PUMPENGINEERING INC.

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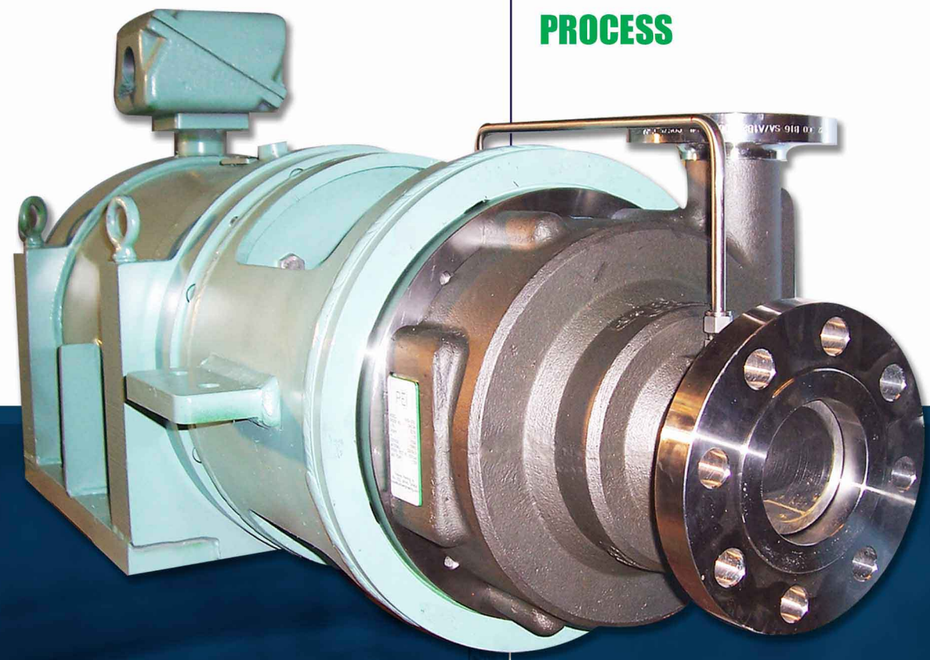
TYPE AVS

PROCESS

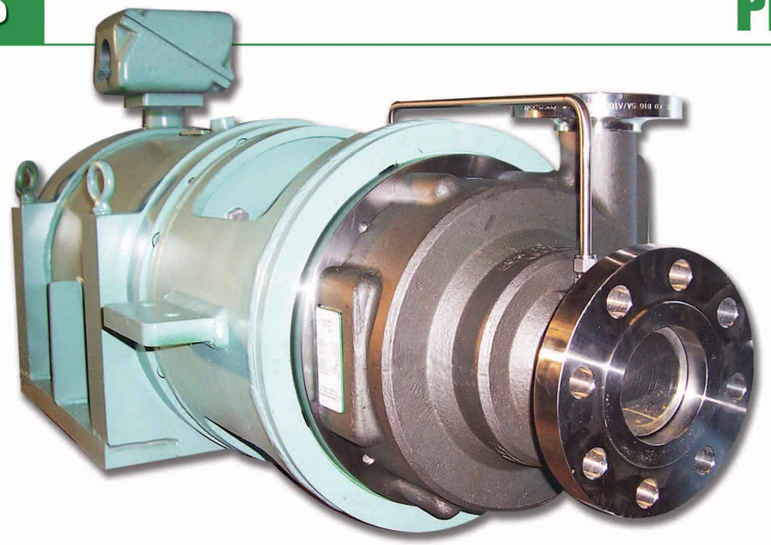


Flows to 12,000 gpm (2,720m3/hr)

Heads to 1,750 ft

TYPE AVS

PROCESS



General Description

The type AVS is a high speed single stage end suction pump designed for continuous service in high pressure application such as seawater and brackish water reverse osmosis and boiler feed service. It is designed to compete favorably with positive displacement and multistage centrifugal pumps

Construction

Casing is centerline supported with end suction, top discharger nozzles and victaulic pipe connections standard, with 300lb and 600lb flanges as an option. The casing is a cylindrical outer housing that contains volute insert waterways.

