

HS430, HD300 and SD300 Vacuum Pumps

Installation Operation Maintenance

Company _____

Contact _____

Date _____

Model _____

SO (build) _____

SO (sales) _____



MHV Corporation

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Warranty Period

Each product sold by Metallurgical High Vacuum Corporation (MHV) is warranted to be free from manufacturing defects for a period of twelve (12) months of operation within eighteen (18) months from the date of shipment.

Mechanical seals are non-warranty items and are not covered under the warranty.

Warranty Repairs

Problems occurring within the warranty period should be first discussed with MHV personnel. MHV will determine whether the pump is to be repaired in the field or returned to MHV for service.

Freight costs are the owner's responsibility.

Non-Warranty Repairs

MHV can provide rebuilding services. Evaluation is at no cost, and a detailed repair quotation is provided. Usual turnaround time is 2 to 4 weeks, but a quicker turnaround is possible.

Repair warranty is for a period of twelve (12) months of operation within eighteen (18) months from the date of shipment.

All dimensions in this manual are given in inches unless specified otherwise.

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Introduction

Congratulations on purchasing an MHV oil-sealed rotary piston vacuum pump. The HS430, HD300, and SD300 all use a proven rotary piston design for excellent reliability even in adverse operating conditions. The HD300 and SD300 operate at a 300 cfm displacement, powered by a 10 hp motor. The HS430 design runs at a faster speed giving 430 cfm displacement and requires a 20 hp motor. On all pumps, MHV installs premium, high-efficiency TEFC motors as a standard component.

Materials of construction include:

- Class 40 pearlitic grey iron for main casting, eccentrics, piston slides, seal caps, and side covers
- 4140/4150 chrome moly steel, heat treated to Rc28-32 hardness (100,000 psi yield strength) for main shaft, hinge bars, hinge bar spacers, and oil pump drive stub.
- 1018 mild steel for valve decks and caps, spacers, etc. Valve seats are carburized and hardened
- 5052 H32 aluminum for the oil mist separator
- Welded A36 mild steel for the main oil reservoir and motor mount
- 1010 mild steel, formed and welded for the belt guard
- 6061-T6 aluminum for the oil pump drive adapter and oil separator base

For the HS430 and HD300 models, there is full pressure oiling on the eccentrics, hinge bars, and piston-slide tangs which eliminates dry start up galling and scoring problems. In the event of oil pump failure, a fail-safe lubrication system takes over, and the pump is lubricated by atmospheric pressure. Duplex spin-on oil filters eliminate the need for external oil filtration. Figures 5.0 and 6.0 show the lubrication schematics.

An FFT (Fast Fourier Transform) vibration spectrum is furnished with each pump. We balance internals to hold primary imbalance velocity to .005 inches/sec or less; typically .003 inches/sec. No attempt has been made to balance out secondary vibrations which are caused by the reciprocating masses inside the pump.

The footprint of the HS430 is slightly wider than other popular 300 cfm pumps it replaces, but otherwise there is complete interchangeability. The pump internals are dimensionally interchangeable with other popular 300 cfm models and have been modified for full pressure lubrication.

 **Read all instructions in this manual before attempting to use the pump.**



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Theory of Operation

Figure 1.0 shows the operation of a typical oil-sealed rotary piston pump. A mainshaft is keyed to an eccentric that carries the piston-slide around the inside of the main pumping chamber. Clearance between the piston and chamber is approximately .005-inch.

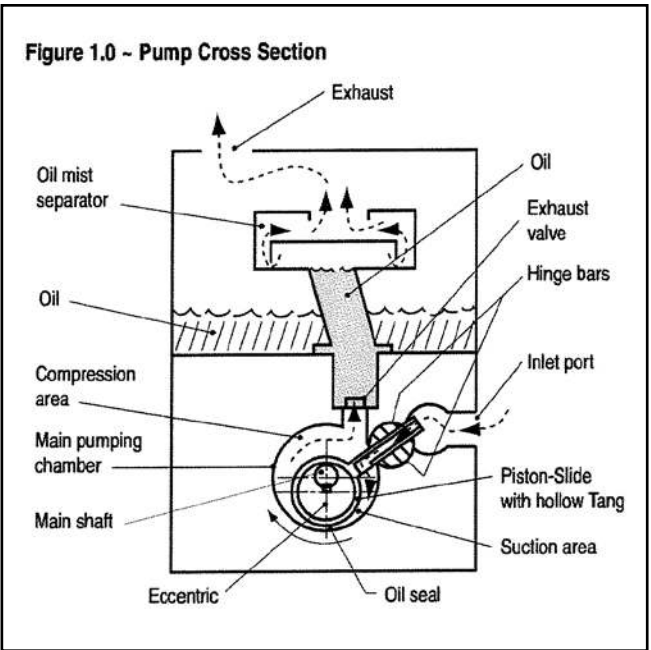
Oil is metered in such a way as to partially flood the pumping chamber and maintain an oil seal on the piston big end. Additional oil seals the hinge bars to the tang of the piston-slide and the hinge bars to their bore. There is full water jacketing around the main pumping chamber (not shown) which carries off the heat of compression.

As the eccentric pulls the piston down into the main chamber, a suction area is developed which causes the pumped gasses to flow into it through the hollow tang of the slide. Half-moon shaped hinge bars locate the tang and seal it. The compression area becomes smaller with eccentric rotation, and the compressed gas and oil mixture are forced out the exhaust valves. An oil mist separator uses centrifugal force to aid in separating the oil droplets from the gas stream. Oil flow is typically 4 gallons per minute through the pump.



Specifications - HS430

Vacuum	
Pump speed	707 rpm
Displacement	414 cfm
Base pressure	≤ 50 millitorr (cold) ≤ 100 millitorr (hot)
Weight	
Dry	2,300 pounds (1,045 Kg)
Materials	
Main pump body	Class 40 grey cast iron
Moving parts	Grey cast iron and 4150 heat treated steel
Shaft seals	Mechanical - carbon faces with Viton® O-rings Ceramic coated seal ring
Temperature	
Minimum start	55°F
Operating range	130° - 170°F
Cooling water flow	+ 2 gpm
Utilities	
Motor	20-HP TEFC premium efficient
Input voltage	480 VAC / 3 phase / 60 Hz other voltages available
Power usage	22kVA, 15kW
Oil capacity	13 gallons
On-board gauges	
Motor run hour meter	
Lube oil pressure	
Oil filter delta P	
Oil temperature	



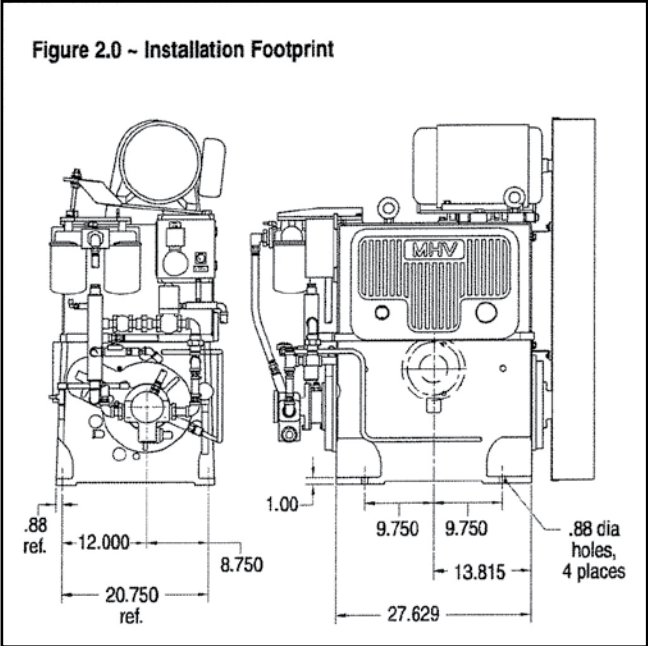
Specifications - HD300

Vacuum	
Pump speed	490 rpm
Displacement	300 cfm
Base pressure	≤ 50 millitorr (cold) ≤ 100 millitorr (hot)
Weight	
Dry	2,300 pounds (1,045 Kg)
Materials	
Main pump body	Class 40 grey cast iron
Moving parts	Grey cast iron and 4150 heat treated steel
Shaft seals	Mechanical - carbon faces with Viton O-rings Ceramic coated seal ring
Temperature	
Minimum start	55 F
Operating range	130 - 170 F
Cooling water flow	= 2 gpm
Utilities	
Motor	10-HP TEFC premium efficient
Input voltage	480 VAC / 3 phase / 60 Hz other voltages available
Power usage	11.6kVA, 7.5kW
Oil capacity	13 gallons
On-board gauges	
Motor run hour meter	
Lube oil pressure	
Oil filter delta P	
Oil temperature	



Specifications - SD300

Vacuum	
Pump speed	490 rpm
Displacement	300 cfm
Base pressure	≤ 20 millitorr
Weight	
Dry	2,200 pounds (1,000 Kg)
Materials	
Main pump body	Class 40 grey cast iron
Moving parts	Grey cast iron and 4150 heat treated steel
Shaft seals	Mechanical - carbon faces with Viton® O-rings Ceramic coated mechanical seal
Temperature	
Minimum start	55°F
Operating range	130° - 170°F
Cooling water flow	= 2 gpm
Utilities	
Motor	10-HP TEFC premium efficient
Input voltage	480 VAC / 3 phase / 60 Hz other voltages available
Power usage	11.6kVA, 7.5kW
Oil capacity	12 gallons
On-board gauges	
Oil temperature	



Installation

FOUNDATION

Bolt or clamp the pump to a firm, even foundation. Grouting or spring mounts are not normally required. The pump weighs approximately 2,300 pounds ready-to-run.

On wood, use 5/8-inch diameter lag screws. On concrete, place a rubber mat under the pump of 1/8-inch thick neoprene, extending approximately one inch beyond the pump base casing. Hold down the pump with clamp bars straddling over the pump or with bolts such as Red Head® or similar concrete anchors. Do not use larger than 1/2-inch bolts as this will allow for some misalignment on the bolt centerlines.

- ❑ See Figure 2.0 for bolting centerlines.
- ❑ All pumps use the same mounting pattern.

If bolting to an unmachined weldment, attempt to insert a .005-inch feeler gauge around the entire base before tightening the mounting bolts. Shim as required before final tightening of the hold-down bolts. Mount pads should be machined flat and parallel within .005-inch tir.

INLET PIPING

Install a flexible connector with 4-inch flanges on the inlet using a Parker Gask-O-Seal® or similar type gasket. If the pump is connected directly to a blower, install a “Dresser” or similar connector in the rigid piping. A flexible connector should be used at the blower inlet.

MHV discourages the use of flat rubber gaskets for intake line sealing. If used, they must be installed dry. The pump will shoot a considerable amount of oil into the inlet piping. For this reason, elevate the inlet line at least 24-inches above the pump inlet centerline. Do not make long horizontal runs at the same elevation as the pump inlet.

Inlet piping must be thoroughly cleaned of weld spatter, loose pipe scale, rags, etc. **These items will score the piston-slide and result in a non-warranty repair.**

PARALLEL OPERATION

If the pump is to be installed in parallel with another, inlet lines between pumps must elevate to a common header or a suitable baffle installed in the horizontal run to prevent oil migration. This migration is significant: it can be up to 4-5 gallons in 24 hours. If left unattended, one pump will starve for oil while the other overflows.

WATER

Plumb water supply and return lines. Requirements are: 1.5-2 gallons per minute at 70-80°F inlet temperature. Do not pressurize the return above 50 psi or the core hole plugs in the main casting may be blown out. MHV installs a “water miser” modulating valve as standard equipment on the HS430, HD300 and SD300 pumps.



Do not plumb water into the gas ballast check valves. Doing so will fill the pump internals with water and corrode the interior.

City water, well, or “tower” water is not recommended due to high oxygen content in these waters. A high oxygen content will lead to a premature scale buildup in the water jackets. MHV recommends a closed loop process water system which can have proper anti-corrosion treatment and low oxygen content which, in turn, transfers heat to another water system via a shell and tube or plate type heat exchanger or a simple fan coil. A chiller can be used, but water supply temperature should be approximately 60-75°F for optimum “cold start” capability.

ELECTRICAL

480-VOLT OPERATION

The 20-hp motor running on 480 volt AC, 3-phase, 60-Hertz source requires a NEMA size 2 starter, #8 thhn motor feeders, and 1/2-inch conduit. On 480 volts, the SD300 10-hp motor will require a NEMA size 1 starter and #10 thhn motor feeders. Existing 10-hp starters and wiring can be used on the 20-hp motor with up-sized overloads, but will not be to N.E.C. code.

Figure 3.0 and 3.1 shows the internal wiring for the hour meter and other electrical components.



The standard installed premium, high-efficiency TEFC motor is a three-lead 460-volts only motor. 230-volt operation will require a different motor and oil solenoid coil.

230-VOLT OPERATION

Operation on 230-volts, 3-phase is becoming increasingly rare. Input voltage must be discussed with MHV, preferably before ordering. To use 230-volt, 3-phase input, follow three steps:

1. Since the standard motor is 460-volt, 3-phase only, a dual voltage motor is required.
2. The oil solenoid coil must be changed to 230-volts on the SD300.
3. The control transformer must be re-wired for 230-volts on the primary.

EXHAUST

MHV recommends a 3-inch oil mist separator piped into the pump exhaust line. There must be a drip leg installed in any external exhaust piping to prevent condensate from running into the separator or pump. If exhaust runs are longer than 20-feet, up-size the line to 4-inch (4-1/2-inch O.D.)

Figure 3.0 ~ Wiring Schematic, HS430 and HD300

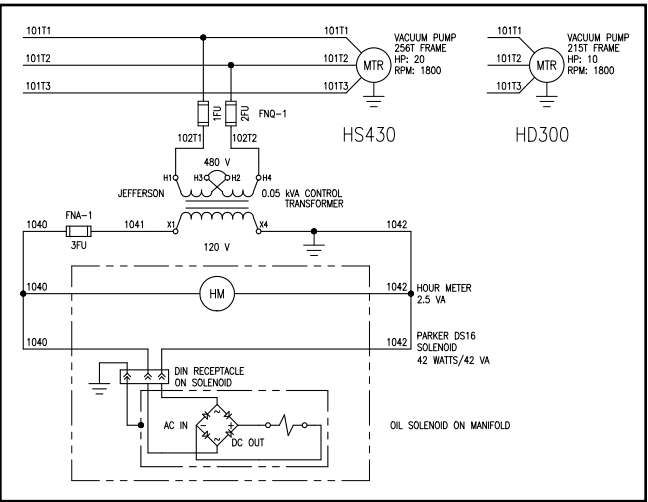


Figure 3.1 ~ Wiring Schematic, SD300

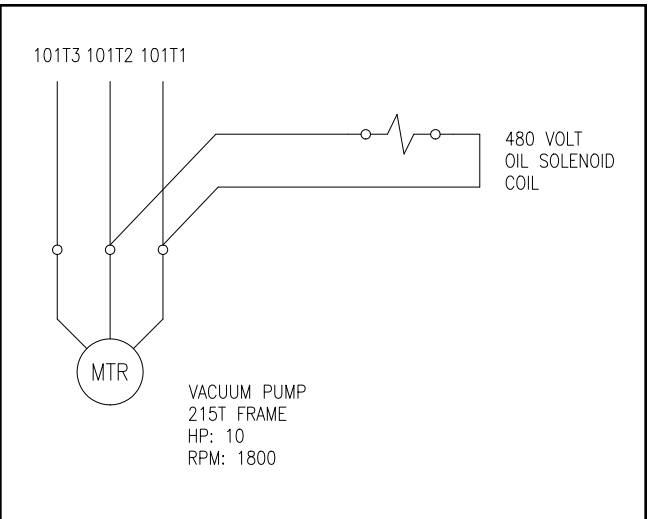
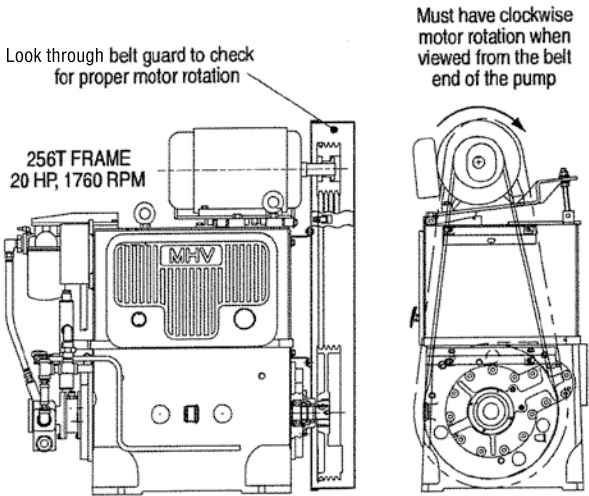




Figure 4.0 - Motor Rotation



Startup

1. Remove belt guard and momentarily activate or “bump” the motor.

- ☐ Must have clockwise motor rotation when viewed from the belt end of the pump.
- ☐ Reverse any two motor leads to correct.
- ☐ Make sure oil solenoid valve coil or on-board transformer is wired to any two motor leads.
- ☐ Motor grounding must be in accordance with N.E.C. code.

 The belt guard must be replaced before operation. Never run the pump without the belt guard in place. Injury may occur without the belt guard installed.

2. Oil level should be at middle of sight glass with pump basing. During roughing, the oil level will rise considerably.

3. Verify that cooling water is available. Refer to the installation section for proper water use. There is a weep hole in the water miser valve that will always flow about ½ GPM.

4. Start the pump.

- ☐ Look at the oil flow sight dome to verify oil flow.
- ☐ Make sure the red LED is lit on the solenoid valve. (HS430 and HD300)

 If there is no oil flow, **stop the pump** and troubleshoot.



5. On the HS430 and HD300 pump models, verify that oil manifold pressure is 10-20 psig with oil cold (70°F).

6. On the HS430 and HD300 pump models, verify that oil filter delta P gauge is at close to zero psi, which means that the filters are clean.

7. On the HS430 and HD300 pump models, verify that the hour meter is running by watching for a change in the “tenths” position.

8. Check the current draw on the motor. See Amps/Phase table.

 Slight voltage variations will cause large current variations.

9. After an hour or two of running, the “water miser” valve should start to open. Verify water flow through the pump. At blank-off conditions, the heat load is low and water flow will be less than 1/2-gallon per minute at 150°F oil temperature. Note that the weep hole in the water miser valve will always flow about ½ gallon per minute.

Amps/Phase at 480 volts Oil at 150° F		
Model	Roughing	Basing
SD300 & HD300 10 hp	13-14	7-8
HS430 20 hp	18-20	10-12



Operation

Due to excess drag caused by cold oil, the pump must be at 55°F or above prior to starting. Starting at lower temperatures will overload and damage the motor. Under cold start conditions, circulate hot water through the pump cooling jacket to increase the oil temperature above 55°F. Optional oil reservoir cartridge heaters are available for cold start applications.

Oil manifold pressure depends on oil temperature and whether or not the pump is roughing or basing. With oil at 70-80°F, oil pressure will run 10-20 psi. With oil at 140°F, manifold pressure will drop to 6-8 psi. If oil pressure is in the vacuum range, it indicates the internal oil pump is not running and you are lubricating via the vacuum differential. **Under these conditions, there is no oil filtration. This must be corrected as soon as possible.**

Two manual gas ballast valves are provided, one on each end of the pump. Normally these valves are cracked open slightly to silence the “oil slap”. MHV recommends these valves always be adjusted slightly open. This will prevent condensation of water vapor during the compression stroke of the pump, thus allowing water vapor to pass through the pump. Note that although no water will condense in the pumping chamber, it will condense as soon as it leaves the valve deck and finds a surface below 212°F.

If a large water load turns the oil “milky”, open the gas ballast valves an additional amount. The oil will usually clear up in 10-20 minutes. Extra large water loads will require an oil change, possibly several, to achieve acceptable base pressures. Under these conditions, it’s always a good idea to remove the inspection cover to allow thorough cleaning of the oil reservoir inside surfaces. Use shop towels for clean up. Do not use solvents, which will contaminate the oil and raise the base pressure.

Gas ballast will increase the base pressure of the pump, but this is of little consequence if a rotary lobe blower is also used.

In a 5-day, single-shift operation, let the pump run overnight and throughout the weekends.



Positive Pressure Lubrication System
Operation Models HS430 and HD300

A crescent-type positive displacement oil pump is driven by the dead end of the vacuum pump. This pump has flooded suction to reduce cavitation with cold oil. An integral relief valve is mounted on the pump and bypasses oil flow around the pump under cold start conditions. This relief is factory set to approximately 50 psi with oil at 70°F or below.

Oil flows past the spring loaded check having a 20 psi cracking pressure. This check eliminates the need for an oil solenoid valve because, when the pump is stopped at full vacuum, there is not enough differential to open the check. (The maximum differential is 15 psi.) Oil then flows to the duplex oil filter. The filter has integral bypass valves set at 25 psig to allow oil to bypass the elements as they plug from dirt. The Filter Fink® differential oil pressure gauge measures the differential across the filters. The green-to-red transition on this gauge corresponds to 5 psid.

Oil from the duplex filter then flows to a distribution manifold. Fail-safe oil flows into this manifold through another oil solenoid valve which is open during normal operation. Manifold pressure normally holds the check closed so oil must be supplied through the filter. If the oil pump fails, the check opens and the pump is lubricated via the oil solenoid valve. Note that no oil filtration occurs during this mode of operation. The manifold is also used as a well for the “water miser” temperature sensing bulb.

There are two oil feed lines: one goes to the pump adapter and the other goes to the drive side. A flow indicator on the drive end oil feed line is piped in to give a visual flow indication. The manifold pressure gauge is also tapped into a port on the manifold. Oil pressure varies with oil temperature. Typically, oil pressure would be 10-12 psi at 70°F oil temperature, which drops to 3-8 psi with 150° F oil temperature.

