



SERVICE AND OPERATING MANUAL

Model HDF1/HDF25 Heavy Duty Flap Valve

Type 1



Table of Contents

Principle of Operation	1
Installation and Start-Up	1
Air Supply	1
Installation Guide.....	2
Air Inlet & Priming.....	3
Air Exhaust	3
Between Uses	3
Check Valve Servicing.....	3
Diaphragm Servicing	3
Air Valve Lubrication.....	3
ESADS+Plus®: Externally Serviceable Air Distribution System	4
Pilot Valve.....	4
Pilot Valve Actuator.....	5
Service Instructions: Troubleshooting	5
Warranty	5
Recommended Accessories	5
Important Safety Information	6
Recycling	6
Grounding The Pump	7
Material Codes	8
Declaration of Conformity.....	9
Composite Repair Parts List.....	10
Composite Repair Drawing.....	12



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Model HDF1/HDF25 Heavy Duty Flap Valve Type 1

PLEASE NOTE!

The photos shown in this manual are for general instruction only. Your specific model may not be shown. Always refer to the parts list and exploded view drawing for your specific model when installing, disassembling or servicing your pump.

PRINCIPLE OF PUMP OPERATION

This ball valve pump is powered by compressed air and is a 1:1 pressure ratio design. It alternately pressurizes the inner side of one diaphragm chamber, while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod, to move endwise. Air pressure is applied over the entire surface of the diaphragm, while liquid is discharged from the opposite side. The diaphragm operates under a balanced condition during the discharge stroke, which allows the unit to be operated at discharge heads over 200 feet (61 meters) of water head.

Since the diaphragms are connected by a common rod, secured by plates to the center of the diaphragms, one diaphragm performs the discharge stroke, while the other is pulled to perform the suction stroke in the opposite chamber.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Positive suction head in excess of 10 feet of liquid (3.048 meters) is not recommended. For applications with higher suction heads, consult the factory.

Alternate pressuring and exhausting of the diaphragm chamber is performed by means of an externally mounted, pilot operated, four-way spool type air distribution valve. When the spool shifts to one end of the valve body, inlet air pressure is applied to one diaphragm chamber and the other diaphragm chamber exhausts. When the spool shifts to the opposite end of the valve body, the porting of chambers is reversed. The air distribution valve spool is moved by an internal pilot valve which alternately pressurizes one side of the air distribution valve spool, while exhausting the other side. The pilot valve is shifted at each end of the diaphragm stroke by the diaphragm plate coming in contact with the end of the pilot valve spool. This pushes it into position for shifting of the air distribution valve.

The chambers are manifolded together with a suction and discharge check valve for each chamber, maintaining flow in one direction through the pump.

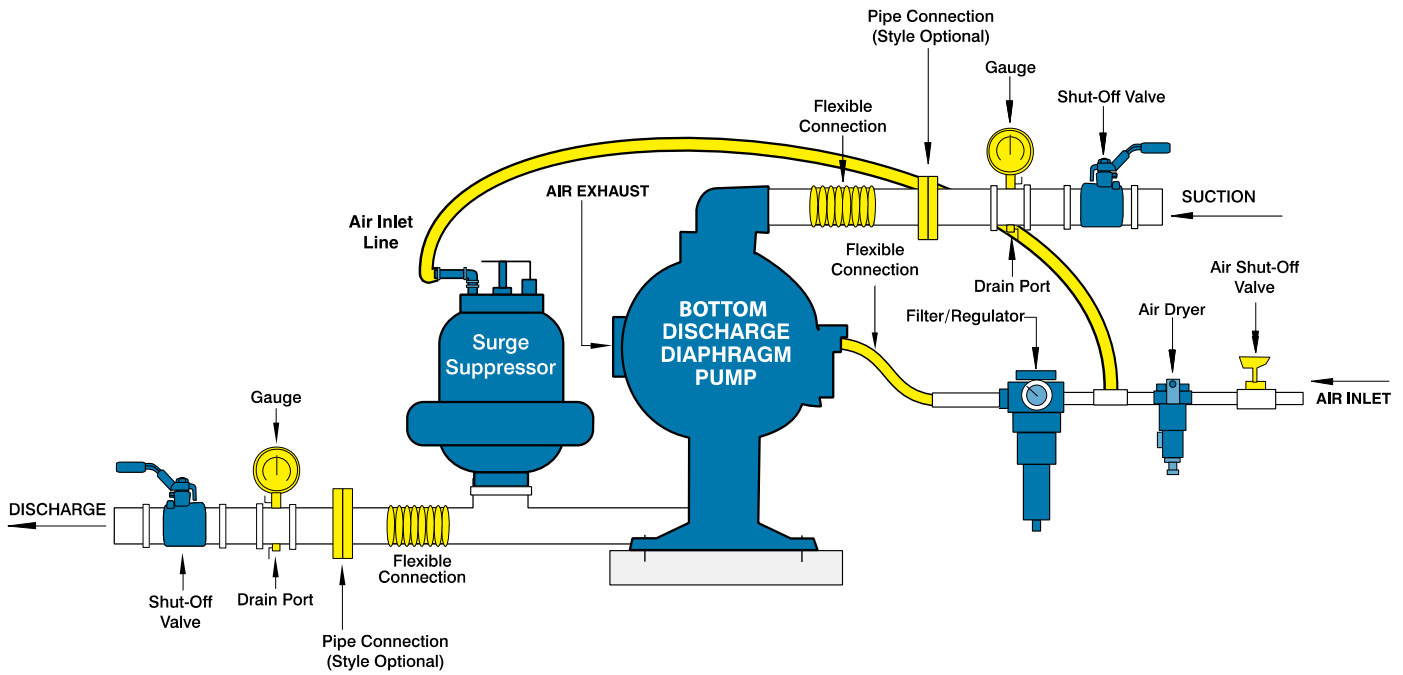
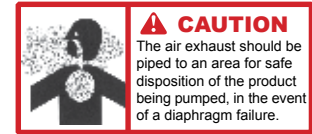
INSTALLATION & START-UP

