**Liquiflo**
**EQUIPMENT COMPANY**

# Endura Air Barrier®
# General Description

The patented Endura AB-Series is a magnetically coupled end-suction centrifugal pump line, capable of dry-running indefinitely and of handling up to 40% solids. It is manufactured by Liquiflo Equipment Company and is available in close-coupled (C-Face mounting) or long-coupled (Power Frame) styles.

## DIMENSIONAL ENVELOPE

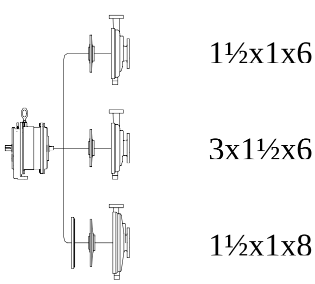
The **long-coupled** option is dimensionally in full compliance with the ANSI B73.1 specification and **will retrofit any existing ANSI pump installation.**

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

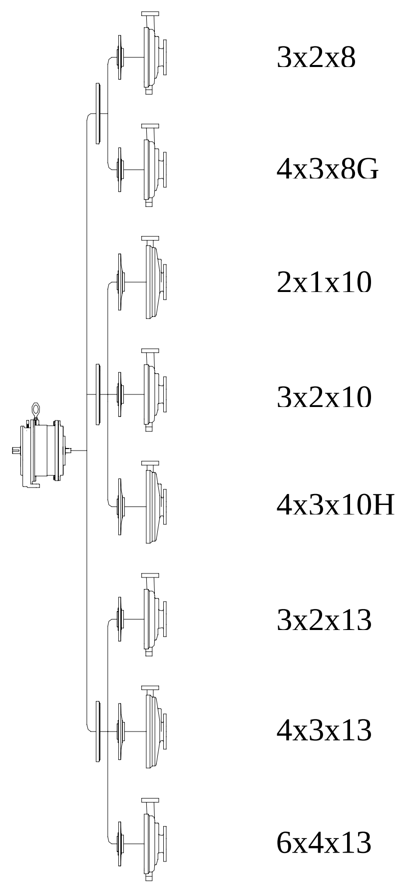
The back pull-out design enables the removal of the rotating assembly without removing the casing from the piping.

## ANSI STANDARD SIZES

**Group I**




**Group II**

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## STANDARD AVAILABLE SIZES

| Group | Size/Model | Max RPM |
|---|---|---|
| I | AB 1.5 x 1 x 6 | 3550 |
| | AB 3 x 1.5 x 6 | 3550 |
| | AB 1.5 x 1 x 8 | 3550 |
| II | AB 3 x 2 x 8 | 3550 |

## IMPELLER

All Group I Air Barrier Pumps use a closed impeller design. All Group II Air Barrier Pumps use an open impeller design

## FLANGES

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

## MATERIALS

The standard option for the wet-end basic material is 316 Stainless Steel. Consult the factory Applications Group for the availability, price and delivery of non-standard materials.

## ELASTOMERS

Teflon O-rings are standard for the 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 AB can be applied between –60 °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 SS).

## CONTAINMENT SHELL

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

## BEARINGS

The Barrier design stands out from other mag-drives because it combines the seal-less mag-drive feature and a gas seal, which prevents pumped fluid 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 bearings to be positioned very close to the impeller, with an extremely small overhang length (L). Since there is no liquid at the back end, regular lubricated-for-life antifriction ball bearings are used. The "stiffness ratio" ($S=L^3/D^4$, where "D" equals the shaft diameter) thus is very small. The ratio for Barrier pumps equals 9.3, as opposed to other ANSI pump design ratios that are much higher, ranging from 20 to 120. These very robust Barrier shafts essentially eliminate shaft deflections, making the Barrier 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 10-20% of the best efficiency point (BEP). However, consult the factory for special requirements.

## DRY-RUNNING, CAVITATION, LOSS OF SUCTION & RUN-OUT OPERATION

The loss of suction is not a problem for the Barrier 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 Barrier 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 NPSH at the run-out condition. The overload of the motor is an issue for Barrier 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 Barrier pump will simply continue to run and will resume pumping once the run-out problem is rectified.

## SOLIDS HANDLING CAPABILITY

Standard mag-drives cannot tolerate solids because they clog up the sleeve bearings. Conversely, the bearings of Barrier mag-drives are isolated from the pumpage and, therefore, can pump solids. The Barrier pump can handle up to forty percent solids by weight.