An acid filter is installed on the HS430 and HD300 pumps.

- HS430 exploded view page 29
- HD300 exploded view page 37

The acid filter shown in the lubrication schematic is teed into the oil pump discharge before the 20 psi check valve. The filters use a zinc treated filter media to filter and neutralize acid. MHV recommends changing the filter when the particulate filters are changed.

Figure 5.0 ~ Lubrication Schematic

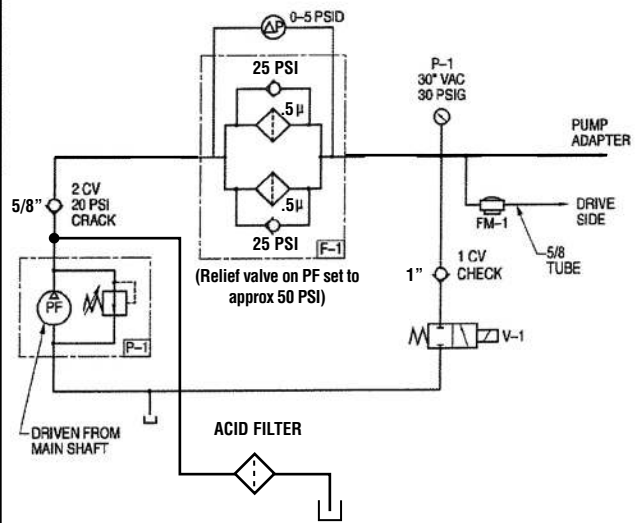
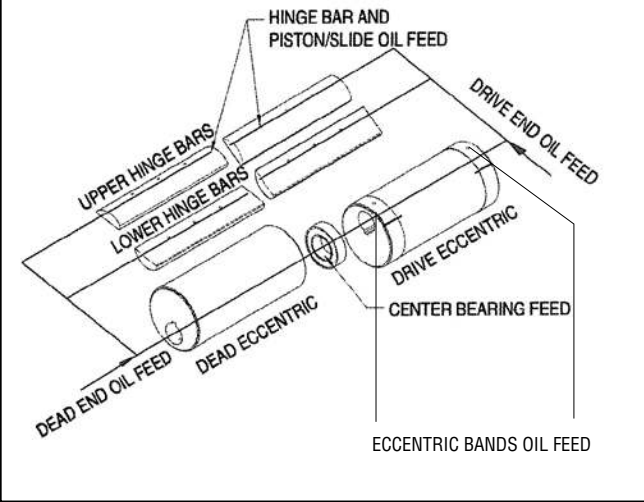
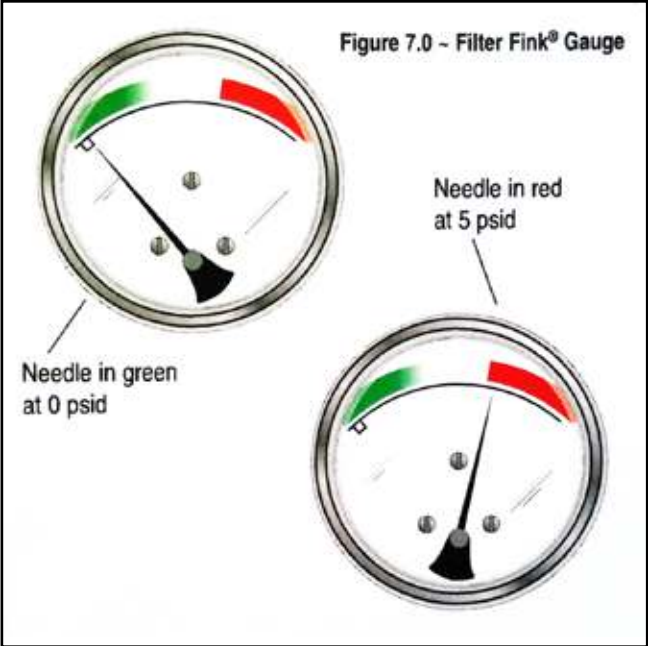


Figure 6.0 ~ Internal Oiling Flow Diagram





Oil Service Schedule	
Service	Suggested Interval
Vacuum Heat treat furnace	1500-2000 hours
Metallizer	2000-2500 hours
Severe service, plasma spray, vacuum induction furnace	Every heat or cycle

Filter Element Data			
MHV Part #	BETA 2-50% REMOVAL		
	BETA 75-98.7% REMOVAL	BETA 200 - 99.5% REMOVAL	
FLT-430-.5 mic	.5µ	3µ	5µ
FLT-430-3 mic	3µ	10µ	—
FLT-PH-725	10µ	—	40µ

We recommend starting with the .5 micron element. If plugging occurs within a few hours, a coarser element can be tried. The FLT-PH-725 is not recommended.

Maintenance

Keep a log book on the pump. Make entries as they occur. Include items as shown on the suggested Maintenance Log sheet, page 60. Check the Filter Fink® gauge for a “delta P”, indicating a need to change the filters and oil. There is an internal bypass in the filter housing that opens at 25 psi differential. When that occurs, no filtration is taking place.

Change oil at least every time the filters are changed. Use MHV FORMULA FR oil. The oil filters are part number FLT-430-.5 mic, two are required. See chart below for suggested oil change intervals.

MAINTENANCE LOG ITEMS

- ☐ Record date and pump hours.
- ☐ Check Filter Fink® and record condition.
- ☐ Inspect for oil leaks around the flywheel. Oil leaks indicate a bad shaft seal. A special tool is required to press the new seal into the seal cap, see Service Parts below.
- ☐ Change clappers and valve springs every 8500-9000 hours. See page 16 for instructions.
- ☐ Inspect drive belts while changing the clappers and valve springs.

SERVICE PARTS

Item	Description	Part Number
1.	FORMULA FR oil 5 gallons 55 gallons	OGL-5FR OGL-55FR
2.	Oil filters, each, 2 required Standard, 0.5 micron Optional, 3.0 micron Acid filter element	FLT-430-.5 MIC FLT-430-3 MIC FLT-ACID
3.	Seal cap tool Bearing nut tool	ST-1051 ST-1058
4.	Valve disks (clappers) Standard High Temperature	SK-412H11-009 SK-212H11-006
5.	Valve springs Corrosion resistant	SK-0179H
6.	Drive belts 300 cfm 430 cfm	VB-T-B105 VB-T-B108
7.	Maintenance Kit	Contact factory for application



Internal Dimensions
(inches)

Item	Size new	Allowable wear dimension
1. Main shaft		
end bearing seat	1.9674	1.9671
center bearing seat	2.1648	2.1646
under eccentrics	1.999	1.998
keyseats	.4385	.4390
2. Eccentrics		
through bore	2.0015	2.0025
OD of bearing band	5.999	5.998
3. Piston-slide		
overall length	12.994	12.992
bores	6.005	6.006
tang thickness	1.497	1.495
4. End plate		
bearing bore	3.5440	3.5455
5. Main casting		
hinge bar bore	3.501	3.503
6. Hinge bars, standard		
round-to-flat	.995	.994
length	12.991	12.989
7. Hinge bar		
total clearance	.009 / .014	.015
8. Eccentric / piston-slide		
clearance	.003 / .006	.008
9. Center bearing retainer		
bore	3.9373	3.9379

Notes on Measuring Clearances
(Numbers refer to item in table above.)

7. To gauge hinge bar clearance, first wipe all oil from eccentric, piston-slide, and hinge bars. Insert an eccentric over the main shaft and slide on a piston slide so that tang is about 1-inch from “home”. Lay in the lower hinge bar and rest tang against it. Slide in the top hinge bar and place a feeler between the upper portion of the tang and lower part of the top hinge bar. If a .015-inch feeler can be inserted, hinge bar bore/tang rework is needed.

8. Lay down a piston-slide and insert an eccentric. If an .008-inch feeler can be inserted between the top of the eccentric and piston-slide, eccentric and/or piston slide bore rework is necessary.

9. Gauge the 3.9373 bearing bore dimension on the end plates by first miking a new bearing and using it as a plug gauge. If a .0015-inch feeler can be inserted between the bearing and the bore, the bore will need to be sleeved and re-sized. Note that all bearing ODs must be a slip fit in their bores. All bearing IDs must have a light press fit.



Troubleshooting

There are three main problem areas:

1. Insufficient or low vacuum
2. Noise
3. Oil leaks

Low Vacuum

Low vacuum is usually the result of system leaks and is rarely a pump problem. Therefore, attempt to isolate the source of the problem before placing a service call for the pump.

Test the pump by installing a suitable blank-off flange with an attached gauge. The blank-off flange should be a 4-inch 150-pound forged steel blind flange with an O-ring groove for sealing. Thin, flimsy flanges will distort, leak, and show poor vacuum. If a flat gasket is used to seal the flange, rather than an O-ring, it must be installed dry. Make sure there's a hole in the flat gasket so the gauge will read.

The pump has a KF-16-inch gauge port on the inlet side. When using this gauge port, install a 90° elbow before the gauge to keep oil from entering the gauge and causing a high vacuum reading.

Use a thermocouple or pirani gauge known to be accurate. Verify the gauge by using it on another pump known to be working properly, or use a helium leak detector to pump it down under 1.0 millitorr. These gauges are subject to oil contamination which will cause the gauge to read high indicating a poor vacuum. A dial type 0-30" Hg gauge is not recommended since they are generally grossly inaccurate at close to 30" Hg. A McLeod gauge is a good choice; however, it should be pumped down for several hours before taking a reading so the desiccant can be thoroughly out gassed.

Normal base vacuum with cold oil should rapidly approach 50-millitorr and slow down after that. With the gas ballast valves closed, there should be a light hydraulic "slap" as base vacuum is reached. As the oil heats up, blank off vacuum will increase to to around 100 millitorr on the HS300 and HD300 models.

A helium leak detector can be connected into the pump test port and the pump checked for leaks on the shaft seal, end plates and oil lines.

To verify leak detector operation:

Spray a small amount of helium into the gas ballast check valve port and quickly cover the tapped hole in the check valve using your thumb. Quickly open and close the gas ballast valve. You should immediately "see" the helium on the leak detector as a large 10^{-6} cc/second leak.

Poor base vacuum is usually due to contaminated oil, a leak at the shaft seal, or very large internal clearances. Heavy gas ballasting will usually clear up an oil contamination problem but several oil changes may be necessary if there has been water contamination.

After the problem has been identified to reside within the pump, contact MHV for service.



Noise

As base pressure is reached, an "oil slap" noise will be heard, which sounds like a light tinging. It is caused by the piston-slide impacting the last portion of the oil trapped in the main pump chamber and forcing the exhaust valves open. This noise is eliminated by bleeding in a small amount of air through the gas ballast valve. This causes air pockets to form in the residual oil thus cushioning the piston-slide as it completes its stroke.

As the internal parts and bearings wear, you will hear heavier knocking which will not be removed by gas ballasting. At this point, the lower end of the pump should be torn down, bearings replaced, and eccentric to piston/slide and hinge bar bore clearances verified.

Continued operation with heavy knocking will usually result in cracking off the tang of the piston-slide.

Running the pump in reverse rotation will cause a loud "death rattle", but will not harm the pump. It will, however, cause a motor burn out if left unattended.

Oil Leaks

A faulty shaft seal will show as an oil puddle beneath the flywheel.

Keep the pump wiped down so the source of the oil leak can be easily determined.

There are a minimum of NPT threads on the pump, so oil leakage in this area should not be a problem.

On the standard duty SD300 pump, there can be internal leakage through the oil solenoid valve. This will allow the pump to fill with oil if stopped under vacuum. Hard starting will result as the oil is moved into the upper reservoir during the first few revolutions. To check for leakage in the oil solenoid valve, stop the pump under vacuum and note the oil level in the reservoir. Wait 60-75 minutes and recheck the level. Leaky exhaust clappers will drain the valve box but leave the oil reservoir level unchanged. A leaky oil solenoid valve will allow the reservoir level to drop.

Clapper Failure

If the valve clappers disintegrate/break, oil will flood into the discharge area of the pump and be pushed up thru the broken valve port on every pump rotation. This will overload the motor, and make the oil run hot. A clamp-on ammeter on the motor feeders will show a pulsing current peak due to this abnormal oil movement. **Change clappers and springs as soon as possible.**



Teardown

- Nomenclature used:
- SHCS socket head cap screw
 - HHCS hex head cap screw
 - SHSS socket head set screw
 - [Item] refer to exploded view and parts list

VALVE SPRING/CLAPPER REPLACEMENT

1. Drain oil from the pump, approximately 12 gallons.
 - Locate the 1/4 NPT cap [133] on the dead side of the pump above the notch in the endplate [30] and remove it.
 - Drain the valve box by inserting a drain pan under the nipple. Or, a wet/dry vacuum can be used to remove the oil after the oil mist separator is removed in Step 2.
2. Remove the oil mist separator [16].
 - Remove the oil reservoir cover [48] and O-ring [50].
 - Loosen twelve (12) 3/8" HHCS holding the oil mist separator.
 - Slide separator out through the oil reservoir opening.
 - If using a wet/dry vacuum, remove residual oil now.
3. With a suitable light, put your head through the oil reservoir opening, look down in the valve box area and locate the four (4) duplex valve assemblies, see page 33.
4. Remove one duplex assembly at a time.

Bolt specifications

- The four (4) corner bolts [20] are 5/16-18 x 1-1/4" long HHCS SEMS
 - The two (2) center edge bolts [24] are 5/16-18 x 3/4" long HHCS SEMS
5. Replace springs and clappers ON A BENCH.
 - Remove the 5/16-18 x 7/8" long HHCS center bolt [19].
 - Disassemble the top valve cap [21] from the seat.
 - Inspect seats [25] for wear and surface grind, if necessary.
 - Replace the valve springs [22] and clappers [23].
 - Re-bolt the valve cap onto the seat.
 - Check for free movement of the clappers by pushing them up with your fingers.



*It's easy to pinch a clapper during assembly, so MHV strongly recommends working on a bench and **not** in the pump.*

6. Re-install the duplex assembly with a new gasket [26].
7. Repeat the procedure for the remaining duplex valve assemblies.

Valve Spring/Clapper Replacement Schedule

Service hours per day	Suggested Interval 8500-9000 hours
-----------------------	------------------------------------

3-shift schedule
or
24 hour running

Yearly

MHV recommends allowing the pump to run continuously 24 hours per day, 7 days a week.

An exception would be if the pump is going to be out of service for an extended period of five days or more, in which case it could be turned off.



Do not drop anything down the exhaust ports as this will require disassembly of the lower end.

8. Replace the oil mist separator using a new gasket [18].
9. Replace the oil reservoir cover using a new O-ring if the old one has a "flat spot".
10. Fill with new oil.

SHAFT SEAL REPLACEMENT: HEAVY DUTY SEAL

INDICATIONS FOR REPLACEMENT OF SHAFT SEAL:

- A) Oil is leaking from the flywheel side of the pump.
- B) A leak is found in this area using a helium leak detector.
- C) Bearings are worn.



If the bearings are worn, the new seal will fail in a short time. Install new bearings now.

MHV has seen bearing wear so severe that no oil was being drawn into the drive side causing rapid wear of the eccentric and piston/slide bearing areas. In one instance, in a pump with atmospheric oil feed, there was NO oil leaking and the pump was basing at 3000 millitorr.



TO REPLACE THE SHAFT SEAL

1. Open belt guard assembly [42] and lay aside.
2. Loosen top motor mount nuts and thread them up about 1/2".
3. Loosen lower motor mount nuts and thread them about 1/4" down.
4. Grip the end of the motor mount weldment [56] with a large adjustable wrench and move platform up enough to allow swing bolts to be swung clear.
5. Lower the motor mount weldment all the way.
6. Remove the belts.
7. Rotate flywheel [46] so that woodruff key [157] is at 12:00 o'clock.
8. Use hex head driver and remove both SHSS on the taper lock bushing [41].
9. Re-thread in one SHSS and tighten to break the taper.
10. Slide the flywheel and bushing off the shaft.



The flywheel is heavy. For safety, two technicians should remove the flywheel.

11. Remove the woodruff key [157] from the main shaft.
12. Using a suitable dial indicator with a magnetic base, mount so that indicator stylus touches the top of the shaft.
13. Pry shaft up with a suitable piece of wood. There should not be more than .002"-.003" movement if the bearings are good. To pull the bearings with the endplate on the pump requires a special bearing puller available from SKF.
14. Remove inner belt guard [42-inner] if bearings are going to be replaced. Otherwise, leave the inner guard on.
15. Remove the four (4) HHCS on the seal carrier [77] and slide the cap off.
16. Continue with the following procedures for standard, heavy duty, or both types of seals below.

PROCEDURE FOR HEAVY DUTY SEAL

1. In this seal, the spring portion is reversed. That is, the carbon seal ring is pressed into the seal carrier and the rotating portion which is ceramic coated is set screwed to the main shaft and is spring loaded.
2. To install this seal, lightly lubricate the seal bore in the seal carrier with vacuum grease.
3. Place the carbon insert with its O-ring on top of the bore.
4. Make sure the mating surfaces are clean and dry, then place the rotary unit on the carbon, grey side facing the carbon.
5. With finger pressure, gently press down and use the rotary unit to push the carbon ring until it seats in the seal carrier. Do not rotate the rotary unit!
6. Slide the rotary unit onto the main shaft. Use a small amount of vacuum grease on the shaft and make sure the O-ring is installed on the ID groove.
7. Push on the rotary unit until it bottoms on the shaft step, then tighten the two (2) 10-32 SHSS in the rear ring.
8. Install the seal carrier with four (4) HHCS. There should be roughly .040"-.060" preload on either type of seal. You can "eyeball" this before the seal carrier bolts are tightened.

FINAL PROCEDURE

1. Install the woodruff key in the main shaft. If the key has a loose fit, prick punch it until it needs to be tapped in.
2. The flywheel bushing should be slightly expanded by driving a screwdriver into the slit while the bushing is in the flywheel. Do not expand the bushing too much or you will break it in two pieces!

The flywheel is heavy. Two technicians should position the flywheel/bushing on the main shaft.

3. Push flywheel in until the bushing is flush with the end of the main shaft. Make sure the woodruff key is still seated.. It can "walk" out during flywheel installation.
4. Tighten the SHSS alternately to 30 ft-lbs.
5. Belts can be placed over the sheaves and the motor mount raised using an adjustable wrench.
6. Swing the adjusting eye-bolts back into the slots and tighten.
7. Tension the belts so they do not squeak on start up. Do not over tighten.



LOWER END DISASSEMBLY

In normal operation with the usual oil change and valve replacement schedule, there should be no reason to open up the lower end until 25,000 hours have accumulated.

UNUSUAL CONDITIONS REQUIRING LOWER END DISASSEMBLY:

- A) Incorrect oil which has no oxidation additive causing rapid gum formation and seizing of pump.
- B) Ingestion of valve spring parts seizing the pump.
- C) Ingestion of metal slugs through pump inlet seizing the pump.
- D) Rapid wear due to ingestion of metal powder.
- E) Rapid wear of ball bearings due to acid formation in the oil caused by pumping free chlorine which combines with water to form HCl. This is often seen in titanium sponge melting operations.
- F) Rapid wear of bearings caused by acid in the oil and infrequent oil changes (a variant of E above). This is often seen in conventional vacuum furnace operation.
- G) Continued operation with large internal clearances which cause the tang of the piston slide to break off seizing the pump.

TO OPEN UP THE LOWER END

*Drain oil from the pump as detailed in
VALVE SPRING/CLAPPER REPLACEMENT*

1. On the drive side, remove the belts and belt guard completely.
2. Remove the seal carrier, mechanical seal ring, and carbon portions as previously discussed - see SHAFT SEAL REPLACEMENT.
3. Using a drift, push back the locking finger on the bearing washer and remove the bearing nut with a special tool and impact wrench.
4. Remove all the HHCS on the end plate (3/4 socket). Remove oil line.
5. Jack off the head plate with the two (2) 1/2-13 set screws already in the head plate. Alternate from end-to-end to pull the plate parallel to the main body.
6. Grip the end plate and pull it off. Push out the double row bearing and use a bore gage to see if the bore will need reworking.

The usual bore is +.0005" above the bearing diameter. Light surface scoring can be stoned out. Heavy scoring will require a surface grind but do not remove more than .007"

7. Pry off the spacer [74] located next to the eccentric.

8. Insert a suitable drift pin in a tang slot and pry the piston slide off the eccentric.

9. Remove both hinge bars.

10. Grip the eccentric and pull out. A puller may be necessary if the shaft has fretted into the eccentric.



If a puller is needed, use a center saver to prevent damage to the mainshaft center.

11. Repeat the process on the dead side. If the pump has pressure lubrication, all piping, manifolds, oil pump, and the aluminum oil pump adapter must be removed first to gain access.

12. Remove the oil pump drive adapter, if used, so a puller can be positioned on the end of the main shaft.

13. With all the hinge bars removed, the hinge bar spacer "puck" can be slid out.

Using your fingernail, check for "step" wear on the hinge bar bore on each side of the spacer.

- If a worn area is detected, measure the inside hinge bar bore with a micrometer. Wear over .006" requires boring to a standard oversize. Heavy scoring also requires a re-bore.

- MHV has special fixtures which put the bore in its original position and hold the taper to less than .001". Contact factory for details.

14. Remove six (6) SHCS holding the center bearing retainer on the drive side. Tap the main shaft on the dead end to help drive out the bearing retainer. Note: There is a pin which indexes the retainer into the counterbore.