Volute Inserts are a PEI patent pending design that allows for the complete customization of the hydraulic flow path. The Volute Insets are machined mirror imaged to the exact shape and flow (throat) areas that like the machined impellers, always insure that the AVS pump's BEP is at the customer's duty point. Never again will pump users have to suffer a lifetime of off design operation. If flow conditions change then the Volute Inserts can be remanufacture to the new conditions at a very economical cost.

Shaft Seals are available in cooled and non cooled configurations and are designed to accommodate ANSI standard, double, tandem, and metal bellows mechanical seals or a PEI labyrinth seal. Seals are located between the bearing housing and coupling thereby providing complete access for seal inspection or maintenance without disassembly of any pump components.

Impellers are closed, single suction, radial flow design. Each impeller is agile engineered for the customer's specific duty point and then machined to the exact geometry on 5 axis CNC milling machines. This method provides excellent hydraulic repeatability in addition to always achieving maximum efficiency so that the duty point is also the Best Efficiency Point.

Rotors are stiff shaft design, insuring operation below first critical speed and minimal deflection at the mechanical seal and impeller.

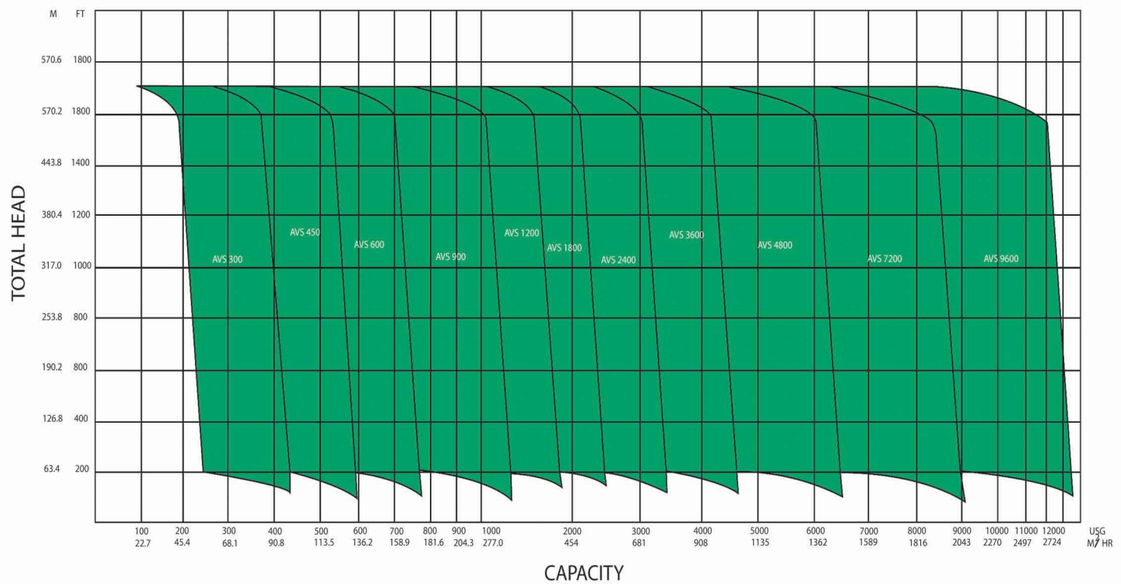
Bearings are product lubricated thus eliminating the need for oil, grease, and auxiliary lubrication systems. One hydrodynamic journal bearing supports and positions the shaft radially. The thrust bearing is a PEI patented hydrodynamic type located on the front impeller face and thus also serves as the high pressure seal between discharge and suction zones of the impeller. Volumetric efficiency of this design is up to 99+% and is one of the principal reasons for the AVS world's highest efficiency performance.

