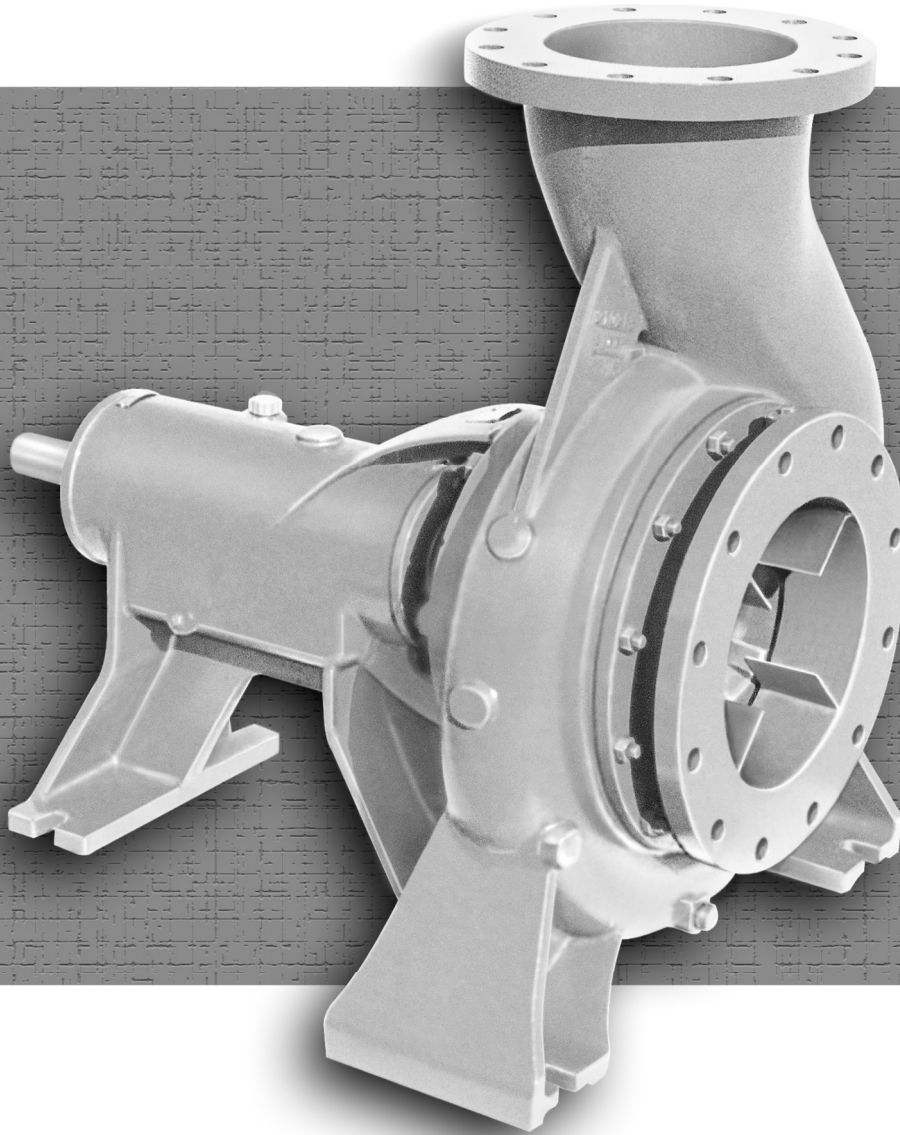


ETA Series

Technical Support Information



 **Carver[®]**

Creating Value.

APRIL
2006

1.0 Overview

The ETA is designed for flow rates that fall beyond the range of most end suction pumps. Performance extends to 9,500 GPM, 440 feet of head, and 88% efficiency. This range is covered by thirteen sizes in cast iron and bronze fitted iron as the standard. Primarily a horizontal unit, the ETA can also be vertically mounted and electric motor, diesel engine or steam turbine driven as well.

1.1 Basic Hydraulic and Mechanical Design Features

Standard design features for the ETA are given in the tables below. All speed-specific values are at the maximum allowable operating speed, and all other values are at the maximum impeller diameter, unless otherwise noted.