15. The mainshaft can be pressed out of the center bearing and the bearing removed from the retainer.

COMPLETE DISASSEMBLY

1. Do the **LOWER END DISASSEMBLY** first.
2. Remove the oil reservoir cover.
3. Remove the oil mist separator.
4. Remove HHCS bolting the oil reservoir to the main casting.
5. Remove motor, motor mount, Zee brackets for belt guard.
6. Oil reservoir can be removed using a crane.
7. With oil reservoir off, valve assemblies can be removed.
8. Remove ten (10) core hole plugs by using two ball peen hammers, one on the center of the plug, the other hitting the first ball peen.
9. Remove all flush pipe plugs on the main casting.



Reassembly

ALWAYS REMEMBER:

- Flats on hinge bars always face down.
- Vee holes in piston slide always face down.
- Heavy eccentric is always mounted on the drive side.
- Threaded puller holes on both eccentrics always face out.

RECOMMENDED SEQUENCE

*Complete the **BOTTOM END ASSEMBLY** and verify that the pump will turn over. Then continue with the **TOP END ASSEMBLY**.*

BOTTOM END ASSEMBLY

1. Put keys [67] in mainshaft [68] and make sure main shaft slides into heavy [73] and light [66] eccentrics. (The flange on the main shaft butts on the heavy eccentric.) Set mainshaft aside.

2. Prepare the SK-0105 center bearing retainer [70]:

- Push the 22213 spherical roller bearing [69] down into the bearing retainer. This should be a slip fit with approximately .0005" clearance.

- Tap the retainer into its counterbore on the drive side. Make sure the anti-rotate pin aligns properly.

- Install six (6) 1/4-20 x 1-1/4" long SHCS with blue Loctite #242. Tighten to 20 ft-lbs.

3. Remove both shaft keys and slide mainshaft in from drive side. If necessary, tap in until flange seats on bearing.

4. Install keys.

5. Lightly lubricate bearing bands on both eccentrics with vacuum pump oil and slide the heavy eccentric on the drive side, making sure tapped puller holes face out. Use lubricant sparingly and do not allow it to run onto other parts.

6. Do the same thing with the light eccentric on the dead side.

7. Lightly lubricate the hinge bar bore with vacuum pump oil and install hinge bar spacer puck [65] halfway down the hinge bar bore. Use lubricant sparingly and do not allow it to run onto other parts.

8. Install lower hinge bars [64] making sure the flat faces mainshaft.

9. Install both piston slides [63] making sure the Vee holes face down. Slide in the top hinge bars [64] making sure flat faces mainshaft, also.

10. Check hinge bar total clearance by sliding in a .010" feeler between the tang of the piston slide and the upper hinge bar. There should be .010"-.012" total clearance.

11. Install shaft spacers on each end of the main shaft [74]

12. Install endplates [30] using Loctite #515 gasket eliminator sealant applied in a thin bead either on the end plate or the main casting. Gasket sealing surfaces must be clean and free of oil. Torque 1/2-13 HHCS to 25 ft-lbs working in a crisscross pattern.



Make sure jack screws [43] do not protrude beyond the face of the endplate.

13. Install gas ballast valves and piping [145-149] on each side.

14. Install spherical bearings [62] on each side using a special driver tool, available by special order from MHV.

- Install bearing washers and nuts [60,61] on each side.

- Torque bearing nuts to 100 ft-lbs using another special tool ST-1058 and impact wrench.

- Bend over washer lock tabs to hold nuts.

- The pump must turn over freely with both bearing nuts torqued to 100 ft-lbs.

15. Install a woodruff key on the mainshaft and use a suitable wrench to turn over the pump.

16. On the SD300, assemble the dead end cap [174] with a new 249 O-ring [75]. On the HS430 and HD300, assemble the oil pump drive adapter [59] in the main shaft making sure the two flats line up under the SHSS.

- The SHSS should be installed with blue Loctite #272.

- Install a heat-treated square key [58] on the end of the adapter. It should fit snugly so it won't roll out when the pump is pushed on.

17. On the HS430 and HD300, install the aluminum oil pump adapter [122], followed by the oil pump [120].

Install O-rings:

- O-ring [75] between the adapter and the end plate.

- O-ring [121] between the pump and the adapter.

18. On the drive end, install a new mechanical seal - see Shaft Seal Replacement in Teardown. Bolt on the seal carrier with a new 249 O-ring [75].



19. Lower assembly is now complete.

20. Double check:

- Make sure water miser is hooked up and water outlet fittings installed.
- Check for open tapped holes.
- Make sure appropriate plugs are in place.
- Verify that the pump will turn over.

TOP END ASSEMBLY.

1. Complete the bottom end assembly first and verify that the pump will turn over.

2. Bolt on the oil reservoir [13] using guide pins.

3. Re-plumb the oil solenoid valve [115] (SD300), re-plumb the oil lines, oil filter, hoses , oil manifold, etc. (HS430, HD300).

Do this before the back belt guard is installed so it will be easier to tighten the drive side oil line nut.

4. Install core hole plugs [29] and [34] using green Loctite #670.

- Use the two hammer method as outlined in disassembly, but use the flat end of the ball peen against the core plug.

- Hit until center dimple is on the same level as the edge of the plug.

- Do not over deform or plug will leak.

- For long plug service life, use brass core plugs, MHV part numbers CP-1875B and CP-2500B, as required.

5. Attach motor mount, swing bolts, and motor.

6. Bolt on the inner belt guard part of the belt guard assembly.

7. Install flywheel and motor sheave, align the flywheel with the motor sheave within 1/8" and tension the drive belts.

8. Assemble oil mist separator and gasket using twelve (12) HHCS.

9. Bolt on oil reservoir cover. Use two (2) LONG 5/16-18 SHSS as guide "pins". If the oil eye is dirty, press it out and replace it with new one, MHV part number OEY-5582.

10. On the SD300, hook up solenoid valve to any two motor leads. On the HS430 and HD300, hook up the pigtailed to any two motor leads.

11. Prelubricate by pumping oil down open ends of piston/slides (enter through 4" inlet opening). Pump more oil in "pocket" area in front of hinge bars. Turn pump over several times by hand while pumping oil in. Pump in about a gallon of oil.

12. Fill oil reservoir until oil is halfway up oil eye.

13. Install suitable blank-off plate and vacuum gage.

14. Wire motor to temporary starter.

15. Connect water supply to water miser valve and pipe water outlet to suitable drain.

16. Momentarily activate or "bump" the motor and check rotation. Refer to page 8 for Startup checklist.

17. Start pump, verify oil flow on ball flow indicator.

18. Top up oil if needed.

19. Run pump 20 hours:

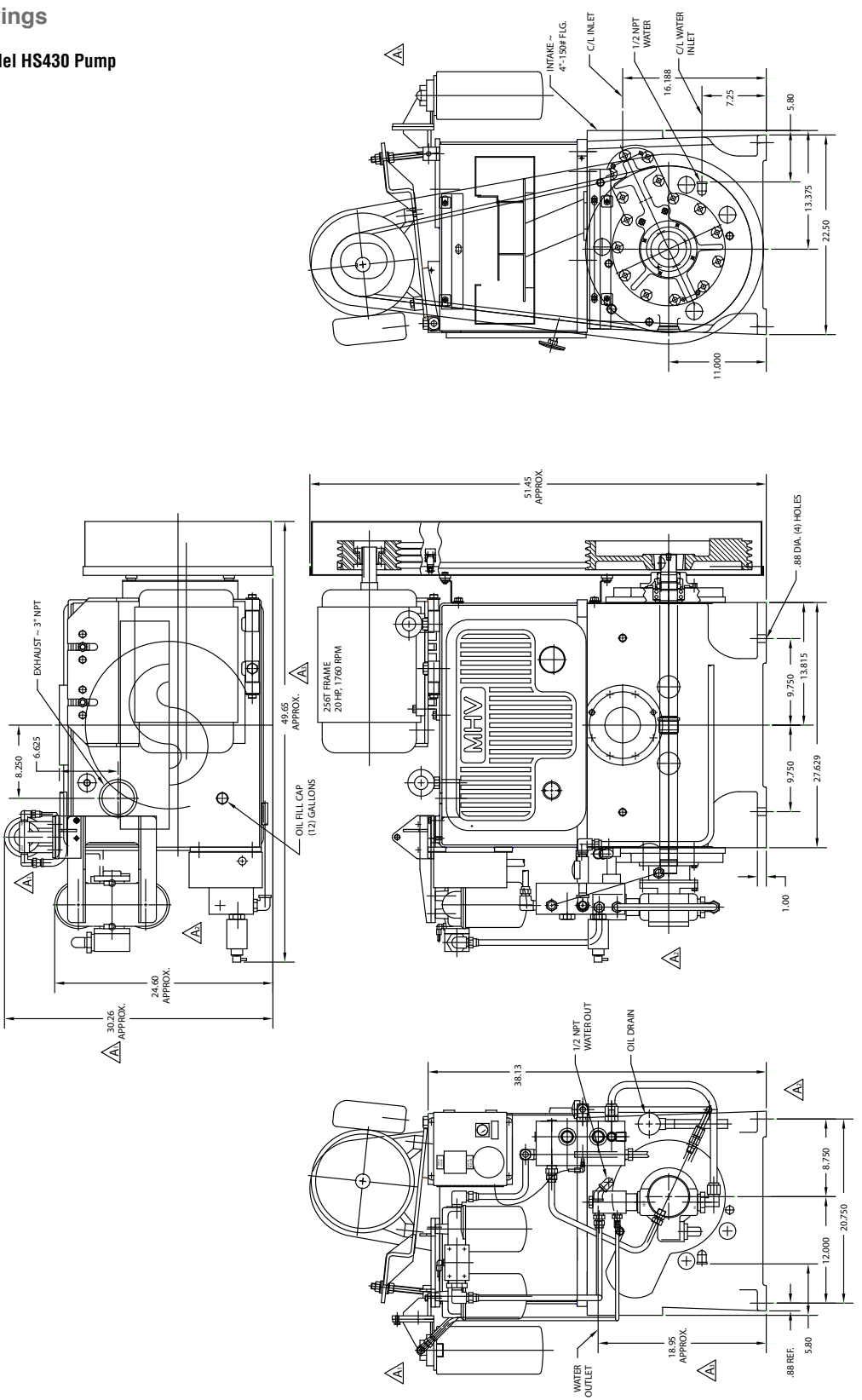
- Helium leak check shaft seal, all oil piping, and end plate seal areas to main casting.

- Check the current draw on the motor. Refer to page 9 for Amps/Phase table.