Locate the pump as close to the product being pumped as possible, keeping suction line length and number of fittings to a minimum. Do not reduce line size.

For installations of rigid piping, short flexible sections of hose should be installed between pump and piping. This reduces vibration and strain to the piping system. A Warren Rupp Tranquilizer® surge suppressor is recommended to further reduce pulsation in flow. Tighten all fasteners before pump startup.

This pump was tested at the factory prior to shipment and is ready for operation. It is completely self-priming from a dry start for suction lifts of 17 feet (5.8 meters) or less. For suction lifts exceeding 17 feet of liquid, fill the chambers with liquid prior to priming.

- Available from Distributor
- Available from Warren Rupp



AIR SUPPLY

Air supply pressures cannot exceed 125 psi (8.61 bar). Connect the pump air inlet to an air supply of sufficient capacity and pressure required for desired performance. When the air line is solid piping, use a short length of flexible hose (not less than 1/2" (12.7 mm) in diameter) between pump and piping to eliminate strain to pipes.

AIR INLET & PRIMING

For start-up, open an air valve approximately 1/2" to 3/4" turn. After the unit primes, an air valve can be opened to increase flow as desired. If opening the valve increases cycling rate, but does not increase flow rate, cavitation has occurred, and the valve should be closed slightly.

For the most efficient use of compressed air and the longest diaphragm life, throttle the air inlet to the lowest cycling rate that does not reduce flow.

AIR EXHAUST

If a diaphragm fails, the pumped liquid or fumes can enter the air end of the pump, and be exhausted into the atmosphere. When pumping hazardous or toxic materials, pipe the exhaust to an appropriate area for safe disposition.

This pump can be submerged if materials of construction are compatible with the liquid. The air exhaust must be piped above the liquid level. Piping used for the air exhaust must not be smaller than 1" (2.54 cm). Reducing the pipe size will restrict air flow and reduce pump performance. When the product source is at a higher level than the pump (flooded suction), pipe the exhaust higher than the product source to prevent siphoning spills.

Freezing or icing-up of the air exhaust can occur under certain temperature and humidity conditions. Use of an air dryer should eliminate most icing problems.

BETWEEN USES

When used for materials that tend to settle out or transform to solid form, the pump should be completely flushed after each use, to prevent damage. Product remaining in the pump between uses could dry out or settle out. This could cause problems with valves and diaphragms at re-start. In freezing temperatures, the pump must be drained between uses in all cases.

FLAP VALVE SERVICING

Valve inspection requires removal of Capscrews and elbows. When the top suction elbows are removed, the valve and seat are connected as an assembly. When the bottom discharge elbows are removed, the valve and seat stay with the outer chamber. Visual inspection and cleaning is possible. If parts are to be replaced, remove the self-locking nuts and all parts are accessible.

Caution should be used while reassembling Flap valves. The valves are designed for some preload over the retainer hinge pad. This is done to insure proper face contact with the seat. After all parts are in place, tighten the lock nuts down on the assembly to the point where visual inspection shows that seat and valve face mate without gap. This is important for dry prime. However, after priming action has started, valves will function due to differential pressure without concern or trouble.