Basic Hydraulic Features									
Pump Size	Max Speed (RPM)	Impeller Design				Specific Speed Ns	Suction Sp. Speed Nss	Max. Solids Size (in)	Rotor WK ² (lb-in ²)
		Type	Max. Dia. (in)	Eye Area (in ²)	No. Vanes				
AA - 10 x 8 x 13	1750	Enclosed	13.00	70.0	6	2,659	16,058	1.88	920
AB - 10 x 10 x 13	1750	Enclosed	11.38	84.0	5	4,170	13,644	2.00	1,115
AC - 12 x 10 x 13	1750	Enclosed	13.00	89.0	6	3,547	14,716	2.75	1,236
AD - 12 x 12 x 13	1750	Enclosed	13.63	99.0	5	4,369	13,841	3.81	1,766
BA - 4 x 3 x 16	1750	Enclosed	15.91	18.0	7	607	10,105	0.44	1,080
BB - 5 x 4 x 16	1750	Enclosed	15.91	21.5	6	812	10,567	0.63	1,194
BC - 6 x 5 x 16	1750	Enclosed	15.91	30.0	6	952	9,002	0.81	1,332
BD - 8 x 6 x 16	1750	Enclosed	15.91	49.0	6	1,325	13,917	1.00	1,696
BE - 10 x 8 x 16	1750	Enclosed	15.94	70.0	7	1,806	12,895	1.44	1,942
BF - 12 x 10 x 16	1750	Enclosed	15.94	95.0	6	2,144	11,858	2.25	2,313
CA - 8 x 6 x 20	1750	Enclosed	19.69	49.0	7	1,060	11,714	0.75	3,768
CB - 10 x 8 x 20	1750	Enclosed	19.88	61.0	7	1,092	11,449	1.00	4,137
CC - 12 x 10 x 20	1750	Enclosed	19.88	102.0	7	1,633	13,006	1.38	5,395

Basic Mechanical Features									
Pump Size	Bearing Frame	Max Allowed Pressure (PSI)		Wear Ring Clearance		Shaft Deflection @ 20% BEP (inch)		Shaft Stiffness L ³ /D ⁴	Min. Case Thickness (in.)
		Hydro test	Working	Front (in)	Back (in)	@ Seal	@ Impeller		
AA - 10 x 8 x 13	C	350	233	0.012	0.011	0.0002	0.0023	35.8	0.750
AB - 10 x 10 x 13	C	225	150	0.015	0.013	0.0028	0.0075	24.2	0.750
AC - 12 x 10 x 13	C	369	246	0.014	0.013	0.0009	0.0035	28.7	0.875
AD - 12 x 12 x 13	C	225	150	0.014	0.013	0.0048	0.0179	28.2	0.875
BA - 4 x 3 x 16	45	282	188	0.012	N/a	0.0031	0.0038	68.0	0.625
BB - 5 x 4 x 16	45	434	299	0.012	N/a	0.0047	0.0057	68.0	0.814
BC - 6 x 5 x 16	45	396	264	0.014	0.013	0.0059	0.0072	68.0	0.814
BD - 8 x 6 x 16	45	225	150	0.016	0.015	0.0095	0.0117	70.0	0.625
BE - 10 x 8 x 16	D	235	156	0.017	0.017	0.0164	0.0305	96.1	0.750
BF - 12 x 10 x 16	D	304	202	0.017	0.017	0.0059	0.0106	91.2	0.875
CA - 8 x 6 x 20	D	399	266	0.012	0.013	0.0028	0.0048	87.4	0.875
CB - 10 x 8 x 20	DS	833	555	0.021	0.022	0.0026	0.0058	77.6	1.125
CC - 12 x 10 x 20	DS	521	327	0.023	0.023	0.0038	0.0094	83.6	1.000

1.2 Standard Surface Treatment

All ETA's handling liquids below 230 °F are painted to Carver Standard PA-001. This provides for one coat of Carver Blue, industrial alkyd metal enamel with a 3-5 mils dry film thickness.

Pumps handling liquids above 230 °F are painted to Carver Standard PA-013 with two coats modified silicone alkyd resin, aluminum colored, to a total of 2 mils dry film thickness.

Standard Surface Preparation		
Component	Material	Specification
Adaptor bracket	Steel	Carver Standard PA-001
Base & Coupling Guard	Steel	Carver Standard PA-001
Bearing frame	Cast iron	Carver Standard PA-001
Casing	Cast iron	Carver Standard PA-001
Motor	Any	Carver Standard PA-001

1.3 Key Material Specifications

ETA material specifications are as follows:

Key Component Materials		
Component	Material	Specification
Bearing Frame	Cast iron	ASTM A48, Class 30
Casing	Cast iron	ASTM A48, Class 30
Impeller	Bronze	ASTM B584, C87500
	Cast iron	ASTM A48, Class 30
O Rings	Elastomer	Viton
Shaft	Carbon steel	AISI A108, UNS G41400 or ASTM A311, Grade B, UNS G11440
Shaft Sleeve	316 SS	ASTM A276, UNS 31600
Wear Ring	Cast iron	ASTM A48, Class 30
	Bronze	ASTM B 505, UNS 93200
Standard Seal	Type 1 Code XF ₅₁ 1C1	Viton w/ carbon on ceramic faces, 300 series SS metal parts
Optional Seal	Type 1 Code XP ₆₆ 1O ₅₈ 1	Viton w/ carbon on silicon carbide faces, 300 series SS metal parts

Note: In the table above, AISI A108 carbon steel shafts are standard for size "A" bearing frames. ASTM A311 steel shafts are standard with all other bearing frames.