Pump Drawings

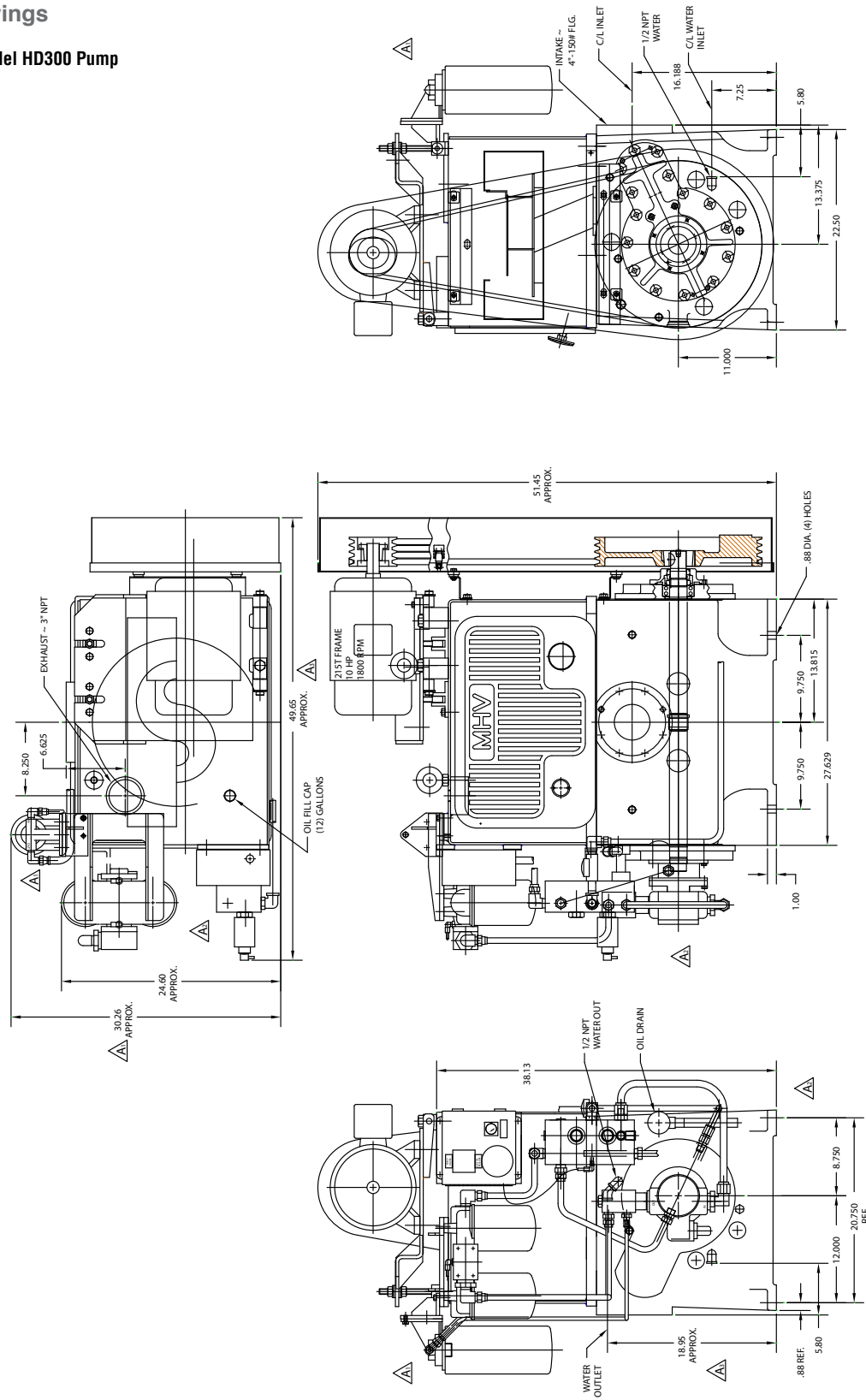
Figure 8.0 – Model HS430 Pump





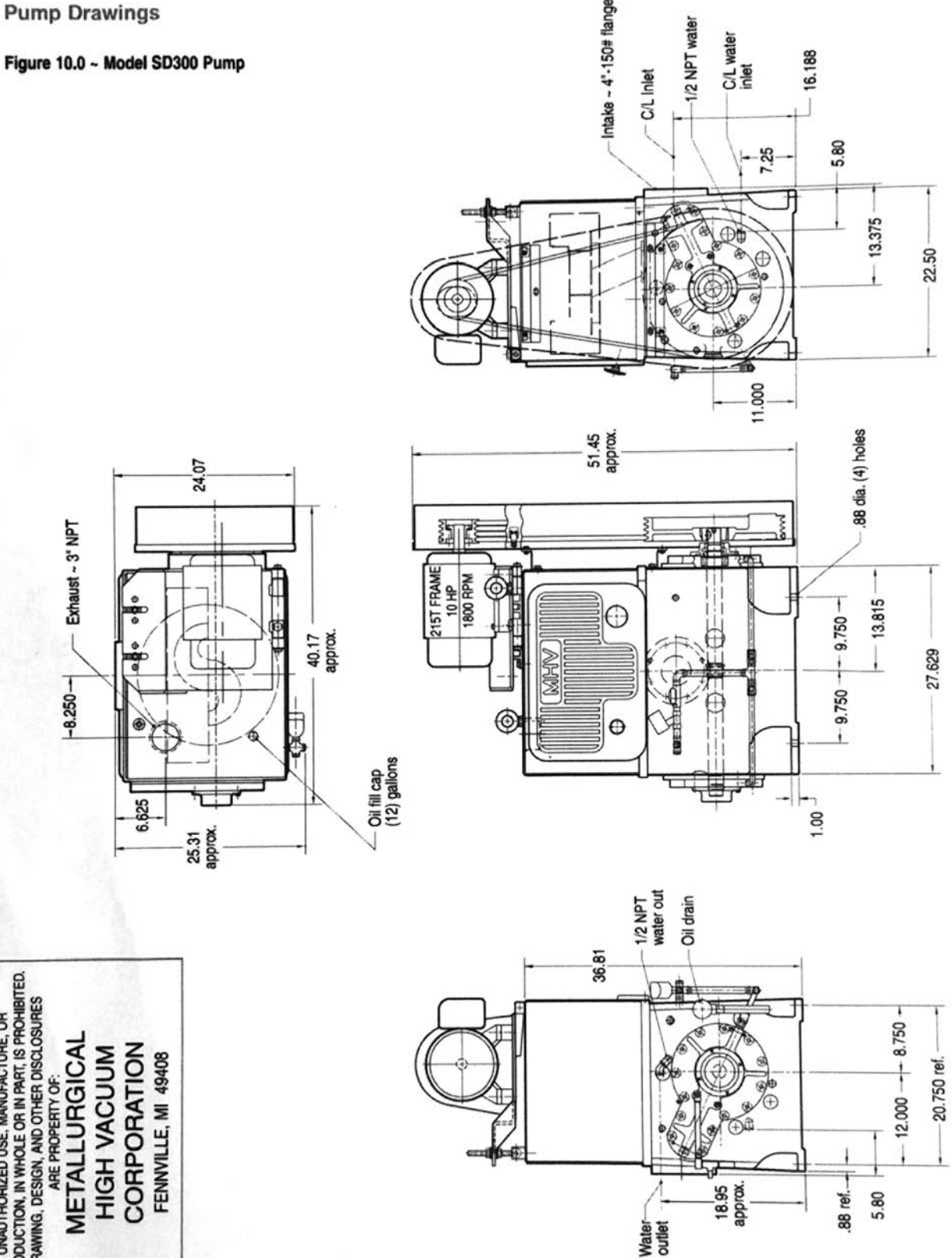
Pump Drawings

Figure 9.0 – Model HD300 Pump



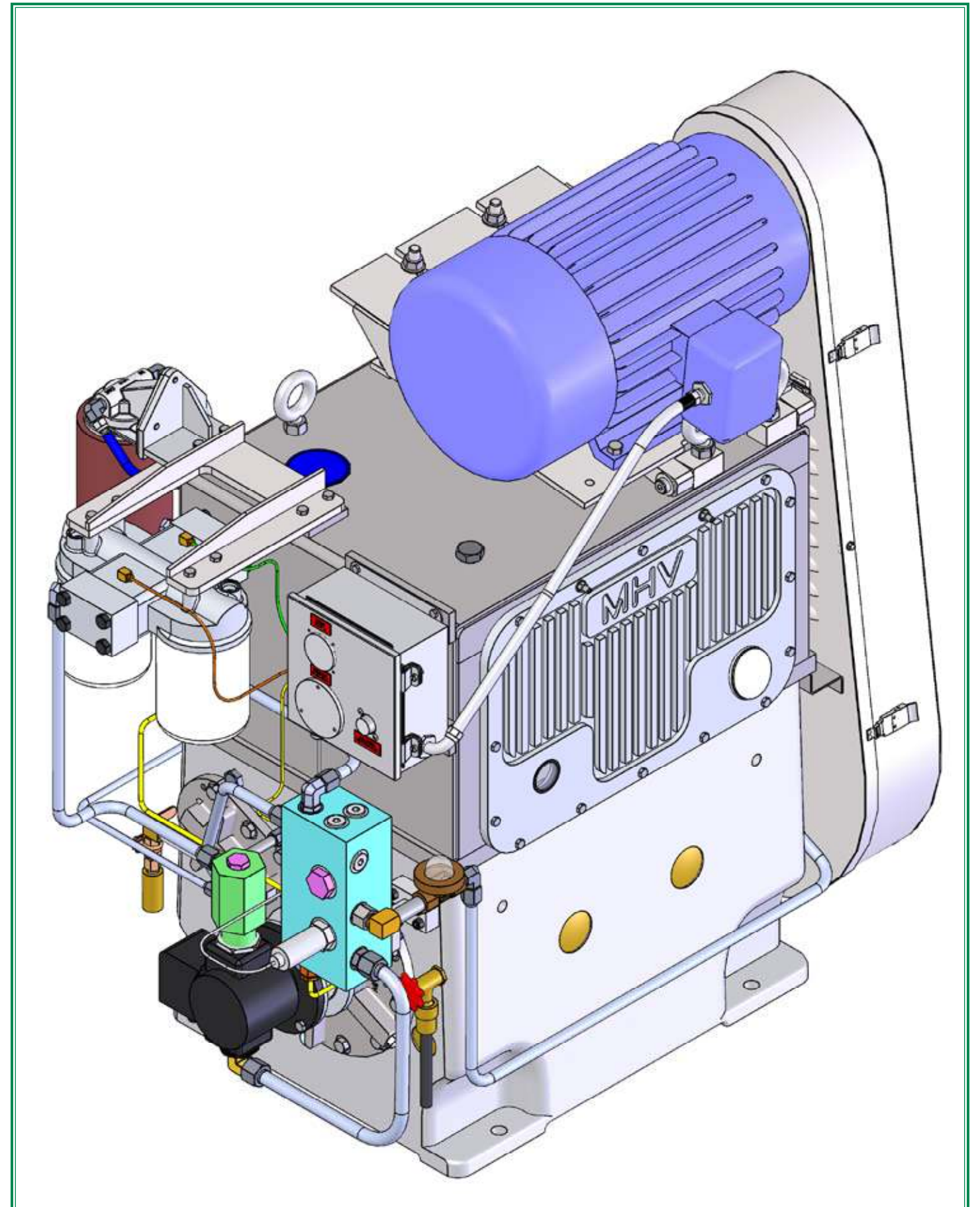
Pump Drawings

Figure 10.0 ~ Model SD300 Pump

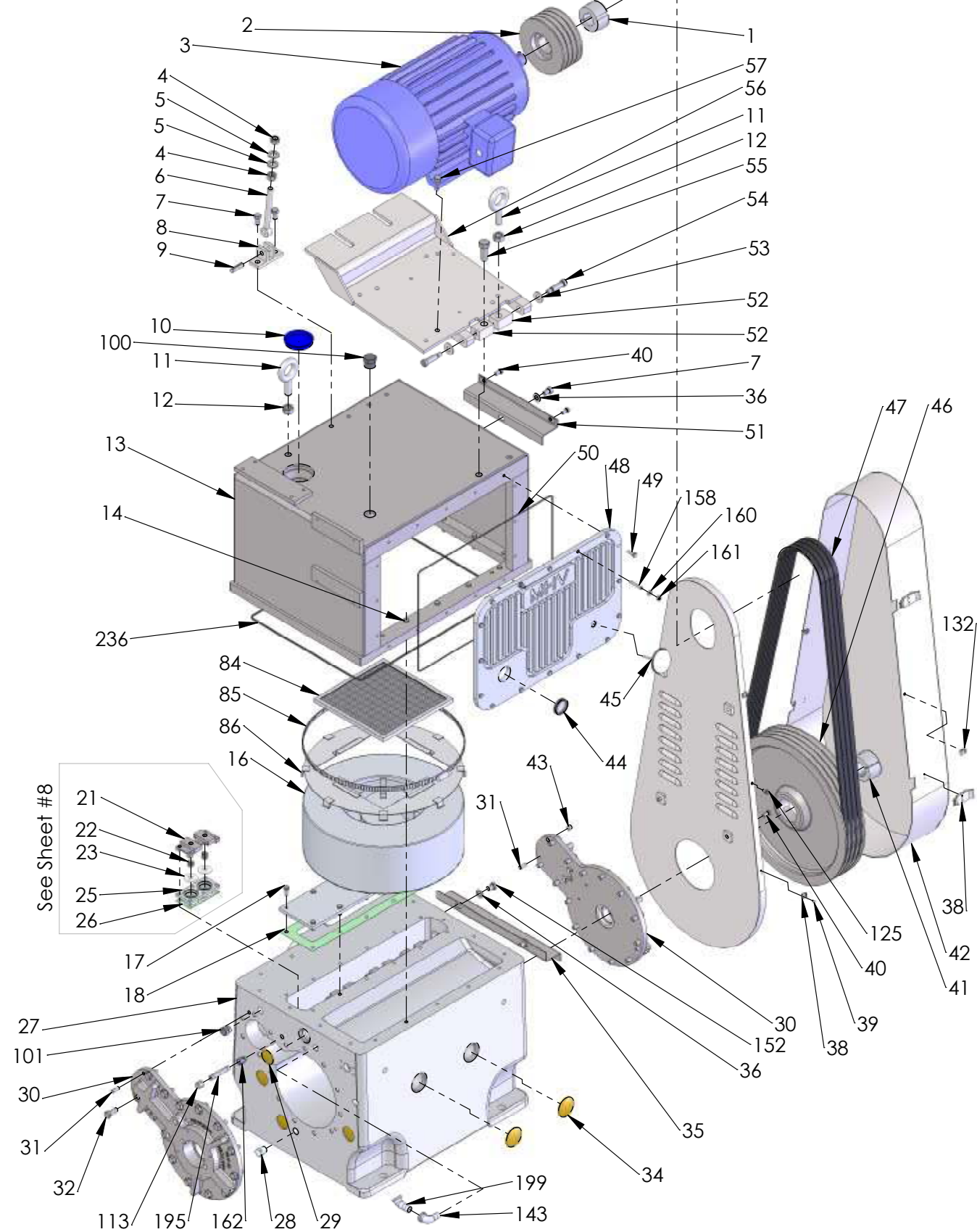


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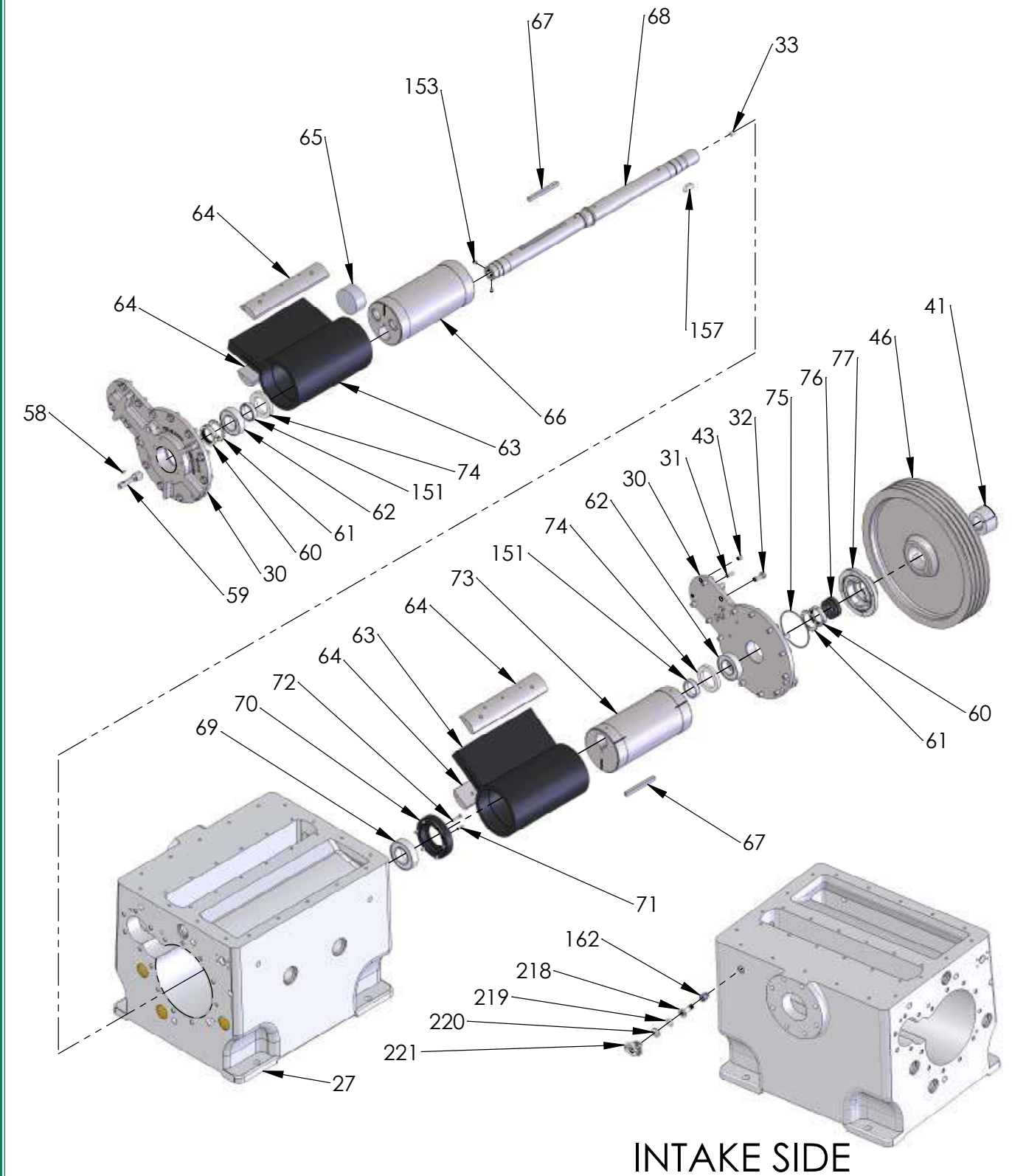
HS430 PUMP ASSEMBLY



