60
2x9	250	50	Flanged DIN PN10	387	300	362	115	12	6	10	51	M10	1.5	65
2½x9	250	65	Flanged DIN PN10	387	300	362	115	12	6	10	51	M10	1.5	65
3x9	350	80	Flanged DIN PN10	521	380	476	135	22	6	10	57	M20	2.5	85
4x9	350	100	Flanged DIN PN10	521	380	476	135	22	6	10	57	M20	2.5	85

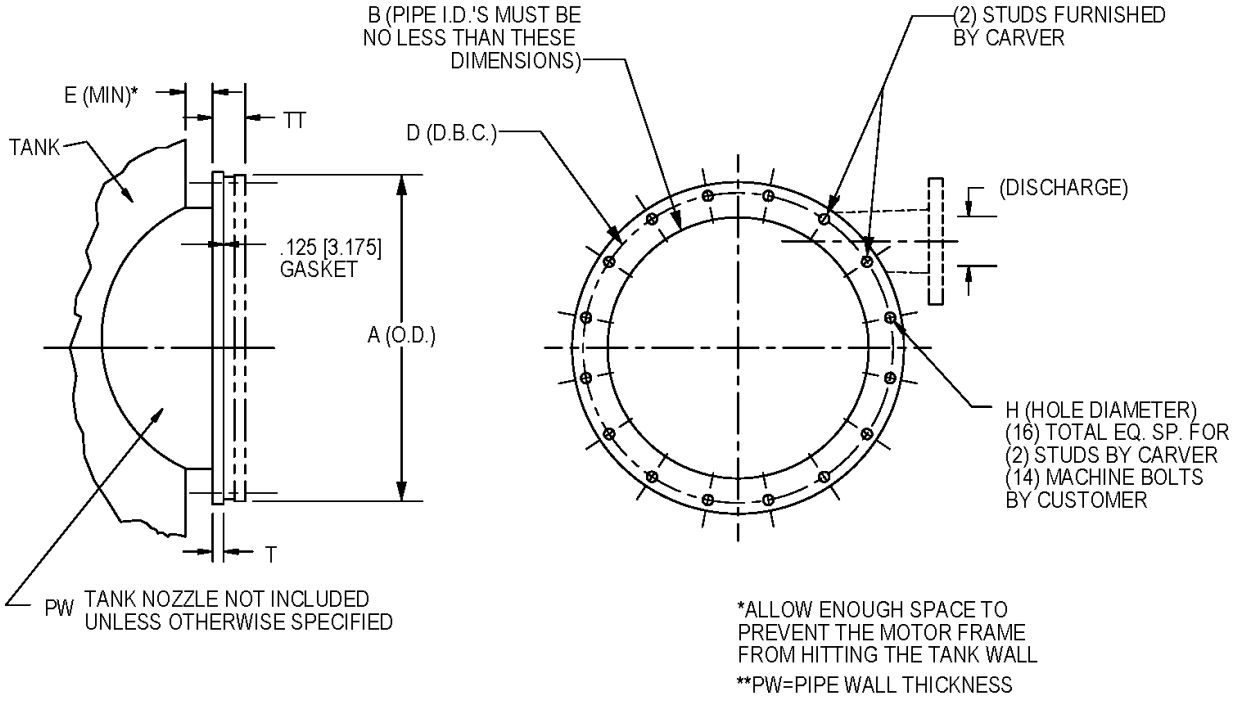


Figure 18. Model 855 Tank Mounting Flange

ANSI SIZE/DIN SIZE	1"/25MM	1.5"/40MM	2"/50MM	2.5"/65MM	3"/80MM	4"/100MM
ANSI HOLE	5/8"	5/8"	3/4"	3/4"	3/4"	3/4"
DIN HOLE	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"
CARVER HOLE	3/4"	15/16"	7/8"	7/8"	15/16"	1"
ANSI D.B.C.	3-1/8"	3-7/8"	4-3/4"	5-1/2"	6"	7-1/2"
DIN D.B.C.	3-3/8"	4-3/8"	4-15/16"	5-3/4"	6-5/16"	7-1/16"
CARVER D.B.C.	3-3/16"	4-1/8"	4-7/8"	5-5/8"	6-1/8"	7-1/4"
ANSI THICKNESS	.56"	.69"	.75"	.88"	.94"	.94"
DIN THICKESS	.63"	.63"	.71"	.71"	.79"	.79"
CARVER THICKNESS	.63"	.69"	.75"	.88"	.94"	.94"

ALL DIMENSIONS ARE DIAMETERS

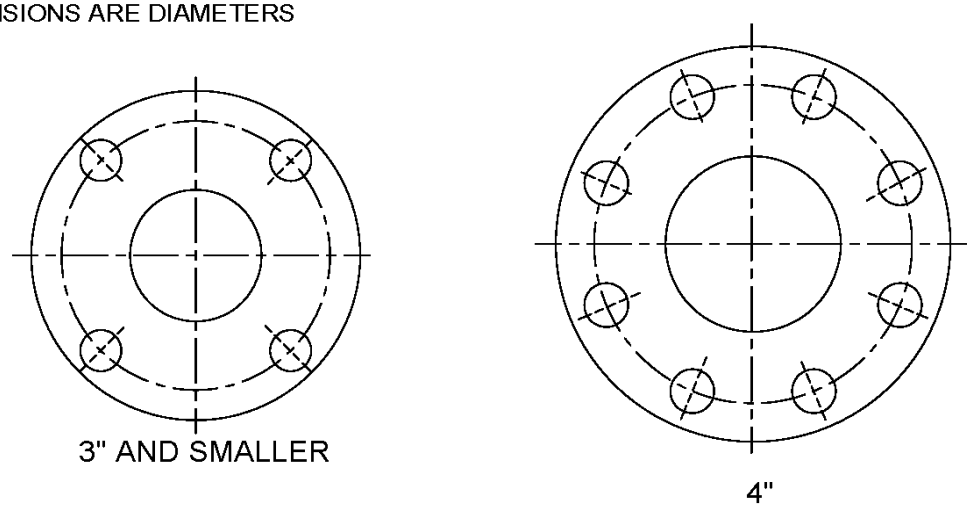


Figure 19. Model 855 Universal Discharge Flange

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CARVER PUMP™

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