Motor/Pump Adapter connects motor to pump, eliminating field aligning on sizes up to 4x6x11

Motors are designed for high speed operation. Motors sizes up to 500 horsepower are dramatically reduced in frame size through water cooling. For instance a 200hp motor is a frame 326 and weighs 700lbs vs. an air cooled 447 which weighs 2,500lbs. Water cooling also eliminates the fan used in air cooled motors, which reduces motor noise to 80 dB or less. Aircraft quality bearings provide a B 10 life of 40,000 hours.

Bases are constructed with X bracing for maximum rigidity and strength and are available with grouting holes for complete grout filling.

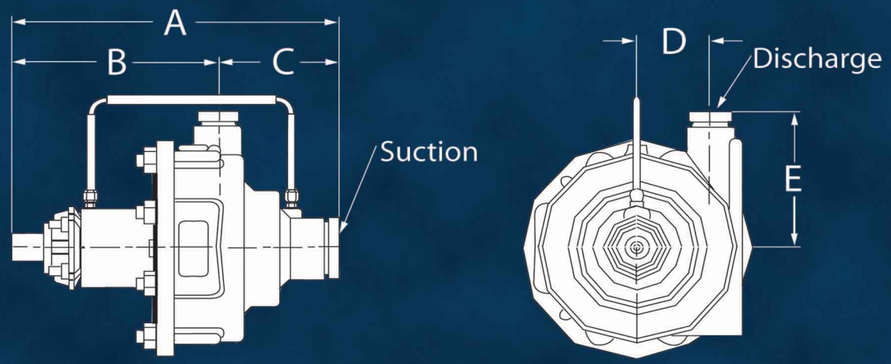
HYDRAULIC COVERAGE CHART



For Liquid Process Energy Recovery, PEI's Hydraulic Turbocharger has set the standard for the last 20 years.

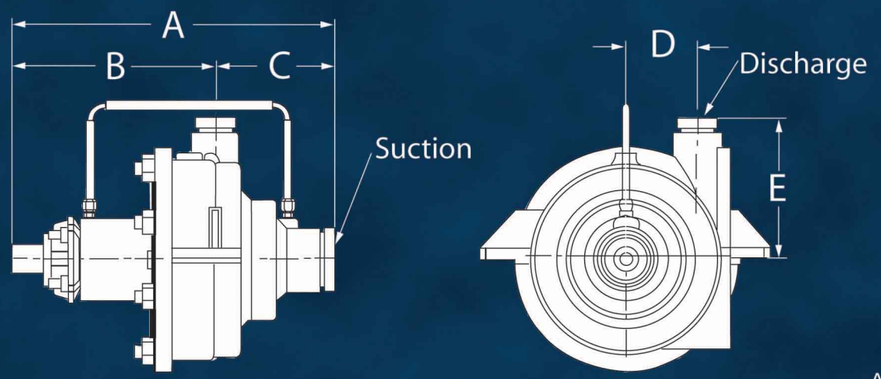
Where a process stream has to be pressurized and then depressurized like in reverse osmosis desalination, gas processing, hydrocarbon processing, ammonia fertilizer production, refrigeration and many others, PEI's Hydraulic Turbocharger product lines have opened new possibilities in the energy recovery industry. World's best efficiency thanks to high speed single stage design, product lubricated bearings, and no shaft seals makes the Turbo the ideal process energy recovery device. From 25 gpm to 12,000 gpm, PEI offers a Hydraulic Turbocharger that can save you tens of thousands to millions of dollars a year in power cost.

