General Introduction

The patented Endura-AB is an **A**ir **B**arrier magnetically coupled end-suction centrifugal pump line, capable of dry-running indefinitely. It is manufactured by Liquiflo Equipment Company and is available in long coupled (Power Frame), or close-coupled (C-Face mounting) styles.

DIMENSIONAL ENVELOPE

The **long-coupled** option is, dimensionally, in full compliance with the ANSI B73.1 specification and **will retrofit any existing ANSI pump installation.**

The **close-coupled** option involves **no piping modifications**. The magnetic coupling mounts directly on the motor shaft, requiring the motor to be moved forward. This C-Face mounting eliminates the need for coupling alignment.

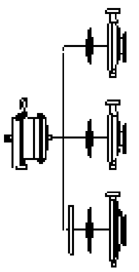
The back pull out design enables the removal of the rotating assembly without removing the casing from the piping.

AVAILABLE STANDARD SIZES

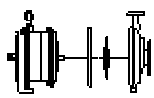
Group I:	Max. RPM
1.5x1x6	3550
3x1.5x6	3550
1.5x1x8	3550

Group II:	Max. RPM
3x2x8	3550

Group I



Group II



3x2x8

IMPELLER

All Group I AB pumps are a closed impeller design. The Group II AB pump is an open impeller design.

FLANGES

The AB is fitted with a 150# serrated Raised Face standard flanged casing and the 300# serrated Raised Face flanged casings are optional.

MATERIALS

The standard option for materials is 316 stainless. Consult the factory for the availability, price, and delivery of non-standard Materials.

ELASTOMERS

Teflon O-rings are the standard for casing and containment can. The gas seal O-ring package consists of five O-rings and is available in Viton, or Kalrez. Consult the factory for other materials.

TEMPERATURE RANGE

The standard AB can be applied at temperatures between 0 °F and +350 °F.

PRESSURE CAPABILITY

AB pumps are rated for 275 psi between –60 °F and +100 °F. Above 100 °F, the rated pressure is linearly de-rated, and at 350 °F is 205 psi (316 s/s).

CONTAINMENT SHELL

The AB containment shell is made from the Transformation-Toughened Zirconia (TTZ), hydrotested at 412 psi. TTZ is a type of ceramic which is non-conductive, therefore it does not experience eddy current losses, as a metal can would experience. As a result, the overall pump efficiency of the AB design is substantially higher than the efficiency of the regular mag-drives that use metal containment shells.

BEARINGS

The AB design stands out from other mag-drives because it combines the seal-less mag-drive feature and a gas seal that prevent pumped fluids from entering the containment shell area. The gas seal is positioned directly behind the impeller, with the rotary portion mounted on the rear impeller shroud. This allows the bearing to be positioned very close to the impeller, with an extremely small overhang of length (L). Since there is no liquid at the back end, regular lubricated-for-life antifriction ball bearings are used. Thus, the "stiffness ratio" ($S=L^3/D^4$, where "D" equals the shaft diameter) is very small. The ratio for AB pumps equals 9.3, as opposed to other ANSI pump design ratios that are much higher, ranging from 20 to 120. These very robust AB shafts eliminate shaft deflections, making the AB capable of withstanding significant hydraulic radial loads that are present at low flow operations.

MINIMUM FLOW RATE

A generally accepted industry practice for minimum flow rate is 15% of the Best Efficiency Point (BEP).

DRY-RUNNING, CAVITATION, LOSS OF SUCTION, AND RUN-OUT OPERATION

The loss of suction is not a problem for the AB design, as long as the gas pressure in the containment is maintained.

For regular mag-drives, cavitation is a serious problem. Cavitation vaporizes liquids, thus starving the mag-drive journal bearings from the essential lubrication the pumped product provides. The AB design does not use journal sleeve bearings; therefore, the loss of liquid during cavitation is not a problem, and pump failure is prevented. However, other cavitation-related effects, such as impeller and casing damage, can still occur. These are strictly a function of the wet-end material selection for cavitation resistance.

The run-out operation usually presents two problems for pumps: motor overload and insufficient NPSHR at the run-out condition. The overload of the motor is an issue for AB pumps, but the NPSH issue is not as critical as it is for other pump types. Run-out may cause pumps to cavitate, but because of its dry-running capability, the AB pump will simply continue to run and will resume pumping once the run-out problem is rectified.