## MAXIMUM VISCOSITY

The maximum viscosity of the Barrier pump is similar to any ANSI pump and is generally applied under 200 centipoises (cP). Refer to the Hydraulic Institute viscosity correction chart or consult the Liquiflo Equipment Company Applications group.

## VENT & DRAIN

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

## SPECIAL FEATURES & ADVANTAGES

- Indefinite dry-running capability
- Capable of handling up to 40% solids (by weight)
- 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 (lowest $L^3/D^4$ ratio – 9.3)
- Greased-for-life antifriction ball bearings
- Inherent secondary containment (gas seal is primary containment)
- TTZ ceramic containment can eliminates eddy current power losses
- Close-coupled or Power Frame
- ANSI-dimensional for easy change out

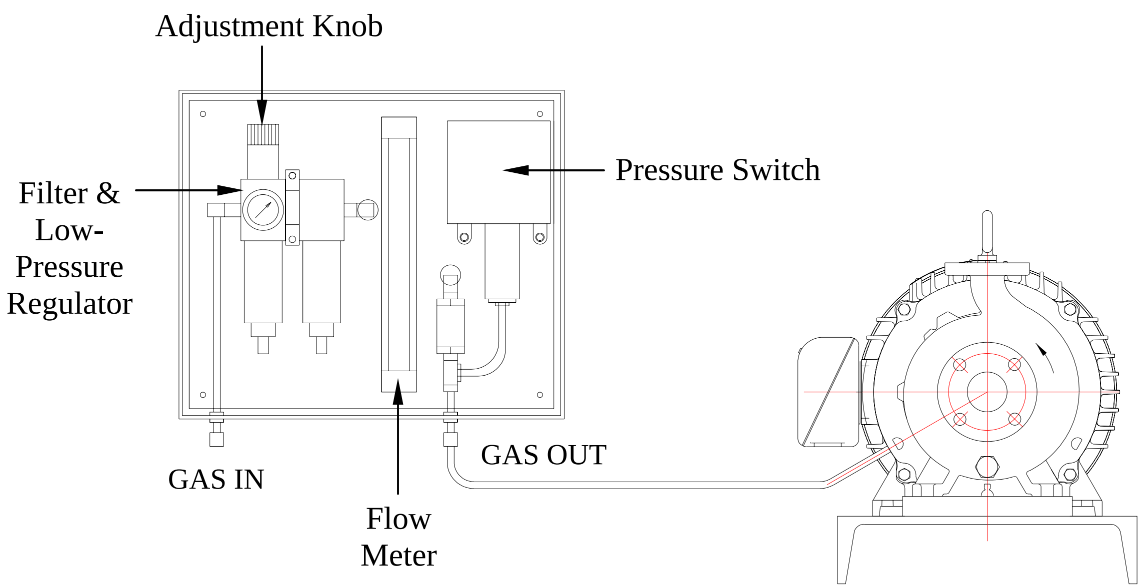
## RECOMMENDED SPARES

Module – Complete spare rotating assembly. This is a complete mag-drive pump less the volute, outer magnet and mounting bracket. It is recommended when a quick turn-around is essential for plant operation.

Parts – All individual parts can be purchased separately (refer to pump Bill of Materials).

## BARRIER SEAL OPERATION

The Barrier 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; thus, the seal's life is theoretically indefinite, because the faces do not contact each other and thus do not wear out. When the pump is idle, however, the seal faces do shut, providing further protection (in addition to the gas pressure), by preventing pumpage from leaking into 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. The reading should never be outside the range of 30 and 120.

**The Principle of the Gas Supply System:**

Clean, dry nitrogen (or a similar gas) is supplied by the plant system or from a 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:

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

For example, if the meter 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 x $\sqrt{84.7/14.7}$ ) / 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 (obviously, if the gas meter ball "tops out", the reading is meaningless, and a problem must be present):

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

A pressure switch may also be supplied with the panel. Its purpose is to alert the user in the event of the loss of nitrogen gas (if the "explosion-proof" switch 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 (NO) or normally closed (NC). The pressure level can be adjusted by turning the knob inside the pressure switch. The switch is rated at 10-100 PSI, 15 A, 480 V.

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

**1) Checking the Panel for 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 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 is 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) Piping and Priming the Pump:**

After the pump is connected to 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 and 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.

<u>Note</u>: 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; 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 product 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.