DIMENSIONS & WEIGHTS (English Units)



APPROXIMATE DIMENSIONS

PUMP	Disch.	Suct.	A	B	C.	D.	E.	Pump & Base Wt.
AVS 300	2.00	3.00	19.44	12.25	7.19	4.31	8.50	278
AVS 450	3.00	4.00	19.63	12.25	7.38	4.41	9.00	300
AVS 600	3.00	4.00	22.13	14.25	7.88	5.56	10.00	412
AVS 900	4.00	6.00	23.31	14.13	9.19	6.38	12.50	580

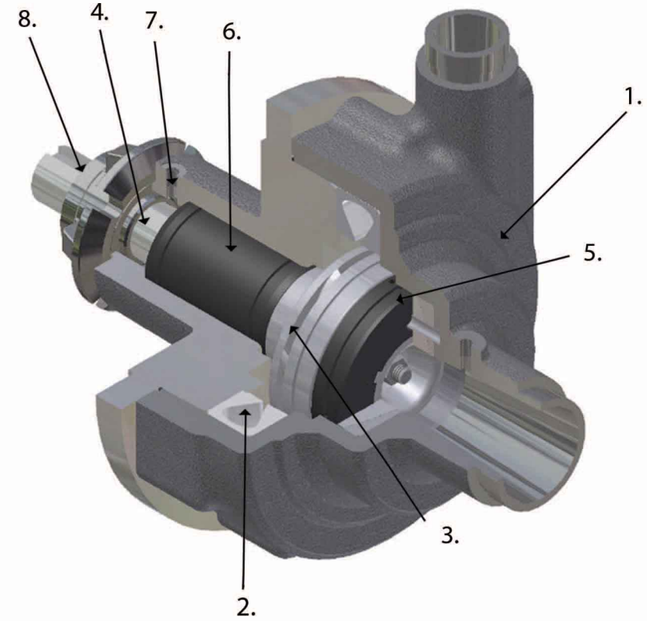


APPROXIMATE DIMENSIONS

PUMP	Disch.	Suct.	A	B	C.	D.	E.	Pump & Base Wt.
AVS 1200	4.00	6.00	26.50	16.50	10.00	7.68	14.50	847
AVS 1800	5.00	8.00	27.50	16.50	11.00	8.13	17.50	1039
AVS 2400	6.00	8.00	31.06	19.06	12.00	9.53	19.50	1497
AVS 3600	8.00	10.00	31.94	19.19	12.75	11.00	22.50	2262
AVS 4800	8.00	10.00	35.50	21.50	14.00	11.44	22.50	3073