MAXIMUM VISCOSITY

The maximum viscosity of the AB pump is similar to any ANSI hydraulics and is generally applied under 200 centipoise. Refer to the Hydraulic Institute viscosity correction chart or consult the Liquiflo Equipment Company Applications Group.

VENT AND DRAIN

The AB pump is self-venting, due to its top discharge ANSI design. The AB pump is supplied with a ½" drain plug standard.

SPECIAL FEATURES AND ADVANTAGES

- Indefinite dry-running capability
- Impeller is keyed to the shaft and attached with a nut to prevent backing-off into casing if rotation is incorrect
- Shaft is oversized to minimize deflections

RECOMMENDED SPARES

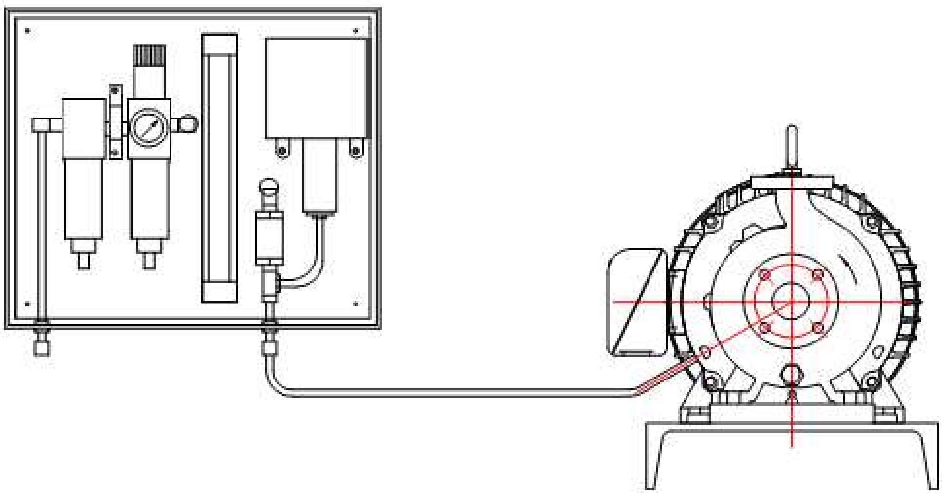
Module – complete spare rotating assembly. This is a complete pump, less the casing. It is recommended when a quick turnaround is essential for plant operation. Due to modular design, the drive (back-end) will fit several casings.

Seal Assemblies – When servicing the pump, it is recommended to buy the air barrier seal assembly, which contains the needed parts to replace the air barrier seal for the pump. The part number suffix changes based on the material of the O-rings.

Parts – all individual parts can be purchased separately. The most common wear parts are listed in the Bill of Materials.

SEAL OPERATION

The AB gas seal is at the heart of this patented pump design. It uses pressurized gas (typically nitrogen) to provide "lift-off" between the seal faces, allowing them to operate without mechanical contact. Therefore, the seal's life is theoretically indefinite because the faces do not contact each other and will not wear out. However, when the pump is idle, the seal faces do shut which provides further protection (in addition to the gas pressure), by preventing pumpage from leaking in to the containment shell. The seal and its gas support system are shown below:



The supplied gas must be clean, dry, pressure-regulated, and available at all times – **regardless of whether the pump is running or idle**. The required gas pressure is dependent on the operating conditions. Generally, the pressure should be adjusted such that the flow meter reading is between 60 and 70 units, and never outside range of 30 and 120 units.

The principle of the gas supply system is as follows:

Clean, dry nitrogen (or a similar gas) is supplied by the plant system or from the gas bottle. Typically a high-pressure regulator is used to reduce the pressure prior to entering the panel to 100 psig.

Inside the panel is a filter, followed by the low-pressure regulator (refer to the panel diagram above). The low-pressure regulator is rated to 250 psi, but the overall panel pressure rating is limited to 200 psig by the rating of the gas flow meter. Rotate the top knob clockwise to increase the pressure or counterclockwise to decrease the pressure as necessary. Once the pressure is set, the knob can be locked (by pushing down) to prevent accidental readjustment.