DIAPHRAGM SERVICING

Remove the eight bolts securing the elbows to the chamber. Remove the four nuts and four capscrews securing the outer diaphragm chamber flange and remove the chamber. Loosen the capscrew securing the diaphragm and plate to the rod by leaving the diaphragm engaged with the capscrews around the outer flange, preventing rotation of the rod. **DO NOT USE A WRENCH ON THE DIAPHRAGM ROD. FLAWS ON THE SURFACE MAY DAMAGE BEARINGS AND SEAL.**

During reassembly make certain that the rubber bumper is on the rod on each side. Install the diaphragm with the natural bulge outward as indicated on the diaphragm. Install the outer plate on the outside of the diaphragm. Place the sealing washer between the inner diaphragm plate and the end of the rod. Tighten the capscrew to approximately 25 ft. lbs. (33.9 Newton meters). Torque while allowing diaphragm to turn freely with plates. Except for EPDM Rubber, use a lightweight oil between plates and diaphragm when doing this procedure. For EPDM water can be used. Use a wrench on the Hex of the opposite side to keep the rod from rotating. If the opposite chamber is assembled, the rod need not be held. The Flap Valves can also be inspected for proper seating at this point.

AIR VALVE LUBRICATION

The SANDPIPER pump's pilot valve and main air valve assemblies are designed to operate **WITHOUT** lubrication. This is the preferred mode of operation. There may be instances of personal preference, or poor quality air supplies when lubrication of the compressed air supply is required. The pump air system will operate with properly lubricated compressed air supplies. Proper lubrication of the compressed air supply would entail the use of an air line lubricator (available from Warren Rupp) set to deliver one drop of 10 weight, non-detergent oil for every 20 SCFM of air the pump consumed at its point of operation. Consult the pump's published Performance Curve to determine this.

It is important to remember to inspect the sleeve and spool set routinely. It should move back and forth freely. This is most important when the air supply is lubricated. If a lubricator is used, oil accumulation will, over time, collect any debris from the compressed air. This can prevent the pump from operating properly.

Water in the compressed air supply can create problems such as icing or freezing of the exhaust air causing the pump to cycle erratically, or stop operating. This can be addressed by using a point of use air dryer to supplement a plant's air drying equipment. This device will remove excess water from the compressed air supply and alleviate the icing or freezing problem.

ESADS+PLUS®: EXTERNALLY SERVICEABLE AIR DISTRIBUTION SYSTEM

Please refer to the exploded view drawing and parts list in the Service Manual supplied with your pump. If you need replacement or additional copies, contact your local Warren Rupp Distributor, or the Warren Rupp factory Literature Department. To receive the correct manual, you must specify the MODEL and TYPE information found on the name plate of the pump.

The main air valve sleeve and spool set is located in the valve body mounted on the pump with four hex head capscrews. The valve body assembly is removed from the pump by removing these four hex head capscrews.

With the valve body assembly off the pump, access to the sleeve and spool set is made by removing a retaining ring (each end) securing the end cap on the valve body assembly. With the end caps removed, slide the spool back and forth in the sleeve. The spool is closely sized to the sleeve and must move freely to allow for proper pump operation. An accumulation of oil, dirt or other contaminants from the pump's air supply, or from a failed diaphragm, may prevent the spool from moving freely. This can cause the spool to stick in a position that prevents the pump from operating. If this is the case, the sleeve and spool set should be removed from the valve body for cleaning and further inspection.

Remove the spool from the sleeve. Using an arbor press or bench vise (with an improvised mandrel), press the sleeve from the valve body. Take care not to damage the sleeve. At this point, inspect the o-rings on the sleeve for nicks, tears or abrasions. Damage of this sort could happen during assembly or servicing. A sheared or cut o-ring can allow the pump's compressed air supply to leak or bypass within the air valve assembly, causing the pump to leak compressed air from the pump air exhaust or not cycle properly. This is most noticeable at pump dead head or high discharge pressure conditions. Replace any of these o-rings as required or set up a routine, preventive maintenance schedule to do so on a regular basis. This practice should include cleaning the spool and sleeve components with a safety solvent or equivalent, inspecting for signs of wear or damage, and replacing worn components.

To re-install the sleeve and spool set, lightly lubricate the o-rings on the sleeve with an o-ring assembly lubricant or lightweight oil (such as 10 wt. air line lubricant). Re-install one end cap, and retaining ring (see safety warning), on the valve body. Using the arbor press or bench vise that was used in disassembly, carefully press the sleeve back into the valve body, without shearing the o-rings. Re-install the spool, opposite end cap and retaining ring (see safety warning), on the valve body. After inspecting and cleaning the gasket surfaces on the valve body and intermediate, reinstall the valve body on the pump using new gaskets. Tighten the four hex head capscrews evenly and in an alternating cross pattern, at 150 in./lbs. (16.94 Newton meters).