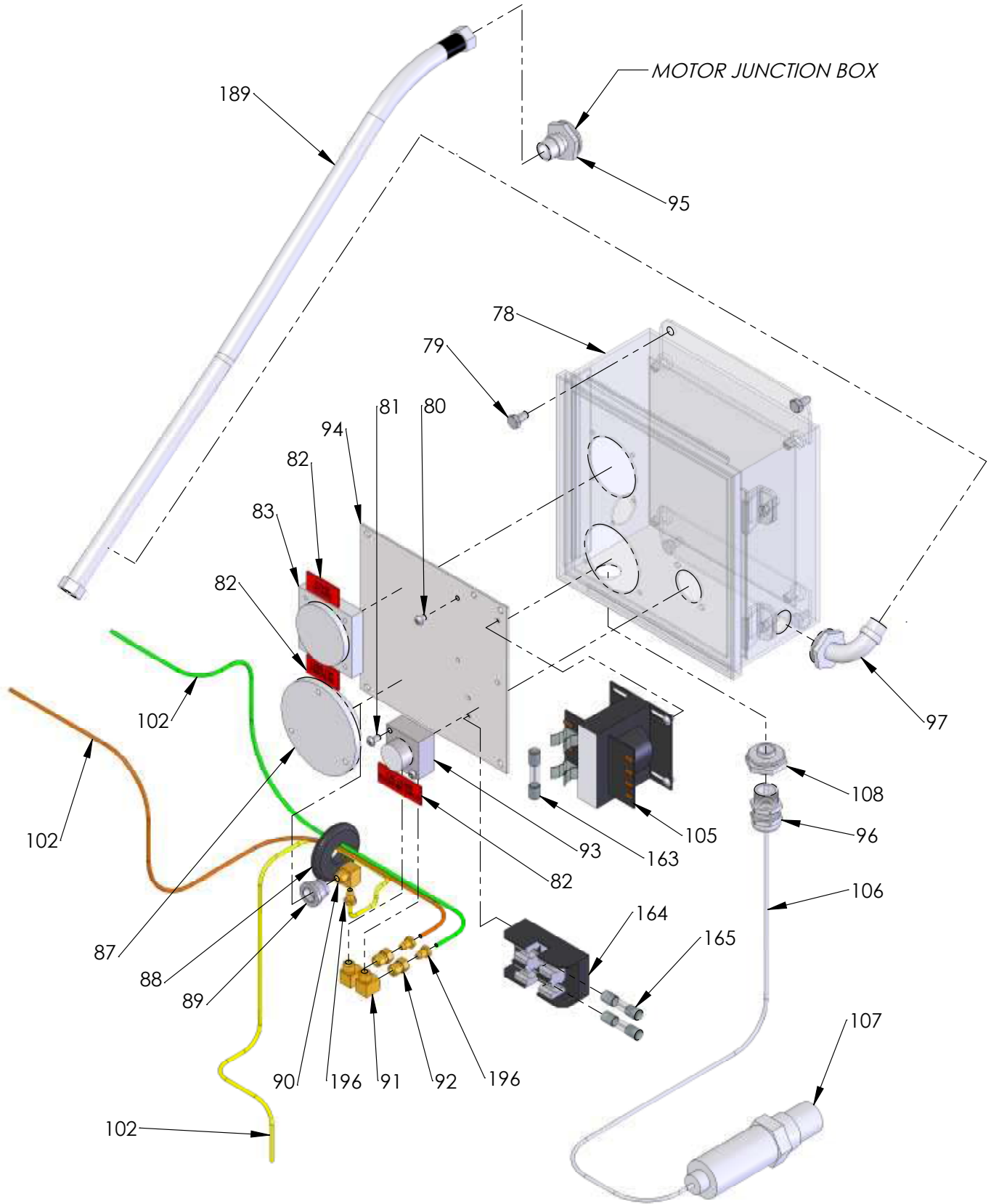
MHV 430 PUMP ASSEMBLY



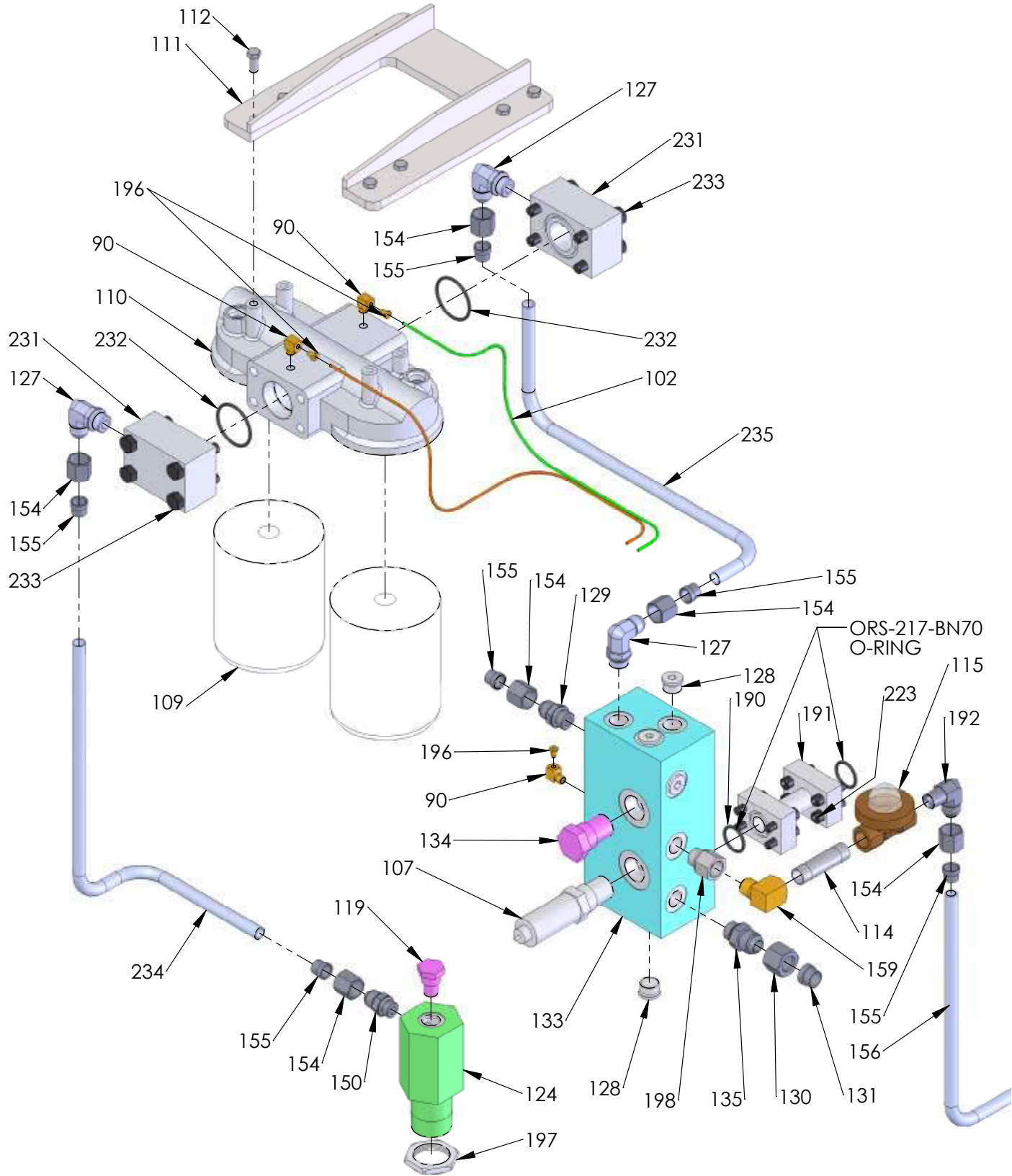
MHV 430 PUMP ASSEMBLY



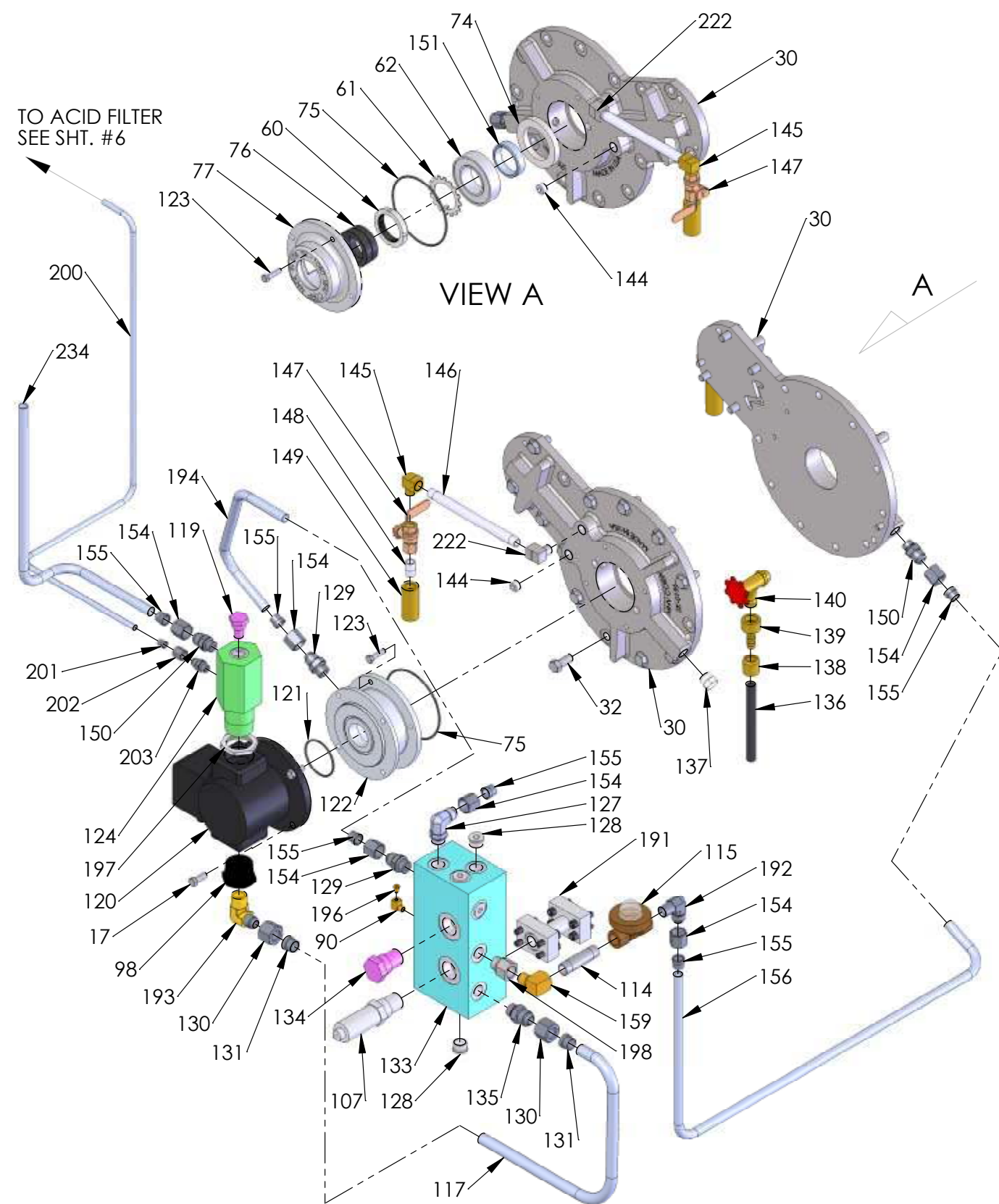
MHV 430 PANEL ASSEMBLY



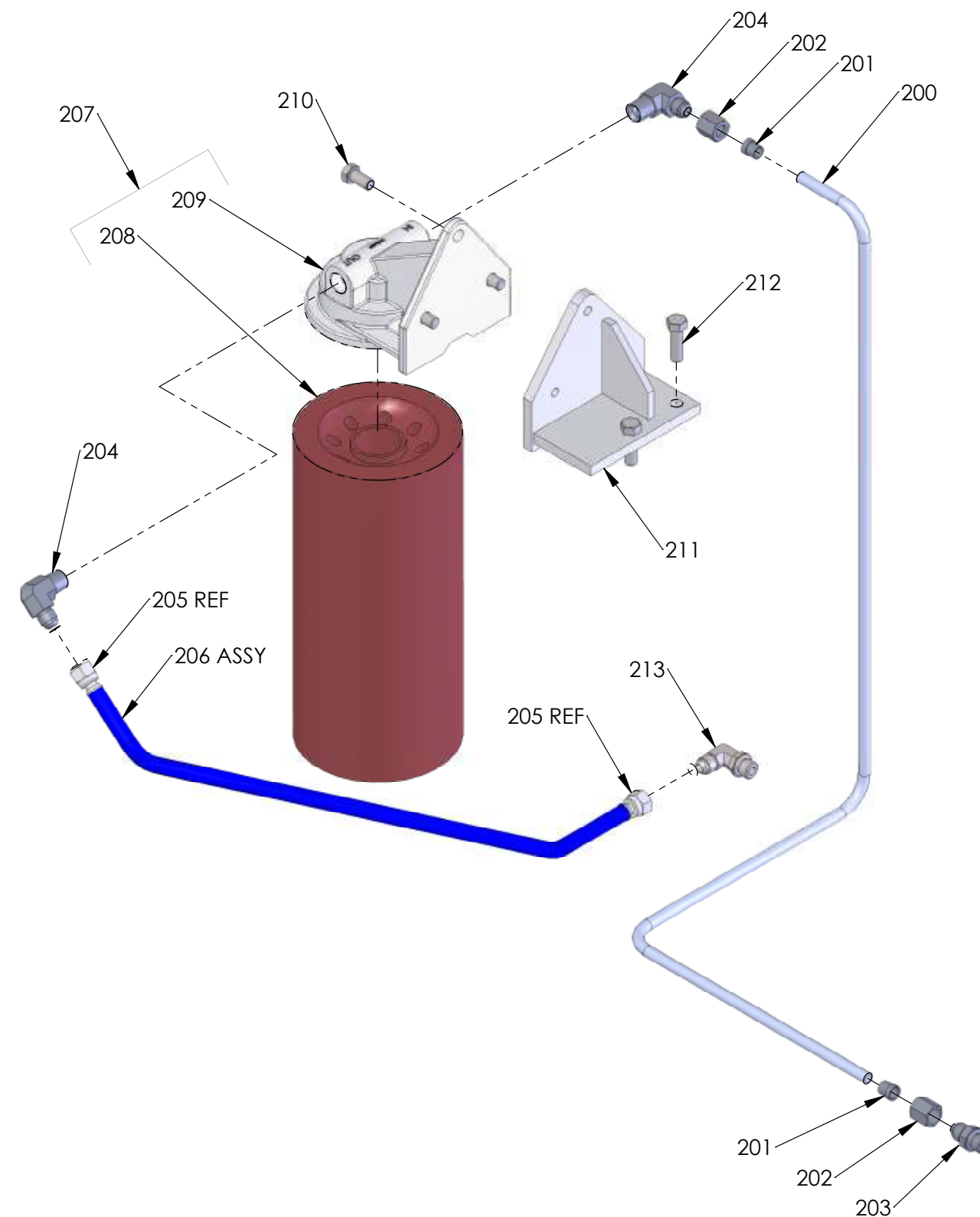
MHV 430 FILTER ASSEMBLY



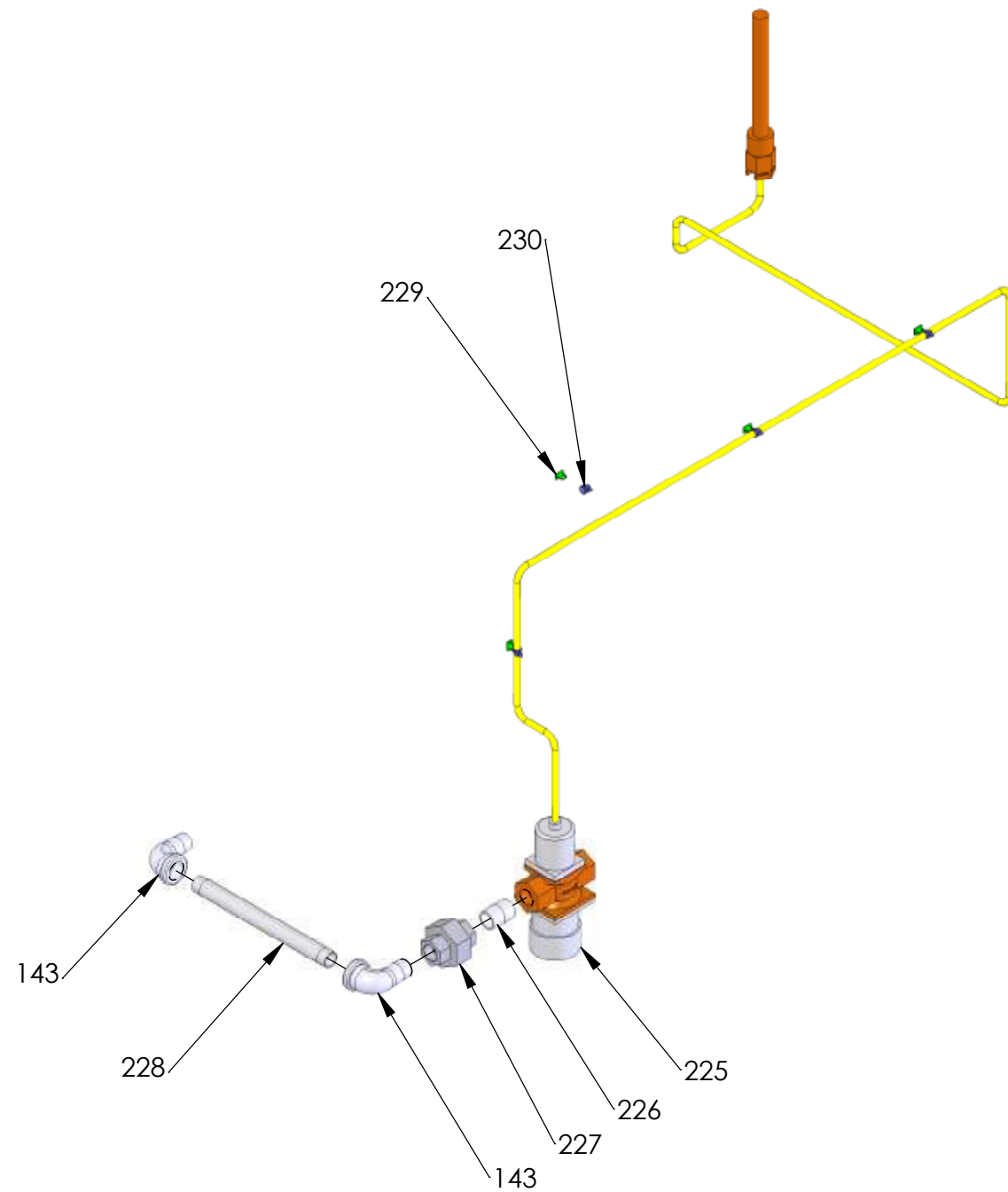
MHV 430 PLUMBING ASSEMBLY



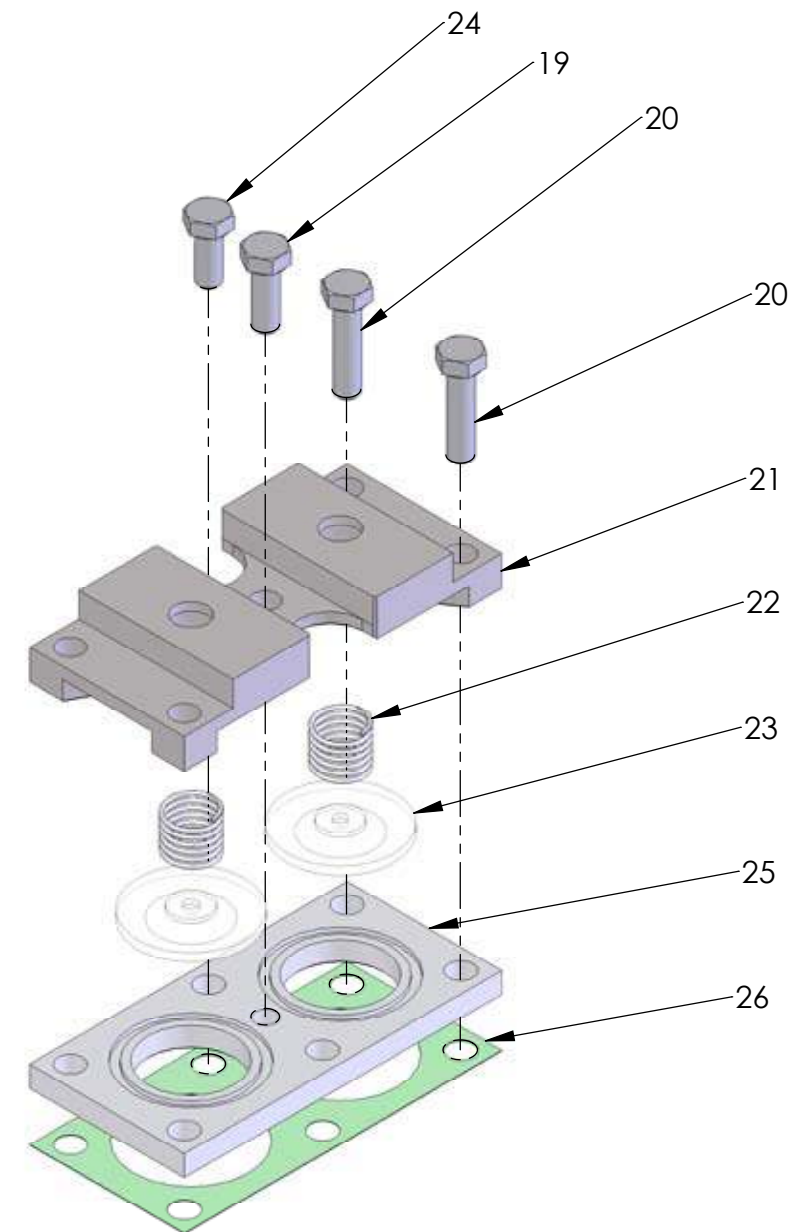
MHV 430 ACID FILTER ASSEMBLY



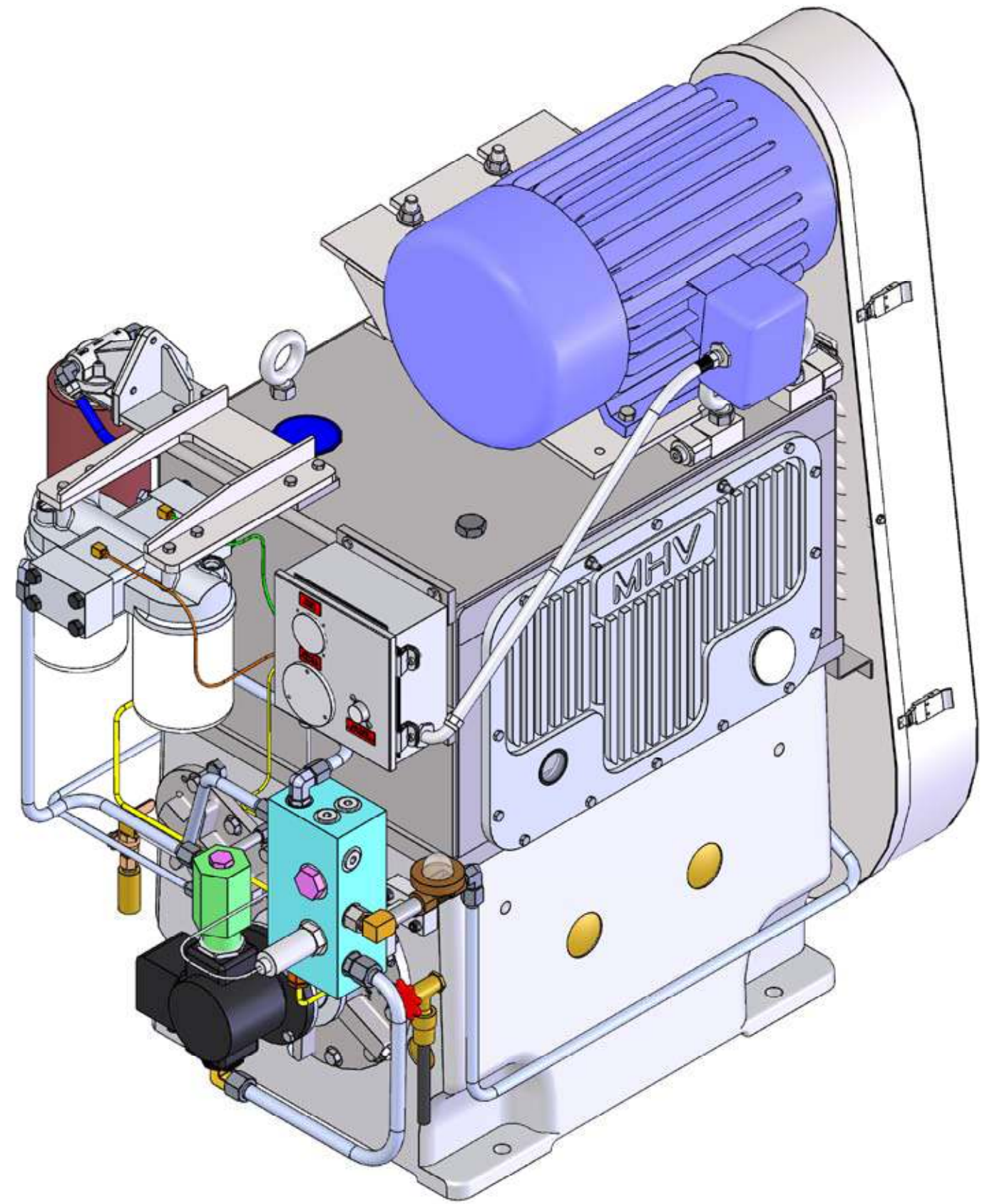
MHV 430 WATER MISER PIPING