*All dimensions in inches, weight in pounds

TYPE AVS PROCESS PUMP



Design Features

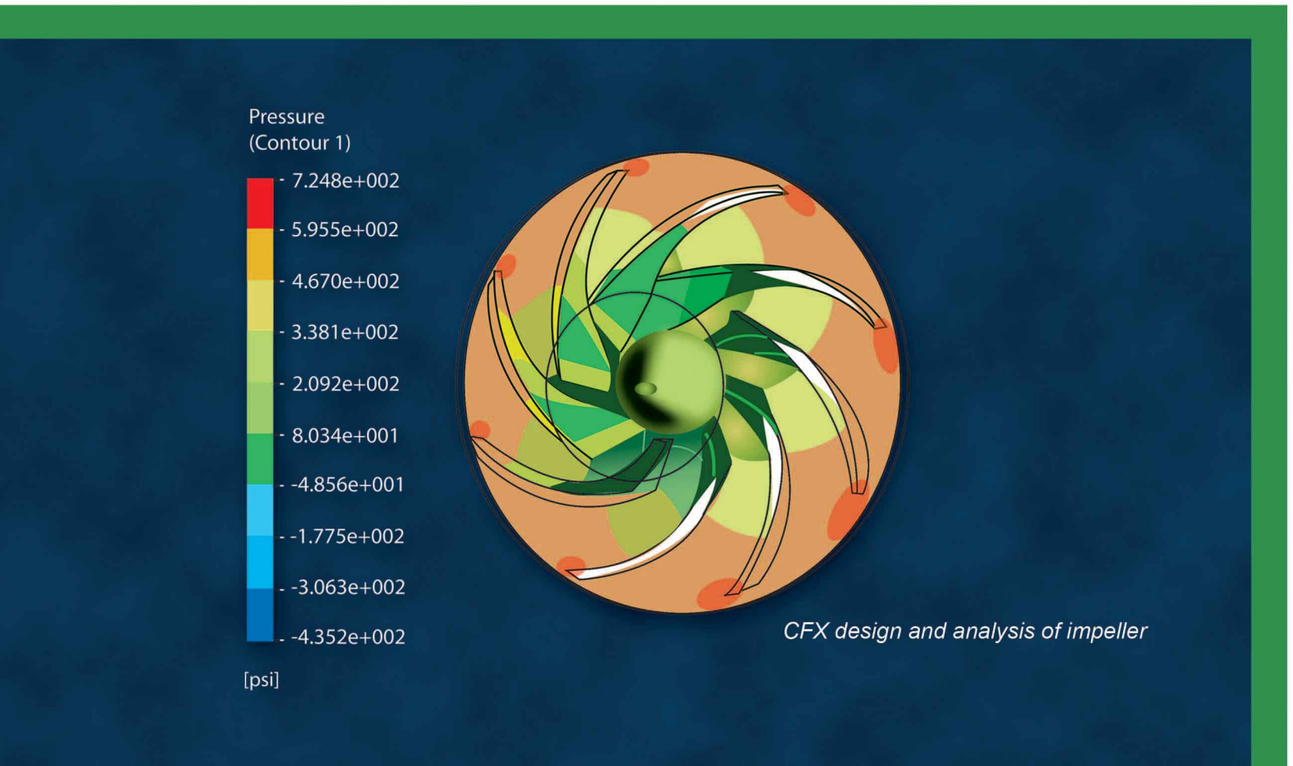
1. **Radially Split Casing** offers superior strength and rigidity compared to multistage construction
2. **Volute Inserts** - Custom engineered and machined volutes for maximum efficiency.
3. **Impellers** computer aided designed and manufactured for specific duty point operation
4. **No Step Shaft** provides maximum strength and rigidity with 1st critical speed well above maximum operating speeds
5. **Thrust Bearing** is product lubricated and can handle very large thrust loads. This PEI patented technology bearing also serves as a self adjusting impeller/casing sealing element that provides 98%+ volumetric efficiency.
6. **Radial Bearing** is also product lubricated and provides full fluid film support to the shaft for years of trouble free service. Radial bearing also service as a pressure breakdown bushing that allows the seal chamber to operate at suction pressure.
7. **Seal Chamber** is maximum diameter for proper cooling of seal and designed to accommo date all single, double, tandem, and bellow seal configurations. The seal chamber is piped through recirculation tubing to the pump suction
8. **Mechanical Seal** is ANSI standard 5610 type located between the coupling and bearing housing for easy inspection and maintenance. Mechanical seal always operates at zero shaft deflection and suction pressure for maximum seal life.

PUMPS ENGINEERED FOR YOUR SPECIFIC DUTY POINT

That's what PEI's new AVS pump will mean to the pump user, No longer will pumps be selected on which model comes closest to the duty point. With Volute Insert design and agile engineered machined impellers, each AVS pump is designed and manufactured to the exact duty point conditions. And since the AVS pump starts out as the highest efficiency centrifugal pump you can buy, the added efficiency of BEP operation is an extra bonus you get only with PEI's AVS pump.

Machining a Volute Insert

5 axis impeller machining



CFX design and analysis of impeller

MATERIALS OF CONSTRUCTION

Part	Material
Pump Casing	2205 SS
Pump Bearing Housing	2205 SS
Impeller	2205 SS
Shaft	2205 SS
Volute Insert	2205 SS / Ertalyte
Center Bearing	Graphite
Thrust Bearing	Graphite
Spherical Washer / Spacer	Ertalyte
Mechanical Seal	316 SS
Motor / Pump Adapter	Low Carbon Steel
Base	Low Carbon Steel

MATERIAL SPECIFICATION

General Description	Specification
2205 Duplex Stainless Steel	ASTM A890 Gr. 4A CD3MN
304 Stainless Steel	ASTM A743 & A351 CF-8
316 Stainless Steal	ASTM A743 & A351 CF-8M
Graphite	M101
Ertalyte	No ASTM Specification