The gas flow meter follows the pressure regulator. It measures the gas flow in units, which also depend on gas pressure. However, in practice, gas flow is more conveniently expressed in *standard cubic feet per minute* (scfm). The approximate conversion formula is:

$$SCFM = \left(FlowMeter\,Reading \times \sqrt{Gas\,Pressure(abs) \div 14.7}\right) \div 28310$$

For example, if the meter the reads 50 units and the gas pressure is 70 psig (i.e. 84.7 psia), then the gas flow in standard units is:

SCFM = (50 × $\sqrt{84.7/14.7}$)/ 28310 = 0.004 (typical case)

The maximum flow rate is at the maximum allowable gas pressure (100 psig) and the maximum reading of the scale (150 units) of the gas meter (if the gas meter ball "tops out", the reading is meaningless, and a problem must be present):

$SCFM_{max}$ = (150 × $\sqrt{114.7/14.7}$)/28310 = 0.015 (extreme case)

A pressure switch is also supplied with a panel. Its purpose is to alert the user in the event of the loss of nitrogen gas (if the "explosion-proof" is required, it must be mounted separately, outside the panel). Depending on what a customer is using for an alarm, the switch may either be wired normally open or normally closed. The pressure level can be adjusted by turning the knob inside the pressure switch. The switch is rated 10-100 psi, 15A, 480V.

START-UP PROCEDURE OF THE BARRIER PUMPS (refer to IOM for complete instructions)

1) Making sure the panel has no gas leaks:
Connect the panel to the nitrogen supply line, but do not connect it to the pump: have the panel outgoing tubing blanked off. Turn the nitrogen supply on and set the gas pressure inside the panel (as read on the pressure regulator) to 80 psig. Initially, the ball inside the gas meter may top out: If this occurs, gently tap the top of the panel and the ball will settle down. There should be no leaks, and the gas flow meter should read zero – the ball should settle at the bottom of the scale. If this is not the case, fix any panel leaks.

2) Connecting the panel to the pump:
Turn off the nitrogen and connect the panel to the pump, then turn the nitrogen back on. Gas will rush into the pump, and will fill up the containment can quickly. The ball in the gas meter should slowly settle down at the bottom, after the initial in-rush of gas. At this point, the gas seal faces inside the pump are closed-shut and there should be no gas flow. On occasion, the flow meter may indicate a small flow (less than 30 units) while the pump idle. If this occurs, a couple of turns of the motor rotor via the back fan may be necessary to help settle the seal, thus bringing the gas flow down to zero.

3) Pump in piping:
After a pump is installed in piping and is flooded, make sure that the suction valve is wide open and that the discharge valve is only slightly open. This will require the least power from the motor and help prevent magnet decoupling. Do *not* allow fluid into pump without gas. Make sure that there are no leaks and that all safety precautions have been observed.

4) Starting the pump:

Energize the pump, and observe the gas meter: the ball should start slowly rising within 10-15 seconds and should settle between 30 – 120 units of scale. If this does not occur, there could be a problem that would need troubleshooting: consult the IOM manual, your local distributor, or the factory.

Note: in some cases, across-the-line rapid starting may cause decoupling of the magnetic coupling. In these cases, slow starting may help (i.e. using variable speed drive). However, do not prolong the start-up time excessively; proper operation of the gas seal depends on its ability to "lift off", which takes place above a certain minimum value of "lift off speed". Barrier seals lift off at approximately 700 rpm; a prolonged operation at speeds below this value may cause the faces to overheat and thus a possible pump failure.

5) Operating conditions:

Open the discharge valve until the desired flow rate is reached. Observe the discharge and suction gauges and continue to monitor the gas flow meter and the gas pressure gauge. The gas flow may drift slightly but this is not a problem. If the flow drifts outside the recommended operating range the pressure regulator should be adjusted to restore the desired 30 – 120 units of flow on the meter. Adjust the pressure regulator slowly and in small turns. Once it is set, fix the pressure regulator knob (push it down) and close the panel. Observe the pump for 10-15 minutes to make sure that it is operating smoothly, with no excessive noise or vibrations.

6) Periodic monitoring:

It is a good idea to initially monitor the gas flow and flow several times per shift and to keep a log of the data. Contact the distributor or the factory if an unusual drifting trend is observed.