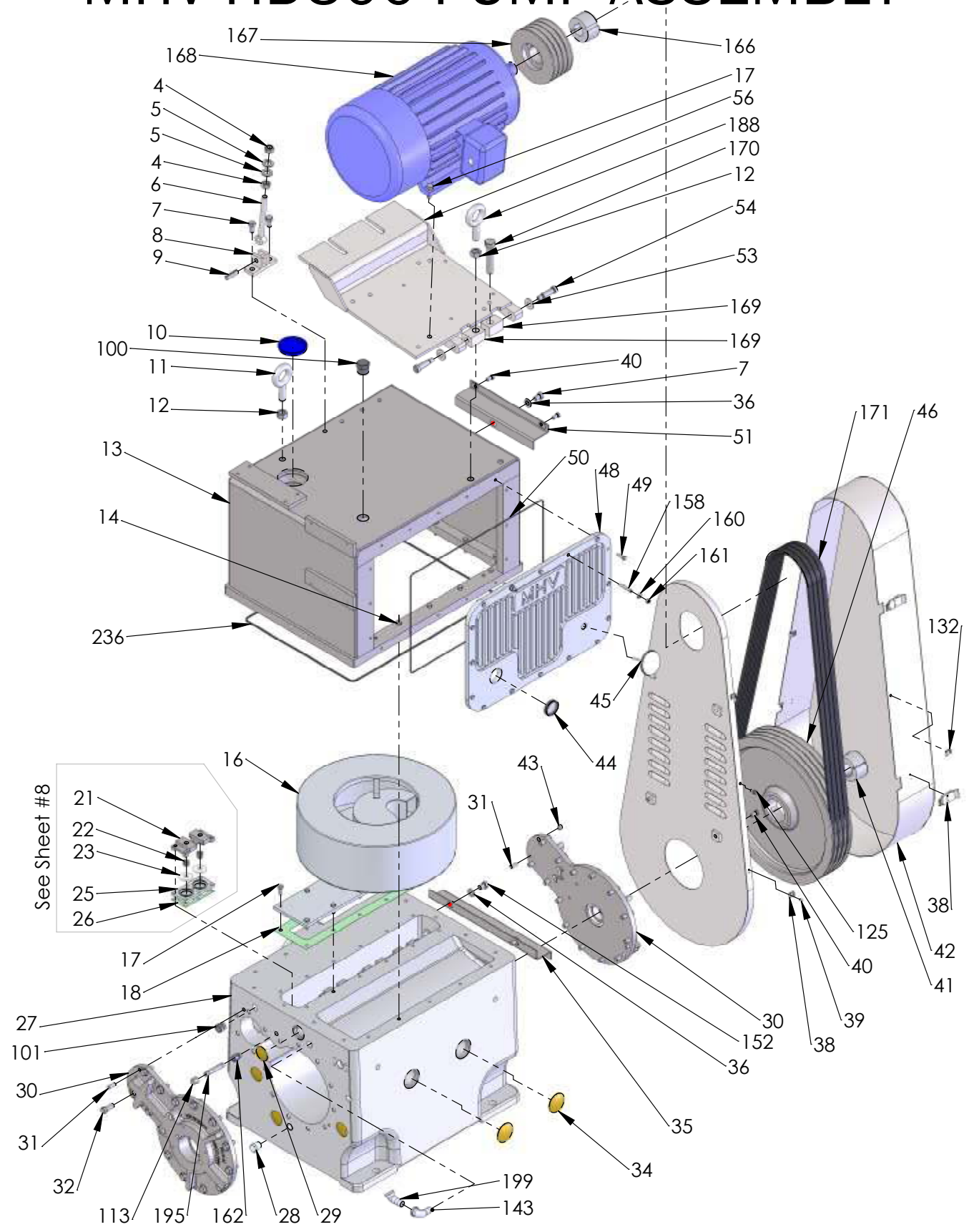
MHV 430 VALVE DECK DETAIL



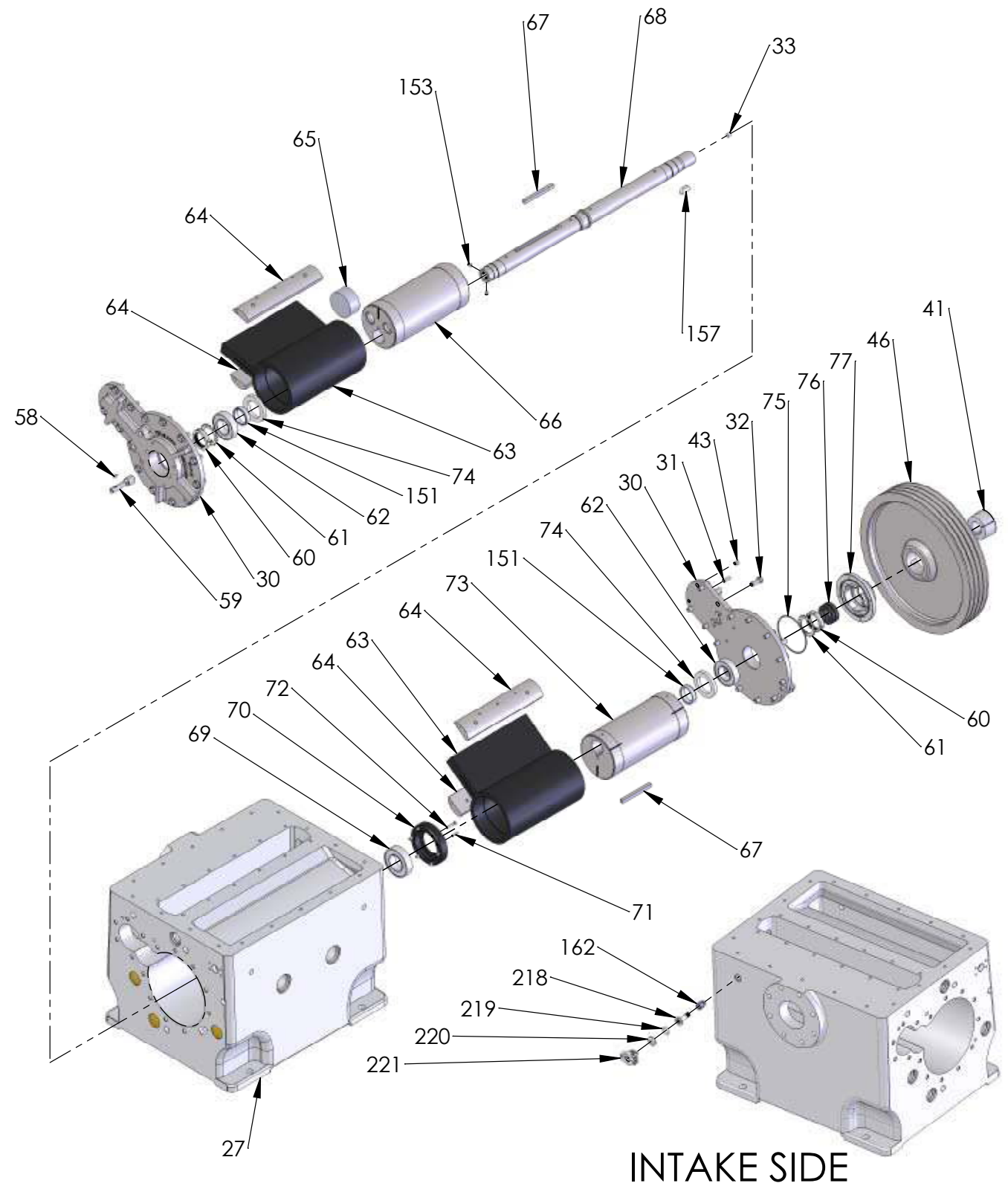
HD300 PUMP ASSEMBLY



MHV HD300 PUMP ASSEMBLY

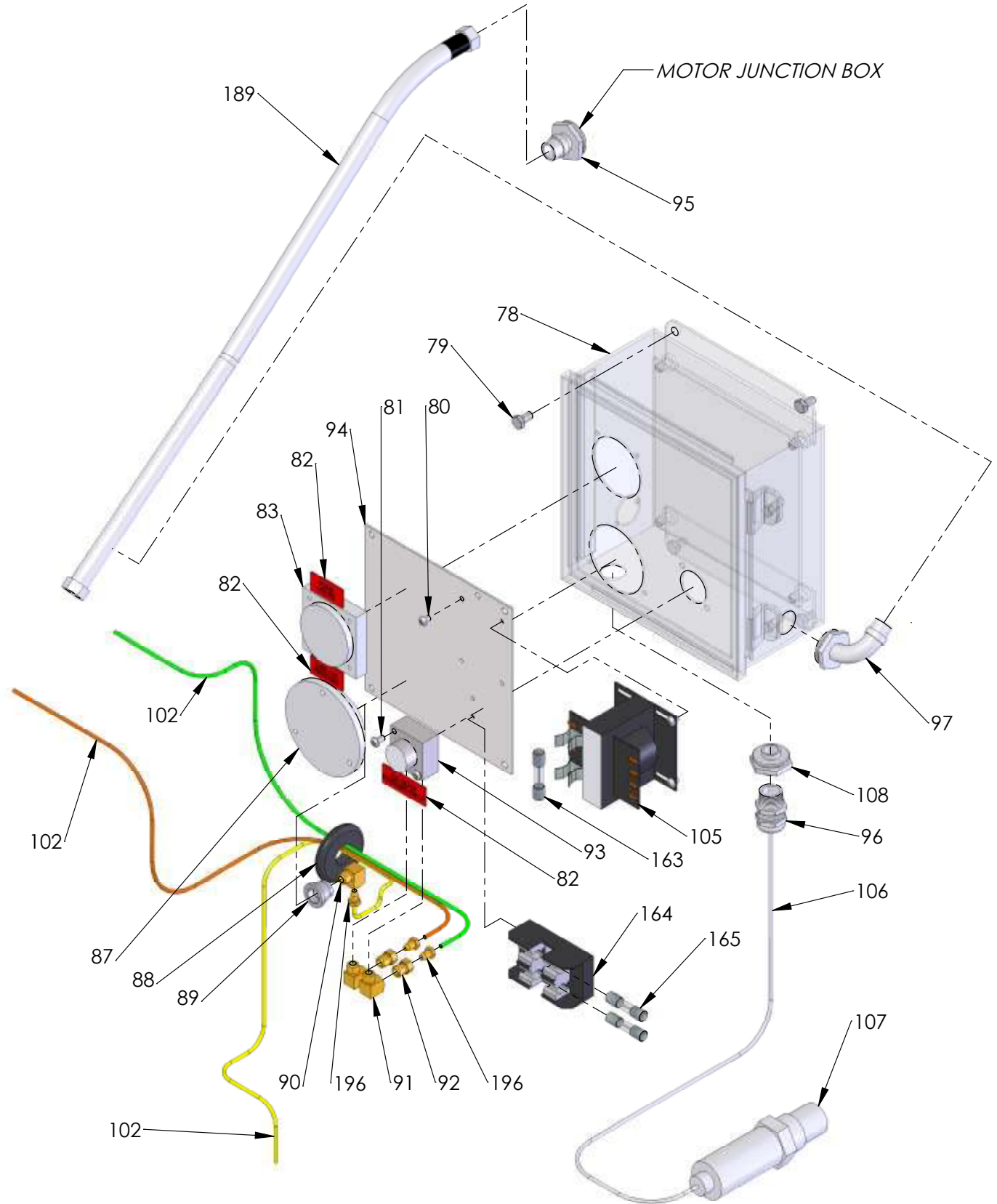


MHV HD300 PUMP ASSEMBLY

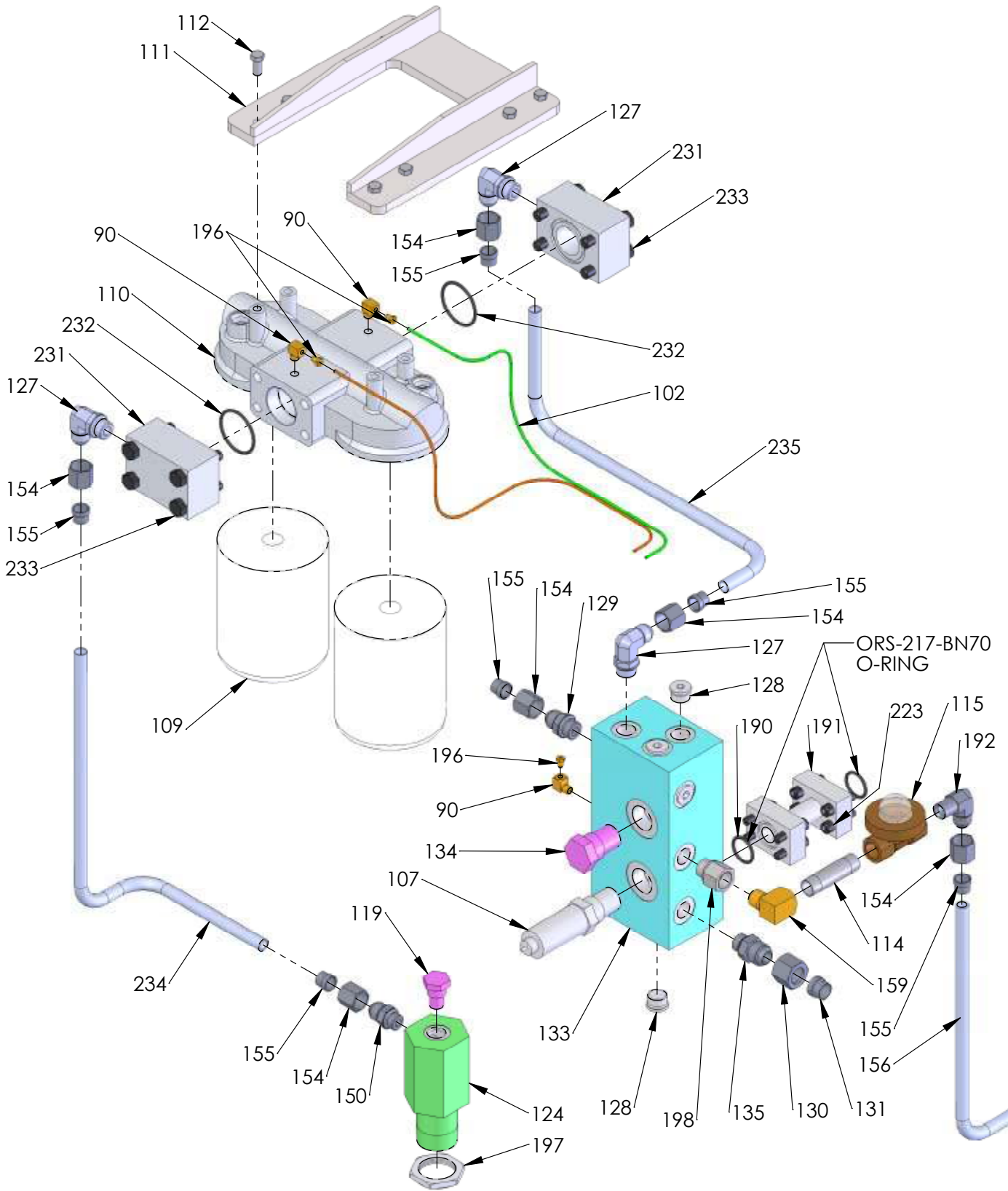


INTAKE SIDE

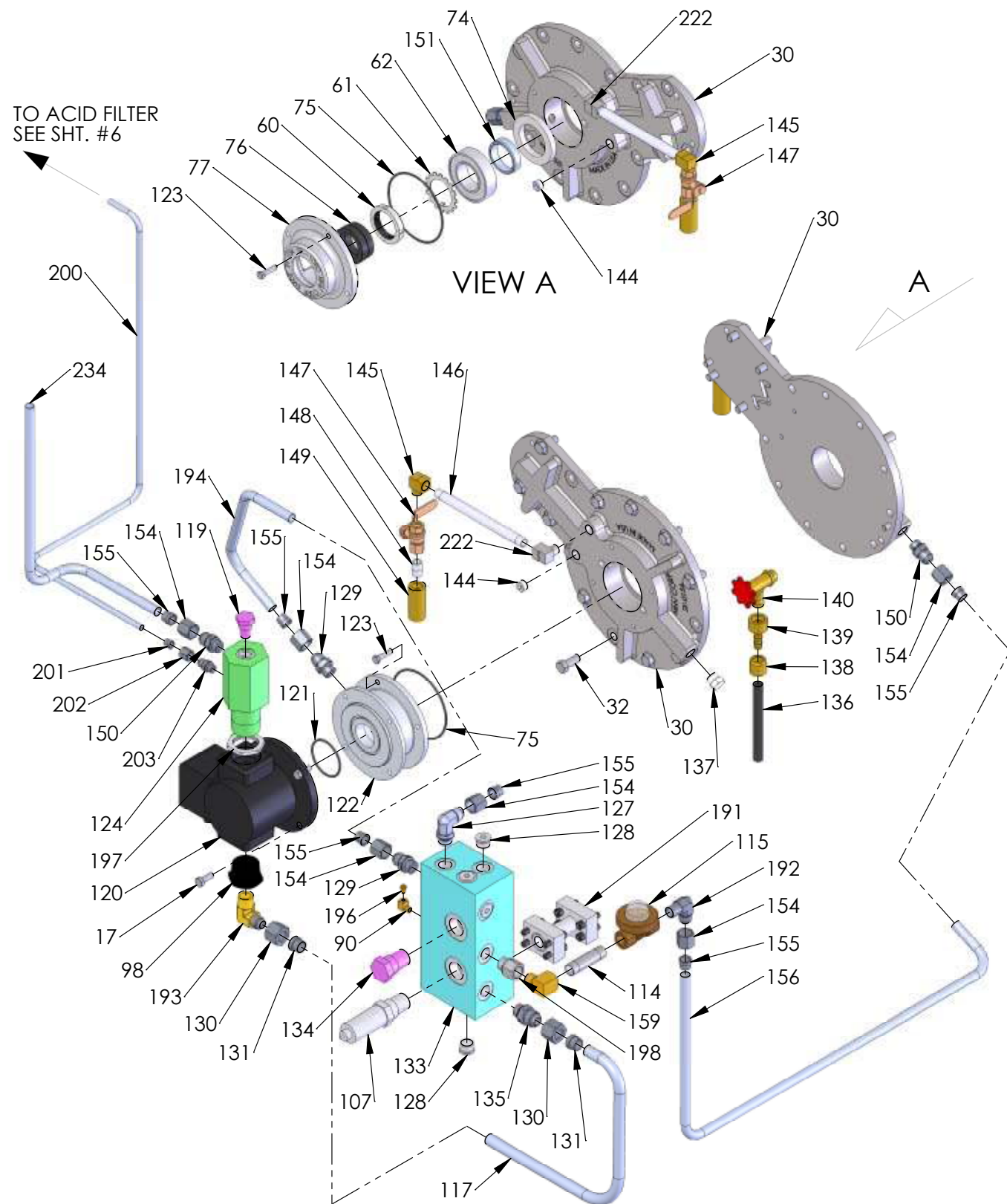
MHV HD300 PANEL ASSEMBLY



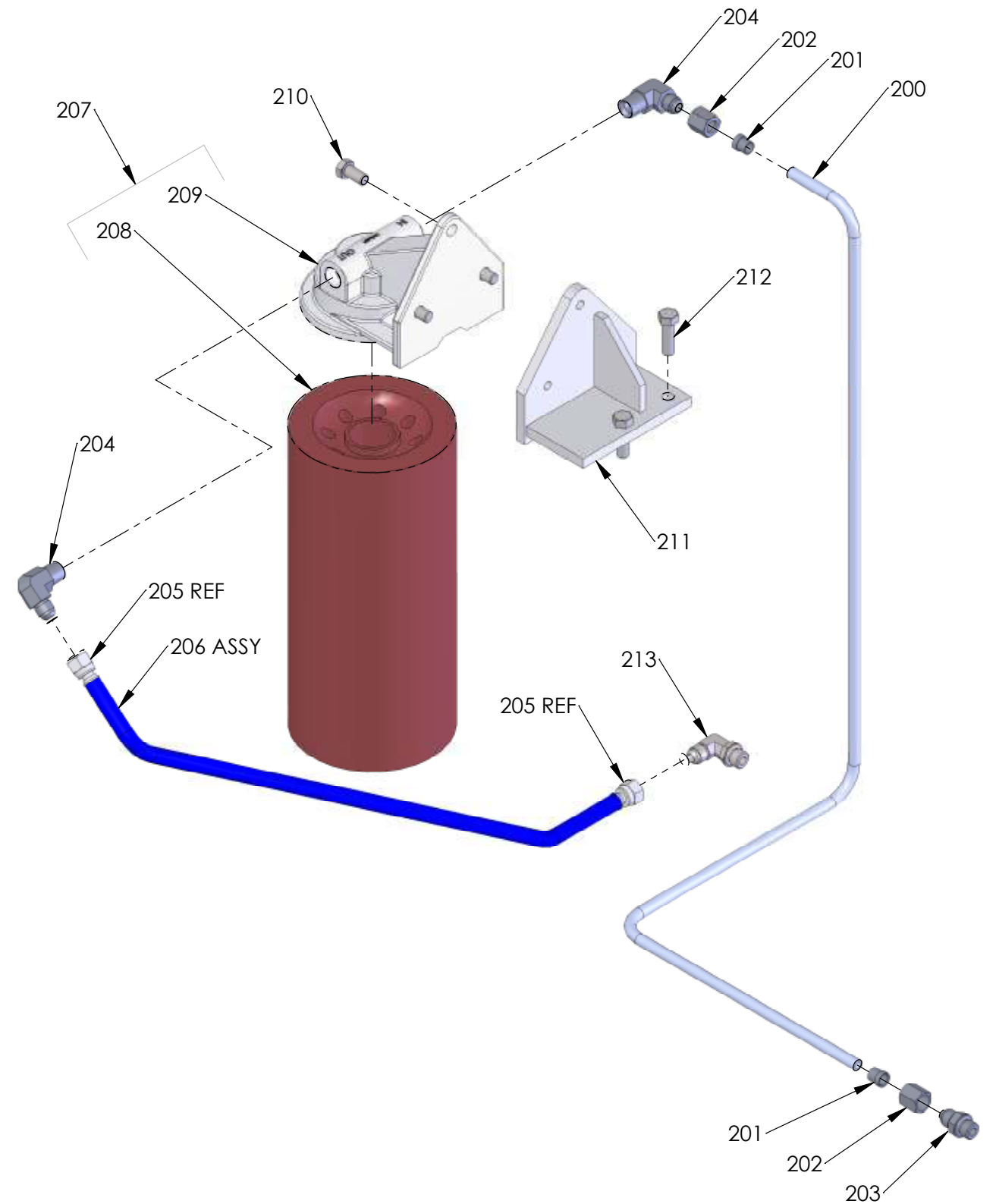
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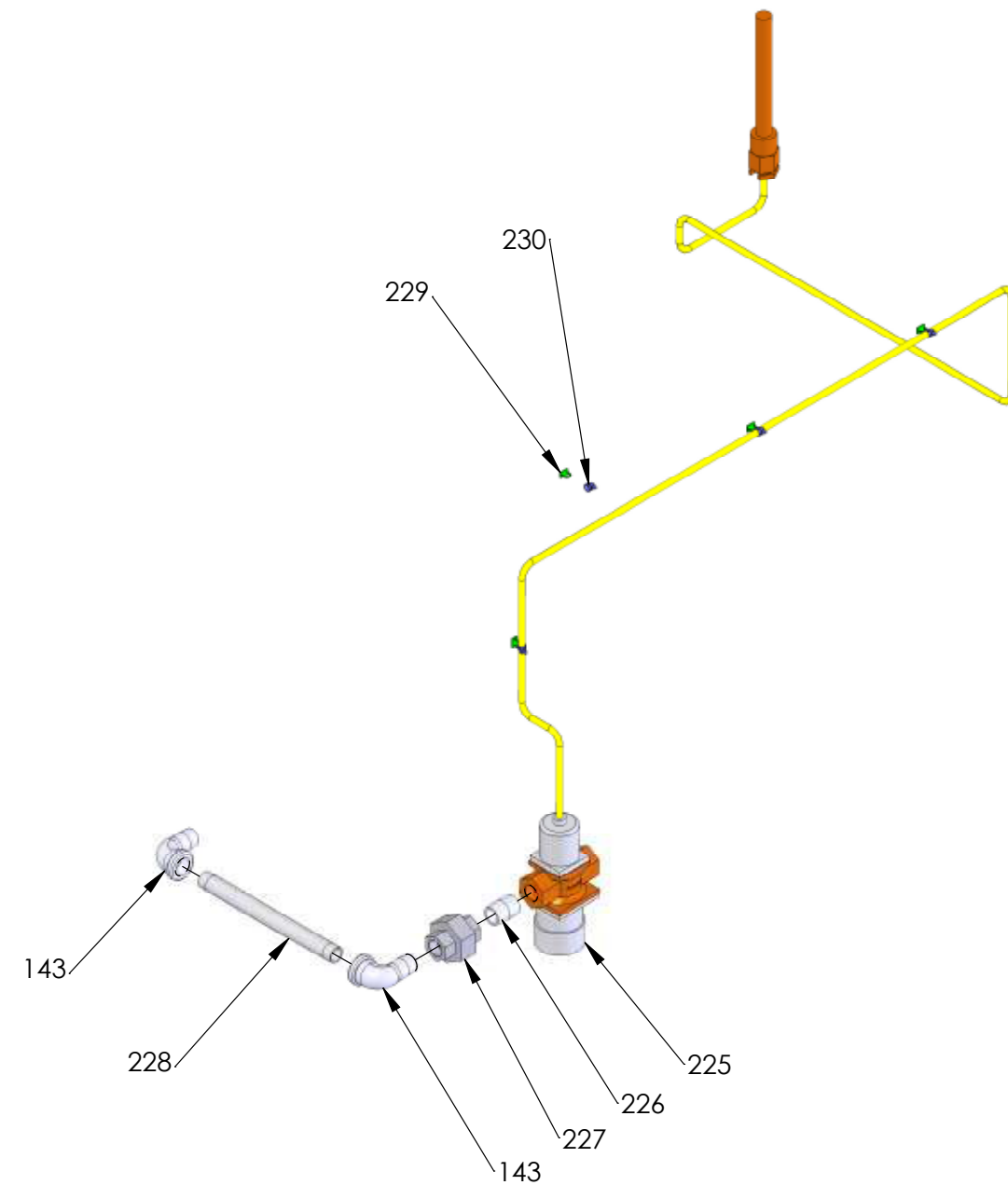
MHV HD300 PLUMBING ASSEMBLY