RECOMMENDED WARREN RUPP ACCESSORIES TO MAXIMIZE PUMP PERFORMANCE:

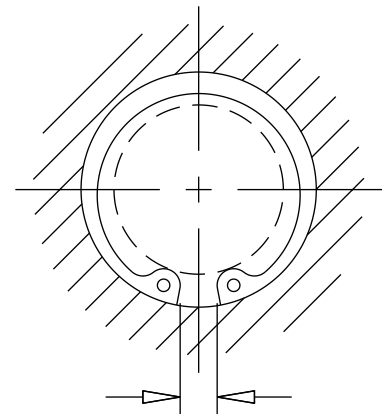
- Tranquilizer® Surge Suppressor.
For nearly pulse-free flow.
- Warren Rupp Filter/Regulator.
For modular installation and service convenience.
- Warren Rupp Speed Control.
For manual or programmable process control. Manual adjustment or 4-20mA reception.

For more detailed information on these accessories, contact your local Warren Rupp Factory-Authorized Distributor, or Warren Rupp corporate headquarters or visit:

www.warrenrupp.com


SAFETY WARNING

To assure proper pump function and safe installation of the retaining ring, check the gap "G" dimension for full installation into the valve body grooves.




≥ .232 "G"
Dimensions between lugs

IMPORTANT SAFETY INFORMATION




IMPORTANT

Read these safety warnings and instructions in this manual completely, before installation and start-up of the pump. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.




WARNING

Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded. (See page 32)



WARNING

This pump is pressurized internally with air pressure during operation. Always make certain that all bolting is in good condition and that all of the correct bolting is reinstalled during assembly.



CAUTION

Before pump operation, inspect all gasketed fasteners for looseness caused by gasket creep. Retorque loose fasteners to prevent leakage. Follow recommended torques stated in this manual.




WARNING

When used for toxic or aggressive fluids, the pump should always be flushed clean prior to disassembly.



WARNING

Before maintenance or repair, shut off the compressed air line, bleed the pressure, and disconnect the air line from the pump. The discharge line may be pressurized and must be bled of its pressure.



WARNING

Before doing any maintenance on the pump, be certain all pressure is completely vented from the pump, suction, discharge, piping, and all other openings and connections. Be certain the air supply is locked out or made non-operational, so that it cannot be started while work is being done on the pump. Be certain that approved eye protection and protective clothing are worn all times in the vicinity of the pump. Failure to follow these recommendations may result in serious injury or death.



WARNING

In the event of diaphragm rupture, pumped material may enter the air end of the pump, and be discharged into the atmosphere. If pumping a product which is hazardous or toxic, the air exhaust must be piped to an appropriate area for safe disposition.



WARNING

Airborne particles and loud noise hazards. Wear ear and eye protection.

RECYCLING

Many components of SANDPIPER® AODD pumps are made of recyclable materials (see chart on page 9 for material specifications). We encourage pump users to recycle worn out parts and pumps whenever possible, after any hazardous pumped fluids are thoroughly flushed.



Pump complies with EN809 Pumping Directive, Directive 2006/42/EC Machinery, according to Annex VIII.



II 2GD T5

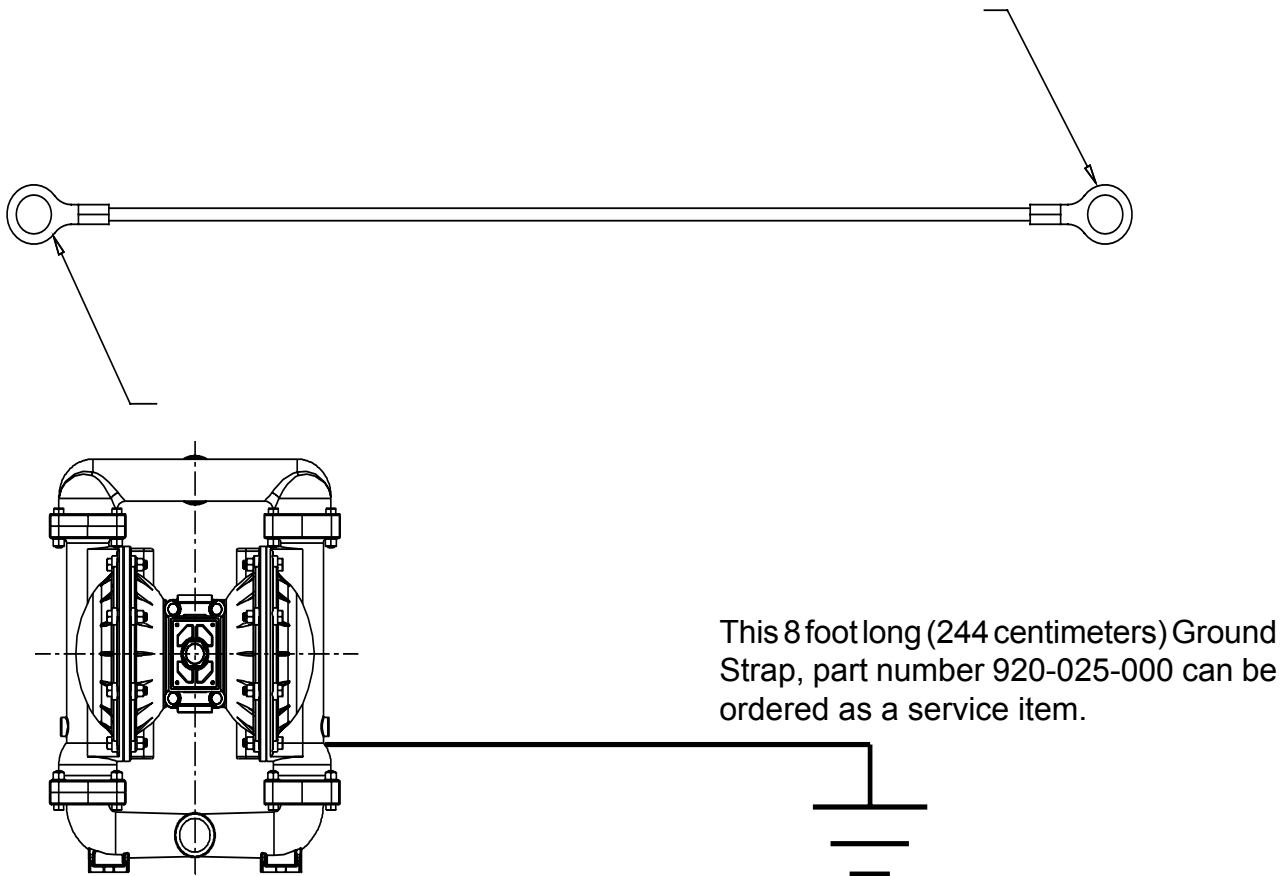
Pump complies with Directive 94/9/EC, EN13463-1 Equipment for use in Potentially Explosive Environments. For reference to the directive certificates visit: www.warrenrupp.com. The Technical File No. AX1 is stored at KEMA, Notified Body 0344, under Document#203040000.

GROUNDING THE PUMP

To be fully groundable, the pumps must be ATEX Compliant. Refer to pump data sheet for ordering.

⚠ WARNING ⚠

Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.



To reduce the risk of static electrical sparking, this pump must be grounded. Check the local electrical code for detailed grounding instruction and the type of equipment required, or in the absence of local codes, an industry or nationally recognized code having jurisdiction over specific installations.