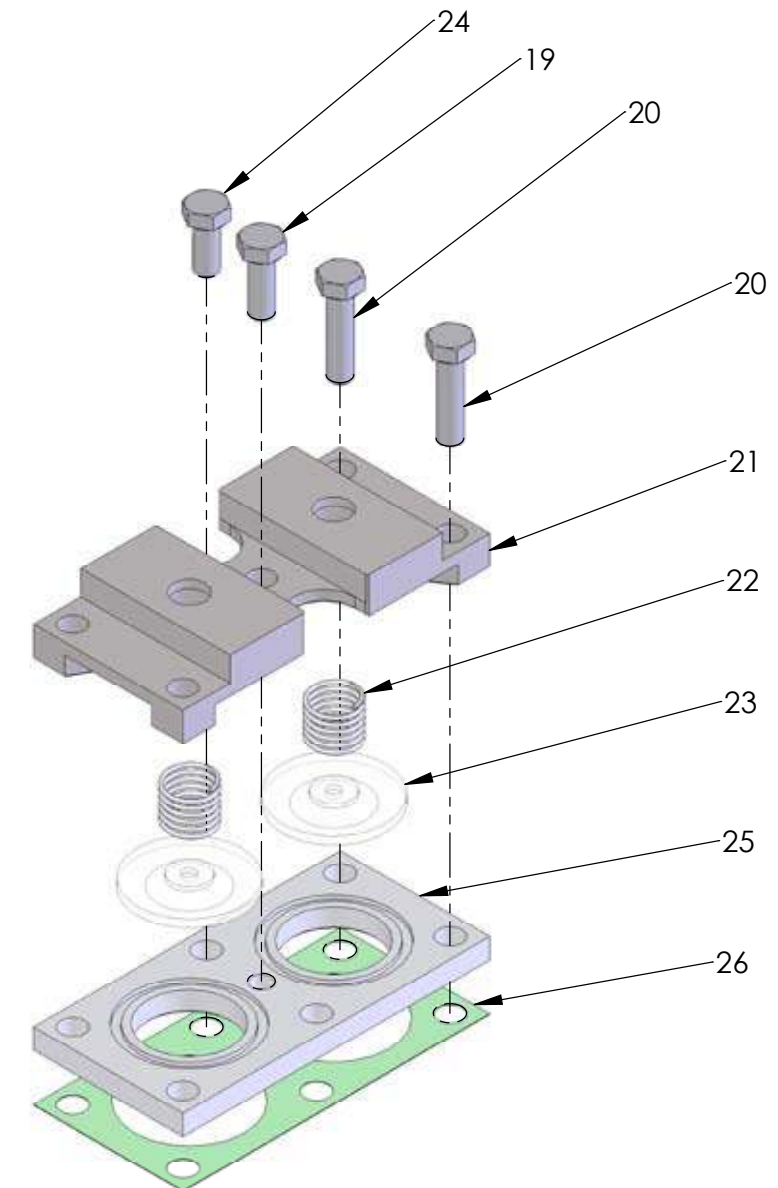
MHV HD300 ACID FILTER ASSEMBLY



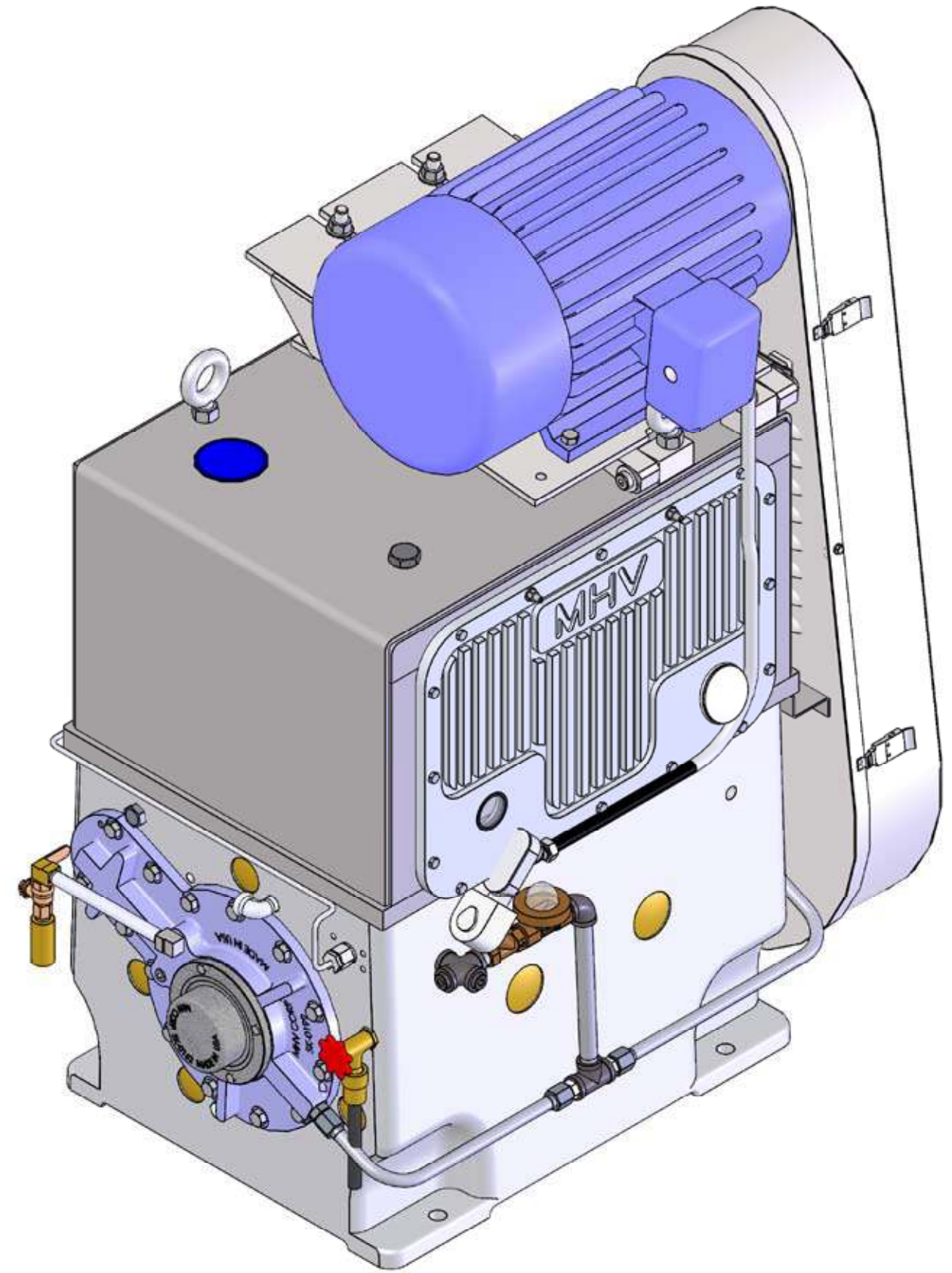
MHV HD300 WATER MISER PIPING



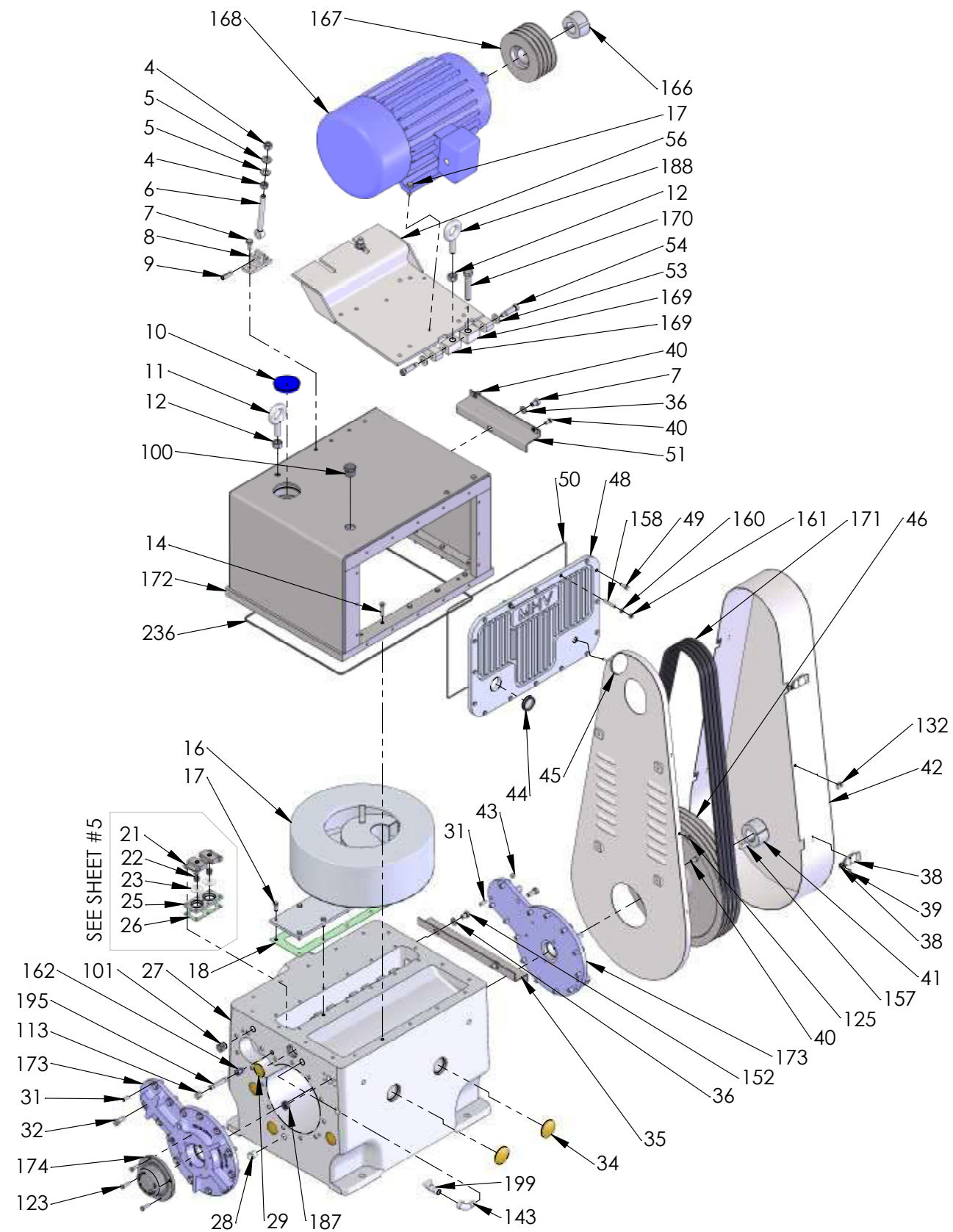
MHV HD300 VALVE DECK DETAIL



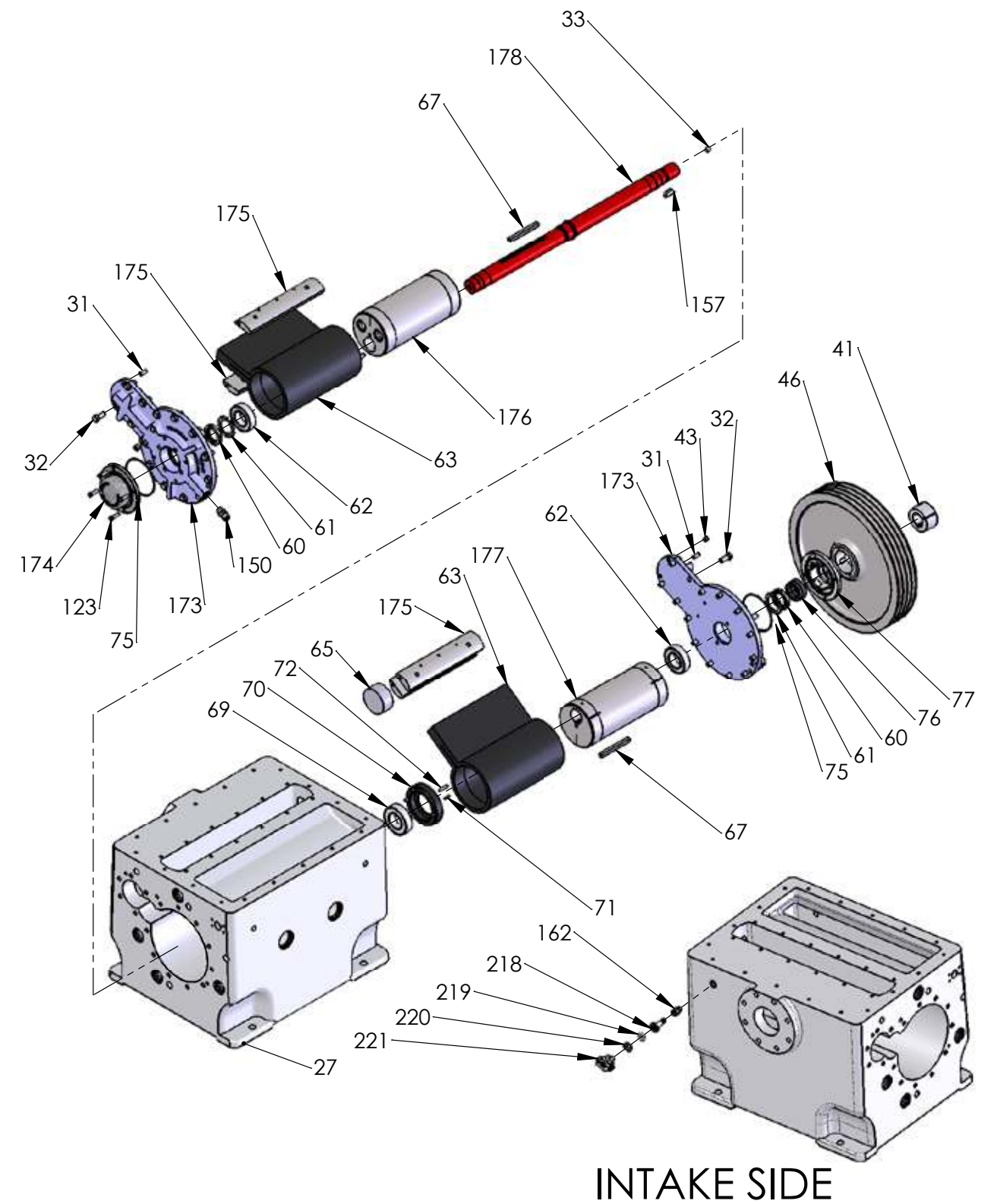
SD300 PUMP ASSEMBLY



MHV SD300 PUMP ASSEMBLY

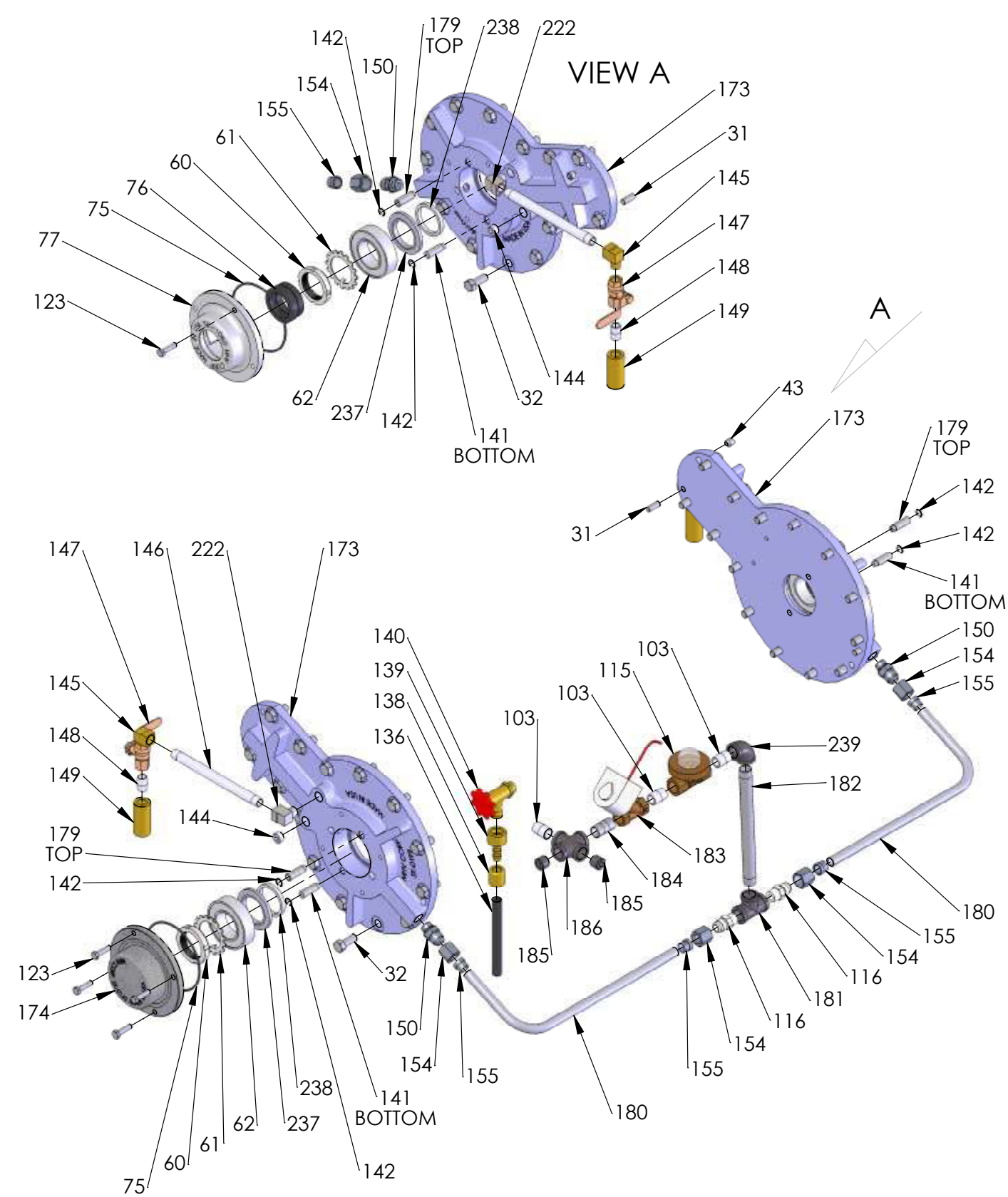


MHV SD300 PUMP ASSEMBLY

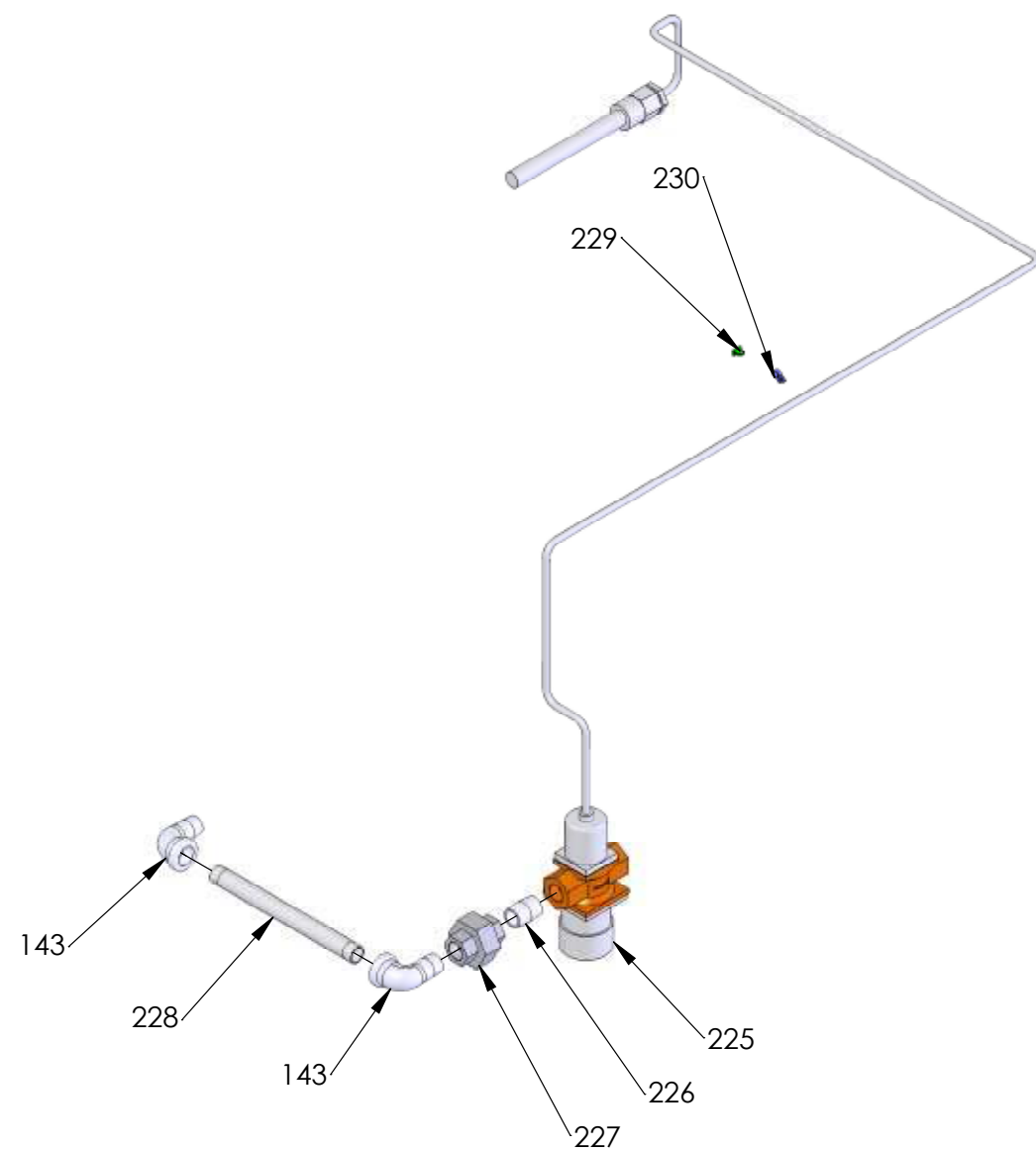


INTAKE SIDE

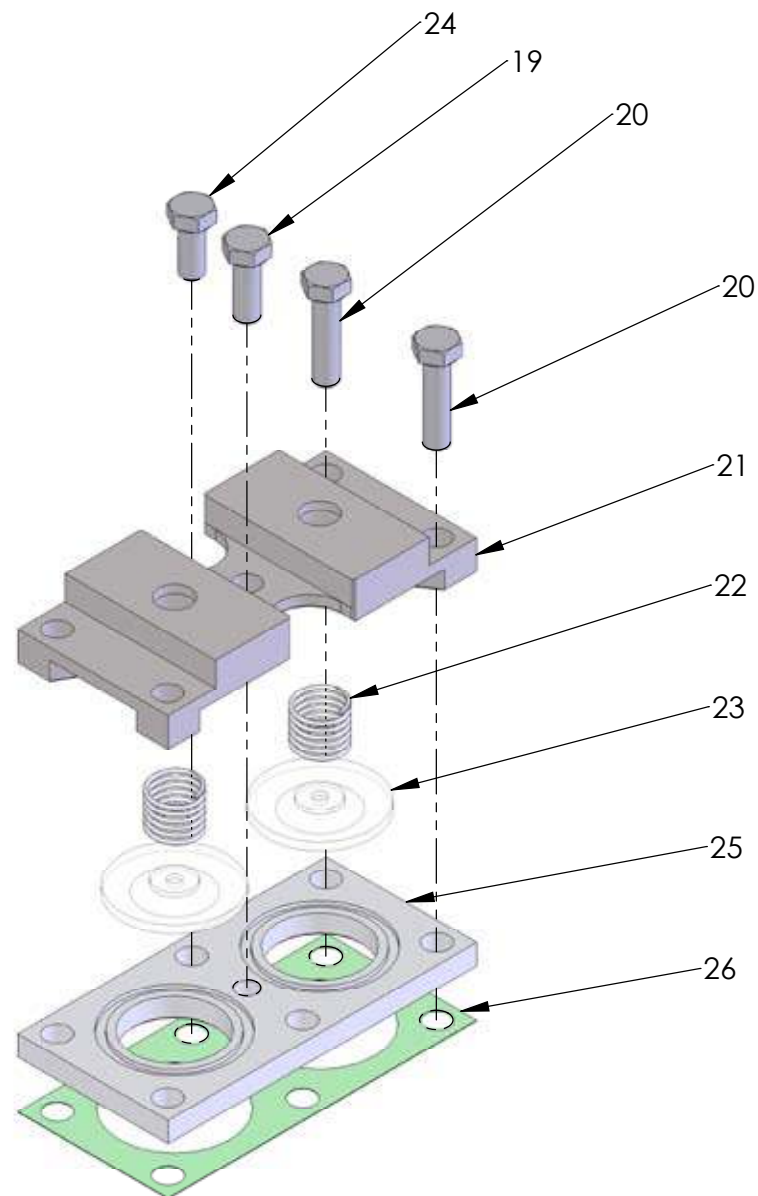
MHV SD300 PLUMBING ASSEMBLY



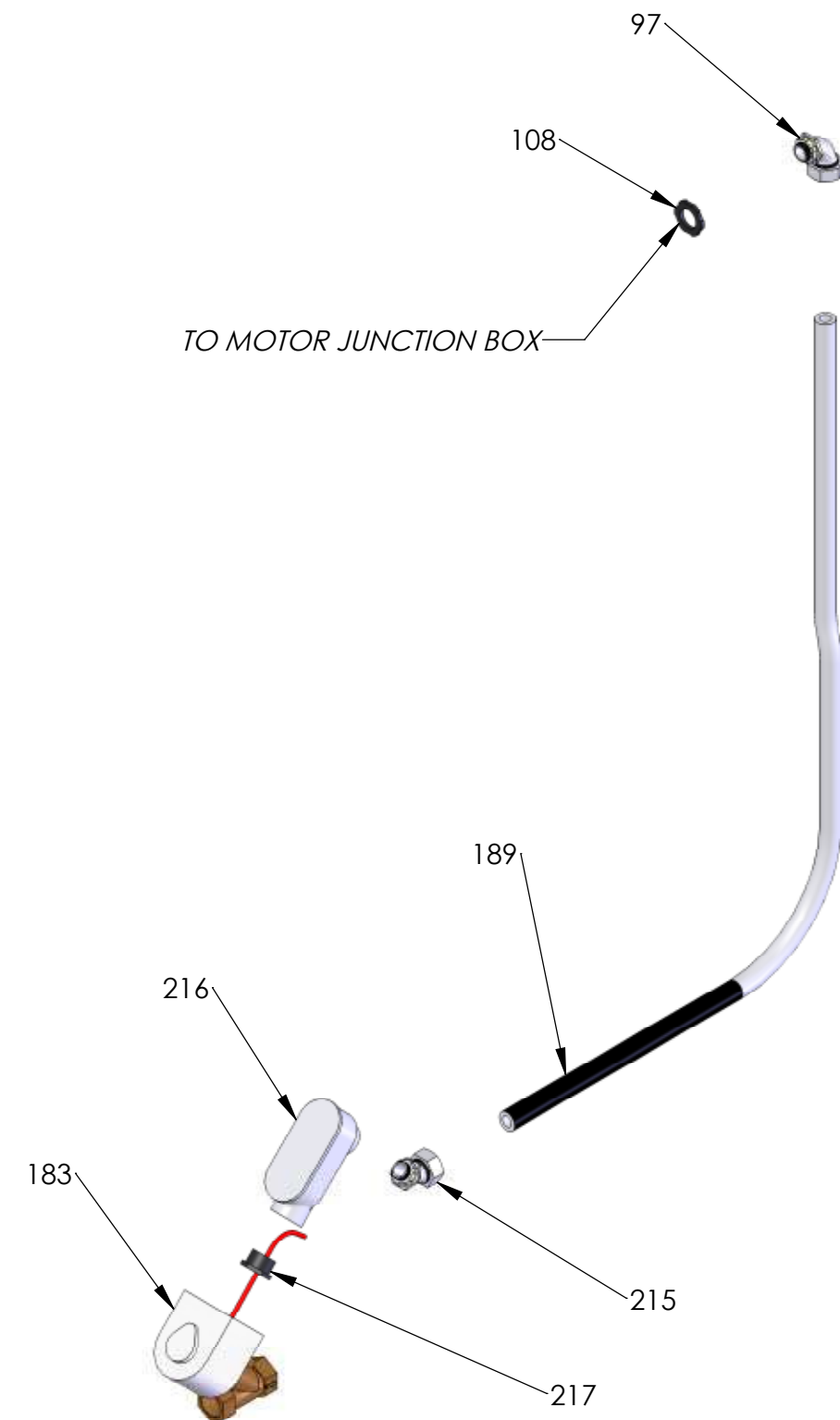
MHV SD300 WATER MISER PIPING



MHV SD300 VALVE DECK DETAIL



MHV SD300 SOLENOID WIRING



HS430, HD300 & SD300 Pump Parts List



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	MHV SD300 ASSY QTY
1	SHVB-SK-1.625	QD BUSHING	1		
2	SHV-430HS2	QD SHEAVE - (4) GROOVE	1		
3	MTR-20HPA	20HP/1800 RPM ELECTRIC MOTOR - PREM. EFF.	1		
4	N-112-50	5/8-11 HEX NUT	4	4	4
5	W-SPW-5	SPHERICAL WASHER SET	4	4	4
6	SK-0173	ROD EYE BLANK	2	2	2
7	F-1522-46-.75	1/2-20 X .75 LG HEX HEAD CAP SCREW	5	5	5
8	SK-0171	CLEVIS BRACKET	2	2	4
9	RPN-.50X1.75	ROLL PIN	2	2	2
10	AAA-NPT-3	3" PLASTIC PLUG	1	1	1
11	F-5021-55-2.00	3/4-10 EYEBOLT	1	1	1
12	N-112-55	3/4-10 HEX NUT	2	2	2
13	SK-0161	OIL RESERVOIR WELDMENT	1	1	
14	F-1523-35-1.75	3/8-16 X 1.75 LG HEX HD. BOLT	10	10	18
15		NOT USED			
16	SK-0181	OIL MIST SEPARATOR - ALUMINUM	1	1	1
17	F-1523-35-1.00	3/8-16 X 1.00 LG HEX HD. BOLT	16	20	16
18	GS-412011	OIL SEPARATOR GASKET	1	1	1
19	F-3711-30-.875	5/16-18 X .88 LG HEX HEAD CAP SCREW - SEMS	4	4	4
20	F-3711-30-1.25	5/16-18 X 1.25 LG HEX HEAD CAP SCREW - SEMS	16	16	16
21	SK-0178	VALVE CAP	4	4	4
22	SK-412H11-039	VALVE SPRING-C-276	8	8	8
23	SK-0180	CLAPPER	8	8	8
24	F-3711-30-.75	5/16-18 X .75 LG HEX HEAD CAP SCREW - SEMS	8	8	8
25	SK-0177	VALVE SEAT	4	4	4
26	GS-412010	VALVE PLATE GASKET	4	4	4
27	SK-0145-2	PUMP HOUSING	1	1	1
28	FSP-C3159X8	HEX HEAD STEEL PLUG(JACKET)	1	1	1
29	CP-1875B	1 7/8 DIA BRASS CORE PLUG	8	8	8
30	SK-0227	END PLATE(MOD SK-0199)	2	2	

HS430, HD300 & SD300 Pump Parts List



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	MHV SD300 ASSY QTY
31	DWLP-038-100	3/8X1.00 LG DOWEL PIN	4	4	4
32	F-1523-45-1.25	1/2-13 X 1.25 LG HEX HD. BOLT	30	30	30
33	FSP-1/4-HHP-S	DRYSEAL PLUG	1	1	1
34	CP-2500B	2 1/2 DIA BRASS CORE PLUG	2	2	2
35	SK-0113	LOWER BELT GUARD BRKT.	1	1	1
36	W-212-30	1/2" SAE FLAT WASHER	3	3	3
37		NOT USED			
38	LAT-430HS	COMPRESSION SPRING CATCH	4	4	4
39	F-PRHS430	1/8" DIA POP RIVET	16	16	16
40	F-1523-35-.75	3/8-16 X .75 LG HEX HD. BOLT	4	4	4
41	SHVB-2517-1.750	1 3/4 TAPER-LOCK BUSHING	1	1	1
42	SK-0176	BELT GUARD ASS'Y.	1	1	1
43	F-2622-45-.75	1/2-13 X .75 LG SOC SET SCR HALF DOG	4	4	4
44	OEY-5582	2" OIL EYE	1	1	1
45	TH-0050	THERMOMETER1	1	1	
46	SK-0172-2	FLYWHEEL	1	1	1
47	VBT-4/B108	BANDED VEE BELT	1		
48	SK-0135	OIL RESERVOIR COVER	1	1	1
49	F-1523-30-1.00	5/16-18 X 1.00 LG HEX HEAD CAP SCREW	12	12	12
50	ORS-SK-0135	1/8 DIA O-RING 71.75 LG	1	1	1
51	SK-0114	UPPER BELT GUARD BRKT.	1	1	1
52	SK-0164	MOTOR MOUNT BLOCK	2		
53	W-EW-90	5/8 HDND WASHER	2	2	2
54	F-4022-625-1.75	5/8 NOM DIA X 1.75 LG SHOULDER SCREW	2	2	
55	F-1523-55-2.00	3/4-10 X 2.00 LG HEX HD. BOLT	1		
56	SK-0163	MOTOR MOUNT WELDMENT	1	1	1
57	F-1523-45-1.50	1/2-13 X 1.50 LG HEX HD. BOLT	4		
58	SK-0231	ALLOY KEY	1	1	
59	SK-0169	OIL PUMP DRIVE ADAPTER	1	1	
60	BRN-10	LOCKNUT	2	2	2



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	MHV SD300 ASSY QTY
61	BRW-10	LOCKWASHER	2	2	2
62	BRG-020ALT3	SPHERICAL ROLLER BEARING	2	2	2
63	SK-0144-2	MACHINED PISTON SLIDE	2	2	2
64	HB-1045	HINGE BAR-DRILLED	4	4	
65	HB-1021	HINGE BAR SPACER	1	1	1
66	SK-0166	LIGHT ECCENTRIC (HI-PRESSURE OILING)	1	1	
67	KY-1000	KEY	2	2	2
68	SF-1020	MAIN SHAFT(MOD SF-1001)	1	1	
69	BRG-030	ROLLER BEARING	1	1	1
70	SK-0105	BEARING SUPPORT (CENTER)	1	1	1
71	SK-0138	RETAINING PIN	1	1	1
72	F-2024-25-1.25	1/4-20 X 1.25 LG SOC HD CAP SCW LOC WEL	6	6	6
73	SK-0167	HEAVY ECCENTRIC (HI-PRESSURE OILING)	1	1	
74	LPS-HS430	OIL CONTROL LIP SEAL	2	2	
75	ORS-249-BN70	O-RING	2	2	2
76	MES-1000F	PREMIUM MECHANICAL SEAL	1	1	1
77	SK-0160	SEAL CARRIER	1	1	1
78	SK-0187	ENCLOSURE	1	1	
79	F-1523-25-.50	1/4-20 X .50 LG HEX HEAD SCREW	4	4	
80	F-0213-15-.375	#8-32 X .38 LG RHMS	6	6	
81	F-3522-21-.38	#10-32 X .38 LG BUTTON HEAD SCREW	2	2	
82	SK-0185	LEGEND PLATE SET	1	1	
83	AAA-098	120V-HOUR METER - NON-RESET	1	1	
84	FLT-OIL MIST	MCMaster-CARR FILTER #2150K16	1		
85	HOC-HS312	DIXON HOSE CLAMP #HS-312	1		
86	SK-0225	SEPARATOR FILTER HOLDER	1		
87	GAU-008	COMPOUND PRESSURE GAGE	1	1	
88	GRM-HS430	GROMMET, 3/4 DIA.	1	1	
89	FMI-5502X01	1/4X1/8 BLACK REDUCER	1	1	
90	FBR-6400X2	MALE ELBOW	4	4	



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	
91	FBR-3400X2	BRASS STREET 90	2	2	
92	FBR-6200X2	MALE CONNECTOR	2	2	
93	GAU-430HS	FILTER FINK GAUGE 0-5 PSI	1	1	
94	SK-0188	PANEL	1	1	
95	AAA-ST4538	3/8 SEALTITE 45 DEG. CONNECTOR	1	2	
96	AAA-CG1850	APPLETON CORD GRIP #CG-1850	1	1	
97	AAA-ST9038	3/8 SEALTITE ELBOW	1	1	1
98	FMI-5012X06	1 1/2 X 3/4 BLACK BUSHING	1	1	
99		NOT USED			
100	FMI-6508	1" NPT BLACK PLUG	1	1	1
101	FHY-7237X10	WHD #7237X10SAE HEX HD PLUG	1	1	1
102	TUB-1/8BLKN	WHD PT-23002 1/8 BLACK NYLON TUBE	9 FT.	9 FT.	
103	NST-04XCLOSE	1/2 CLOSE BLACK NIPPLE			3
104		NOT USED			
105	XFMR-HS430	50 VA TRANSFORMER	1	1	
106	VSL-DIN CABLE	PARKER CABLE NOR-MA634V55-BA05-300	1	1	
107	VSL-16CARTR	PARKER SOL. VALVE #DS-162-CH120-D	1	1	
108	AAA-219	1/2" CONDUIT LOCKNUT	1	1	1
109	FLT-430-.5MIC	FILTER ELEMENT, 10 MICRON ABSOLUTE	2	2	
110	SK-0186	FILTER HEAD-SET 25 PSI RELIEF	1	1	
111	SK-0182	FILTER BRACKET	1	1	
112	F-1523-35-.88	3/8-16 X .88 LG HEX HEAD SCREW	8	8	
113	FMI-4002	1/4 NPT CAP	1	1	1