MATERIAL CODES

THE LAST 3 DIGITS OF PART NUMBER

000	Assembly, sub-assembly; and some purchased items	337	Silver Plated Steel	555	Polyvinyl Chloride
010	Cast Iron	340	Nickel Plated	556	Black Vinyl
012	Powered Metal	342	Filled Nylon	558	Conductive HDPE
015	Ductile Iron	351	Food Grade Santoprene	570	Rulon II
020	Ferritic Malleable Iron	353	Geolast; Color: Black	580	Ryton
025	Music Wire	354	Injection Molded #203-40 Santoprene- Duro 40D +/-5; Color: RED	590	Valox
080	Carbon Steel, AISI B-1112			591	Nylatron G-S
100	Alloy 20	355	Thermal Plastic	592	Nylatron NSB
110	Alloy Type 316 Stainless Steel	356	Hytrel	600	PTFE (virgin material) Tetrafluorocarbon (TFE)
111	Alloy Type 316 Stainless Steel (Electro Polished)	357	Injection Molded Polyurethane	601	PTFE (Bronze and moly filled)
112	Alloy C	358	Urethane Rubber (Some Applications) (Compression Mold)	602	Filled PTFE
113	Alloy Type 316 Stainless Steel (Hand Polished)			603	Blue Gylon
114	303 Stainless Steel	359	Urethane Rubber	604	PTFE
115	302/304 Stainless Steel	360	Nitrile Rubber Color coded: RED	606	PTFE
117	440-C Stainless Steel (Martensitic)	361	Nitrile	607	Envelon
120	416 Stainless Steel (Wrought Martensitic)	363	FKM (Fluorocarbon). Color coded: YELLOW	608	Conductive PTFE
123	410 Stainless Steel (Wrought Martensitic)	364	E.P.D.M. Rubber. Color coded: BLUE	610	PTFE Encapsulated Silicon
148	Hardcoat Anodized Aluminum	365	Neoprene Rubber. Color coded: GREEN	611	PTFE Encapsulated FKM
149	2024-T4 Aluminum	366	Food Grade Nitrile	632	Neoprene/Hytrel
150	6061-T6 Aluminum	368	Food Grade EPDM	633	FKM/PTFE
151	6063-T6 Aluminum	370	Butyl Rubber	634	EPDM/PTFE
152	2024-T4 Aluminum (2023-T351)			635	Neoprene/PTFE
154	Almag 35 Aluminum	371	Philthane (Tuftane)	637	PTFE, FKM/PTFE
155	356-T6 Aluminum	374	Carboxylated Nitrile	638	PTFE, Hytrel/PTFE
156	356-T6 Aluminum	375	Fluorinated Nitrile	639	Nitrile/TFE
157	Die Cast Aluminum Alloy #380	378	High Density Polypropylene	643	Santoprene®/EPDM
158	Aluminum Alloy SR-319	379	Conductive Nitrile	644	Santoprene®/PTFE
159	Anodized Aluminum	405	Cellulose Fibre	656	Santoprene Diaphragm and Check Balls/EPDM Seats
162	Brass, Yellow, Screw Machine Stock	408	Cork and Neoprene	661	EPDM/Santoprene
165	Cast Bronze, 85-5-5-5	425	Compressed Fibre	666	FDA Nitrile Diaphragm, PTFE Overlay, Balls, and Seals
166	Bronze, SAE 660	426	Blue Gard	668	PTFE, FDA Santoprene/PTFE
170	Bronze, Bearing Type, Oil Impregnated	440	Vegetable Fibre		
175	Die Cast Zinc	465	Fibre		
180	Copper Alloy	500	Delrin 500		
305	Carbon Steel, Black Epoxy Coated	501	Delrin 570		
306	Carbon Steel, Black PTFE Coated	502	Conductive Acetal, ESD-800		
307	Aluminum, Black Epoxy Coated	503	Conductive Acetal, Glass-Filled		
308	Stainless Steel, Black PTFE Coated	505	Acrylic Resin Plastic		
309	Aluminum, Black PTFE Coated	506	Delrin 150		
310	PVDF Coated	520	Injection Molded PVDF Natural color		
313	Aluminum, White Epoxy Coated	540	Nylon		
330	Zinc Plated Steel	541	Nylon		
331	Chrome Plated Steel	542	Nylon		
332	Aluminum, Electroless Nickel Plated	544	Nylon Injection Molded		
333	Carbon Steel, Electroless Nickel Plated	550	Polyethylene		
335	Galvanized Steel	551	Glass Filled Polypropylene		
336	Zinc Plated Yellow Brass	552	Unfilled Polypropylene		
		553	Unfilled Polypropylene		

Delrin and Hytrel are registered tradenames of E.I. DuPont.

Gylon is a registered tradename of Garlock, Inc.

Nylatron is a registered tradename of Polymer Corp.

Santoprene is a registered tradename of Monsanto Corp.

Rulon II is a registered tradename of Dixon Industries Corp.

Ryton is a registered tradename of Phillips Chemical Co.

Valox is a registered tradename of General Electric Co.

PortaPump, Tranquilizer and SludgeMaster are registered tradenames of IDEX AODD, Inc.

WARREN RUPP®

Declaration of Conformity

**Warren Rupp®, IDEX AODD, Inc., 800 N. Main Street, P.O. Box 1568,
Mansfield, Ohio, 44901-1568 USA**

certifies that Air-Operated Double Diaphragm Pumps Series: HDB, HDF, M Non-Metallic, S Non-Metallic, M Metallic, S Metallic, T Series, G Series, U Series, EH and SH High Pressure, W Series, SMA and SPA Submersibles, and Tranquilizer Surge Suppressors comply with the European Community Directive 2006/42/EC on Machinery, according to Annex VIII. This product has used Harmonized Standard EN 809, Pumps and Pump Units for Liquids - Common Safety Requirements, to verify conformance.