114	NST-04X3.00	1/2" X 3" BLACK NIPPLE	1	1	
115	OEY-1/2 RADA	OIL FLOW INDICATOR	1	1	1
116	FHY-C5205X10	5/8T X 1/2 NPT MALE CONNECTOR			2
117	SK-0224	3/4" OIL PUMP INLET TUBE	1	1	
118		NOT USED			
119	VCK-10CARTR	PARKER CHECK VALVE #CV102P-20	1	1	
120	PHY-005	OIL PUMP-30 GPM@1800 RPM	1	1	

HS430, HD300 & SD300 Pump Parts List



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	MHV SD300 ASSY QTY
121	ORS-230-BN70	PUMP O-RING	1	1	
122	SK-0168	PUMP ADAPTER	1	1	
123	F-1523-30-.88	5/16-18 X .88 LG HEX HD. BOLT	8	8	8
124	SK-0219	SMALL MANIFOLD	1	1	
125	F-3503-25-.63	1/4-20 X 5/8 BSCS ZINC	2	2	2
126		NOT USED			
127	10-C50X-S	PARKER MALE 90 ELBOW	3	3	
128	FHY-7238X10	WHD -10 SAE FLUSH PLUG	4	4	
129	FHY-C5315X10	5/8TX-10SAE MALE CONNECTOR	2	2	
130	FHY-C5105X12	3/4 NUT	2	2	
131	FHY-C5165X12	3/4 SLEEVE	2	2	
132	N-C02-25	1/4-20 SQ. CLIP-ON NUT	2	2	2
133	SK-0217	MANIFOLD	1	1	
134	VCK-16CARTR	PARKER CHECK VALVE #CVH-161P	1	1	
135	FHY-C5315X12X10	3/4 TX10 SAE MALE CONNECTOR	1	1	
136	HOS-050	1/2" HYDRAULIC HOSE	1 FT.	1 FT.	1 FT.
137	FHY-7237X8	1/2" - SAE HEX PLUG	1	1	
138	HOS-1600	.811 DIA HOSE FERRULE	1	1	1
139	HOS-1500	1/2" ID X 3/4" HOSE ADAPTER"	1	1	1
140	VBD-0050M	BOILER DRAIN	1	1	1
141	SK-0159	PLUG, BLANK	2		
142	RRG-N5000-50	RETAINING RING	4		
143	FGL-1504	1/2 GALV. STREET ELBOW	3	3	3
144	FHY-7238X8	1/2 SAE FLUSH PLUG	2	2	2
145	FBR-3400X6	BRASS STREET ELBOW	2	2	2
146	NST-03X8.00	3/8 PIPE NIPPLE	2	2	2
147	VBV-0038	3/8 BALL VALVE2	2	2	
148	FBR-3326X6	3/8 CLOSE NIPPLE-BRASS	2	2	2
149	VCK-0038	3/8 CHECK VALVE	2	2	2
150	FHY-C5315X10X8	5/8T X -8 SAE MALE CONNECTOR	2	2	2

HS430, HD300 & SD300 Pump Parts List



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	
151	SK-0228	SEAL SLEEVE ~ DRIVE & DEAD END	2	2	
152	F-1523-45-.75	1/2-13 X .75 LG HEX HEAD BOLT	2	2	2
153	F-2522-30-.50	5/16-18 X .50 LG SOCKET SET SCREW	2	2	
154	FHY-C5105X10	5/8 JIC NUT	8	8	4
155	FHY-C5165X10	5/8 JIC SLEEVE	8	8	4
156	SK-0221	5/8 LONG-BEARING FEED TUBE	1	1	
157	WOK-G	WOODRUFF KEY	1	1	1
158	F-2522-30-2.00	5/16-18 X 2.00 LG SOCKET HEAD SET SCREW	2	2	2
159	FBR-3400X8	1/2 BRASS STREET 90 ELL	1	1	
160	W-212-15	5/16 SAE WASHER	2	2	2
161	N-112-30	5/16-18 HEX NUT	2	2	2
162	FHY-C3269X6X4	WHD. 6SAE ADAPTER	2	2	2
163	FU-FNA-1	FUSE	1	1	
164	FU-KTK30-2-PP	FUSE HOLDER	1	1	
165	FU-FNQ-1	FUSE	2	2	
166	SHVB-SD-1.375	QD BUSHING		1	1
167	SHV-455650-QD	QD SHEAVE - (4) GROOVE		1	1
168	MTR-SD300	10HP/1800 RPM ELECTRIC MOTOR - PREM. EFF.		1	1
169	SK-0208	MOTOR MOUNT BLOCK		2	2
170	F-1523-55-4.00	3/4-10 X 4.00 LG HEX HD. BOLT		1	1
171	VBT-4/B105	BANDED VEE BELT		1	1
172	SK-0161	OIL RESERVOIR WELDMENT			1
173	SK-0199	END PLATE			2
174	SK-0162	DEAD END CAP			1
175	HB-1010	HINGE BAR			4
176	SK-0146	LIGHT ECCENTRIC			1
177	SK-0147	HEAVY ECCENTRIC			1
178	SF-1001	MAIN SHAFT			1
179	SK-0158	PLUG, .250 ID			2
180	TUB-10X049H	5/8 HYDRAULIC TUBING			A/R

HS430, HD300 & SD300 Pump Parts List



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	MHV SD300 ASSY QTY
181	FMI-2504	BLACK TEE			1
182	NST-04X8.50	1/2 X 8.50 LG BLACK NIPPLE			1
183	VSL-0050-480	1/2 SOLENOID VALVE - 480 VOLT			1
184	NST-04X1.50	1/2 X 1.50 LG BLACK NIPPLE			1
185	FSP-1/2 FHP-S	FLUSH PLUG			2
186	FMI-3504	BLACK CROSS			1
187	FSP-3/4 HHP-S	FLUSH PLUG			1
188	F-5021-55-4.50	3/4-10 EYEBOLT, FULL THREAD	1	1	1
189	AAA-020	3/8 SEALTITE CONDUIT	3 FT.	3 FT.	5 FT.
190	ORS-217-BN70	217 BN70 O-RING	2	2	
191	SK-0218	STUB MANIFOLD-6000# SAE	1	1	
192	FHY-C5405X10	WHD 5/8T X 1/2 NPT ELBOW	1	1	
193	FHY-C5405X12	3/4T X 3/4NPT MALE ELL	1	1	
194	SK-0222	5/8 BRG. FEED TUBE	1	1	
195	NST-02X3.00	1/4X3.00 BLACK NIPPLE	1	1	1
196	FBR-6100X2	WHD. 1/8 O.D. NUT	6	6	
197	FFS-9012	MCMaster-CARR NUT #5530K27	1	1	
198	FHY-C3269X10X8	WHD 1/2 NPT FEM X-10 SAE ADAPTER	1	1	
199	FGL-2004	1/2 GALV STREET 45 ELBOW	1	1	1
200	SK-020703	ACID FILTER FEED TUBE	1	1	
201	FHY-C5165X6	WHD 3/8 DIA. FITTING SLEEVE	2	2	
202	FHY-C5105X6	WHD. 3/8 DIA. FITTING NUT	2	2	
203	FHY-C5315X6	WHD. 3/8 T X-6SAE MALE CONNECTOR	1	1	
204	FHY-C5405X6X6	3/8 T X 3/8 NPT MALE ELBOW	2	2	
205	HF-06PLOCWVL	3/8 ID X 3/8 JIC SWIVEL	2	2	
206	HOS-038B	3/8 ID BLUE PUSH-ON HOSE	2 FT.	2 FT.	
207	FLT-ZKIT	ACID FILTER ASS'Y.	1	1	
208	FLT-PH-9750	ACID FILTER ELEMENT(IN 207)	1	1	
209	FLT-ZKITHEAD	ACID FILTER HEAD (IN 207)	1	1	
210	F-1523-35-.75	3/8-16 X .75LG HHCS	3	3	

HS430, HD300 & SD300 Pump Parts List



ITEM NUMBER	MHV PART NUMBER	DESCRIPTION	MHV HS430 ASSY QTY	MHV HD300 ASSY QTY	
211	SK-0207	FILTER MOUNT BRACKET	1	1	
212	F-1523-35-1.25	3/8-16 X 1.25LG HHCS	2	2	
213	FHY-C5515X6	WHD. 3/8T-6SAE MALE ELBOW	1	1	
214		NOT USED			
215	AAA-ST4538	3/8 SEALTITE 45 DEG ELBOW			1
216	AAA-193	1/2" SLB ENTRANCE ELBOW			1
217	AAA-CN50	1/2" CHASE NIPPLE			1
218	FKF-16AS2MP	HIS #KF16X1/4 NPT ADAPTER	1	1	1
219	FKF-16CRAB	HIS #KF16 CENT RING	1	1	1
220	FKF-16BS	HIS #KF16 BLANK	1	1	1
221	FKF-16CL	HIS #KF16 CLAMP	1	1	1
222	FHY-C3459X8	#8 SAE ELBOW ADAPTER	2	2	2
223	F-2022-35-1.50	3/8-16 X 1 1/2 LG SHCS LOC WEL	8	8	
224		NOT USED			
225	VTM-0050WH	125F - 200F MODULATING VALVE	1	1	1
226	NGL-04XCL	1/2 X CLOSE GALVANIZED NIPPLE	1	1	1
227	FGL-3004	1/2 GALVANIZED UNION	1	1	1
228	NGL-04X7.00	1/2 X 7.00 LG GALVANIZED NIPPLE	1	1	1
229	AAA-TMT	TIE-MOUNT	4	4	4
230	AAA-388WRT	TIE-WRAP	4	4	4
231	SK-0230	2" #3000 SAE ELBOW	2	2	
232	ORS-226-BN70	226 BN70 O-RING	2	2	
233	F-1523-45-2.5	1/2-13 X 2.50 LG HEX HD. BOLT	8	8	
234	SK-0223	5/8 FILTER FEED TUBE	1	1	
235	SK-0220	5/8 FILTER RETURN TUBE	1	1	
236	ORC-210-BN70	3/16" DIA O-RING FROM BULK	1	1	1
237	SK-0170	SHOULDER RING			2
238	SK-0214	INNER RACE SPACER			2
239	FMI-0504	1/2" BLACK MALE, 90 ELL			1

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