David Roseberry
Signature of authorized person

October 20, 2005

Date of issue

David Roseberry
Printed name of authorized person

Engineering Manager
Title

Revision Level: C

October 13, 2009

Date of revision





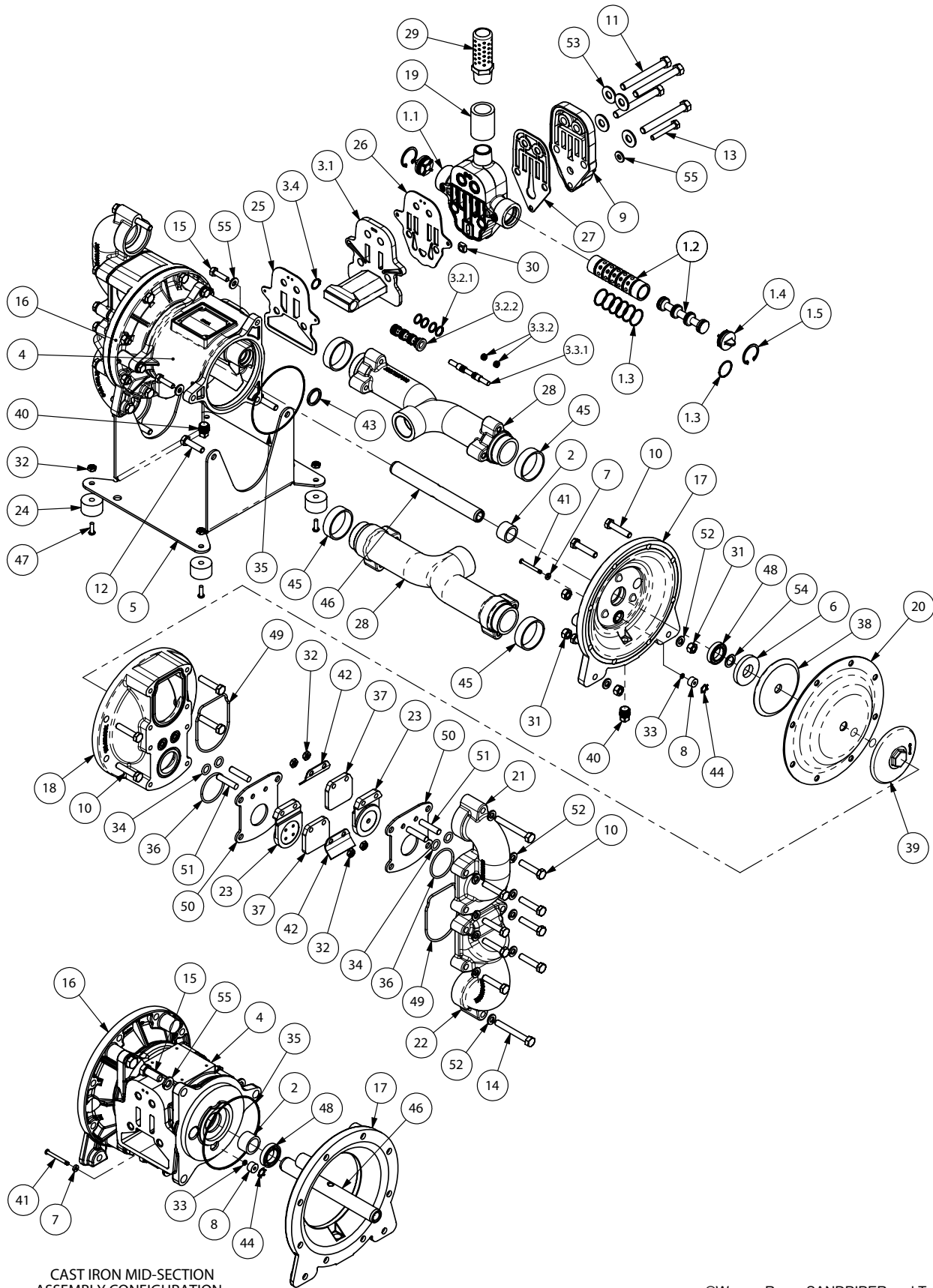
Ex II 2GD T5
CE

Composite Repair Parts List
Model HDF1/HDF25
Heavy Duty Flap Valve
Type 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	031.030.558	Assembly, Air Valve	1
1.1	095.051.558	Body, Air Valve	1
1.2	031.039.000	Sleeve & Spool Set	1
1.3	560.058.360	O-Ring	8
1.4	165.038.356	Cap, End	2
1.5	675.043.115	Ring, Retaining	2
2	070.012.170	Bearing, Sleeve	2
3	095.074.000	Pilot Valve Assembly	1
3.1	095.071.551	Body, Pilot Valve	1
3.2	755.025.000	Sleeve Assembly (w/ O-Rings)	1
3.2.1	560.033.360	O-Ring	4
3.2.2	755.025.162	Sleeve, Pilot Valve	1
3.3	775.014.000	Spool Assembly (w/ O-Rings)	1
3.3.1	775.014.115	Spool, Pilot Valve	1
3.3.2	560.023.360	O-Ring	4
3.4	675.037.080	Ring, Retaining	1
4	114.007.157	Bracket, Intermediate (AL Center)	1
	114.012.010	Bracket, Intermediate (CI Center)	1
5	115.071.330	Bracket, Mounting	1
6	132.019.360	Bumper	2
7	132.022.360	Bumper, Actuator	2
8	135.034.506	Bushing, Plunger	2
9	165.134.157	Cap, Air Inlet, Ass'y (AL Center)	1
	165.134.558	Cap, Air Inlet, Ass'y (CI Center)	1
10	170.029.330	Capscrew, Hex HD	32
11	170.033.330	Capscrew, Hex HD	4
12	170.045.330	Capscrew, Hex HD	4
13	170.063.330	Capscrew, Hex HD	1
14	170.080.330	Capscrew, Hex HD	4
15	170.043.330	Capscrew, Hex HD (AL Center)	6
	170.006.330	Capscrew, Hex HD (CI Center)	6
16	196.042.157	Chamber, Inner (AL Center)	1
	196.084.010	Chamber, Inner (CI Center)	1
17	196.043.157	Chamber, Inner (AL Center)	1
	196.090.010	Chamber, Inner (CI Center)	1
18	196.199.156	Chamber, Outer	2
	196.199.010	Chamber, Outer	2
	196.199.110	Chamber, Outer	2
19	255.012.335	Coupling, Pipe, 3/4 NPT	1
20	286.008.354	Diaphragm	2
	286.008.356	Diaphragm	2
	286.008.360	Diaphragm	2
	286.008.363	Diaphragm	2
	286.008.364	Diaphragm	2
	286.008.365	Diaphragm	2
21	312.119.156	Elbow, Suction	2
	312.119.010	Elbow, Suction	2
	312.119.110	Elbow, Suction	2
22	312.120.156	Elbow, Discharge	2
	312.120.010	Elbow, Discharge	2
	312.120.110	Elbow, Discharge	2

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
23	338.014.354	Flap Valve	4
	338.014.356	Flap Valve	4
	338.014.360	Flap Valve	4
	338.014.363	Flap Valve	4
	338.014.364	Flap Valve	4
	338.014.365	Flap Valve	4
24	350.002.360	Foot, Rubber	4
25	360.056.379	Gasket	1
26	360.057.360	Gasket	1
27	360.058.360	Gasket	1
28	518.205.156	Manifold	2
	518.205.156 E	Manifold	2
	518.205.010	Manifold	2
	518.205.010 E	Manifold	2
	518.205.110	Manifold	2
	518.205.110 E	Manifold	2
29	530.036.000	Muffler	1
30	542.001.330	Nut, Square	1
31	545.004.330	Nut, Hex, 5/16-18	14
32	547.002.330	Nut, Stop	12
33	560.001.360	O-Ring	2
34	560.038.360	O-Ring	8
	560.038.363	O-Ring	8
	560.038.364	O-Ring	8
	560.038.365	O-Ring	8
35	560.040.360	O-Ring	2
36	560.198.360	O-Ring	4
	560.198.363	O-Ring	4
	560.198.364	O-Ring	4
	560.198.365	O-Ring	4
37	570.018.360	Pad, Hinge	4
	570.018.363	Pad, Hinge	4
	570.018.364	Pad, Hinge	4
	570.018.365	Pad, Hinge	4
38	612.022.330	Plate, Diaphragm, Inner	2
39	612.108.157	Assembly, Diaphragm Plate	2
	612.101.082	Assembly, Diaphragm Plate	2
	612.101.110	Assembly, Diaphragm Plate	2
40	618.003.330	Plug, Pipe, 1/4	3
41	620.007.114	Plunger, Actuator	2
42	670.053.110	Retainer	4
43	675.040.360	Ring, Sealing	2
44	675.042.115	Ring, Retaining	2
45	675.065.360	Ring, Sealing	4
	675.065.363	Ring, Sealing	4
	675.065.364	Ring, Sealing	4
	675.065.364	Ring, Sealing	4
46	685.039.120	Rod, Diaphragm	1
47	706.013.330	Screw, Machine	4
48	720.010.375	Seal, U-Cup	2
49	720.066.360	Seal, Seat	4
	720.066.363	Seal, Seat	4
	720.066.364	Seal, Seat	4
	720.066.365	Seal, Seat	4
50	722.101.110	Seat, Flap	4
51	807.018.110	Stud, 1/4-20	8
52	900.004.330	Washer, Lock, 5/16	24
53	901.005.330	Washer, Flat, 3/8	4
54	901.012.180	Washer, Sealing	2
55	901.035.330	Washer, Flat	7

Composite Repair Drawing



CAST IRON MID-SECTION
ASSEMBLY CONFIGURATION

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