1.4 Key Mechanical Data

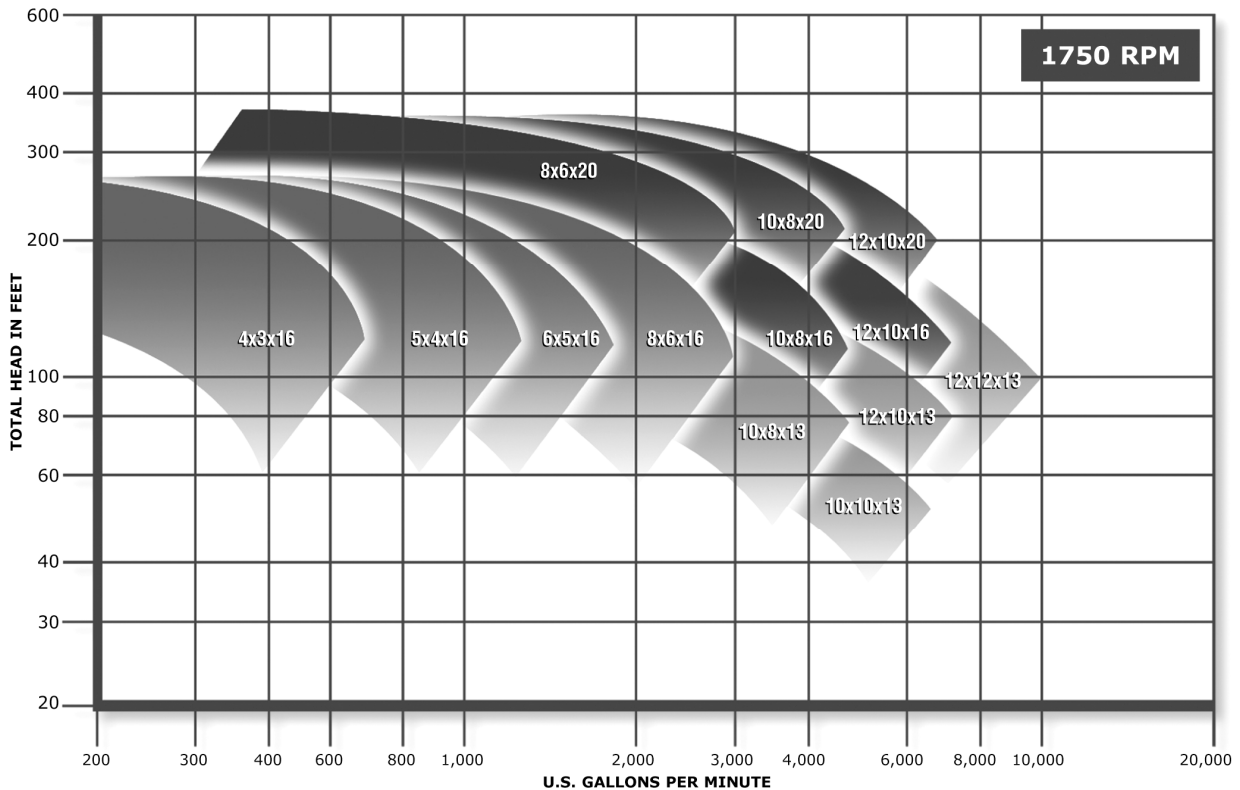
ETA mechanical design parameters are as follows:

Item	Bearing Frame			
	C	45	D	DS
Max power (BHP) @ 1750 RPM	275	200	400	850
@ 1150 RPM	180	80	250	400
Bearing type - radial bearing	6213	6311	6411	6411
thrust bearing	7313	6312	6411	6313
Lubrication method (standard)	Oil	Grease	Oil	Oil
L ₁₀ bearing life (hrs) - radial	50,000			
thrust	50,000			
Shaft diameter (in.) @ coupling	2.000	1.875	2.000	2.000
@ impeller hub	2.000	1.495	1.986	1.875
@ radial bearing	2.559	2.166	2.165	2.559
@ thrust bearing	2.559	2.362	2.165	2.165
@ shaft sleeve	2.500	1.693	1.968	2.166

Note: Size "DS" bearing frame is very similar to "D" bearing frame, and has the same external dimensions. It is used on the two largest ETA sizes: 10 x 8 x 20 and 12 x 10 x 20.

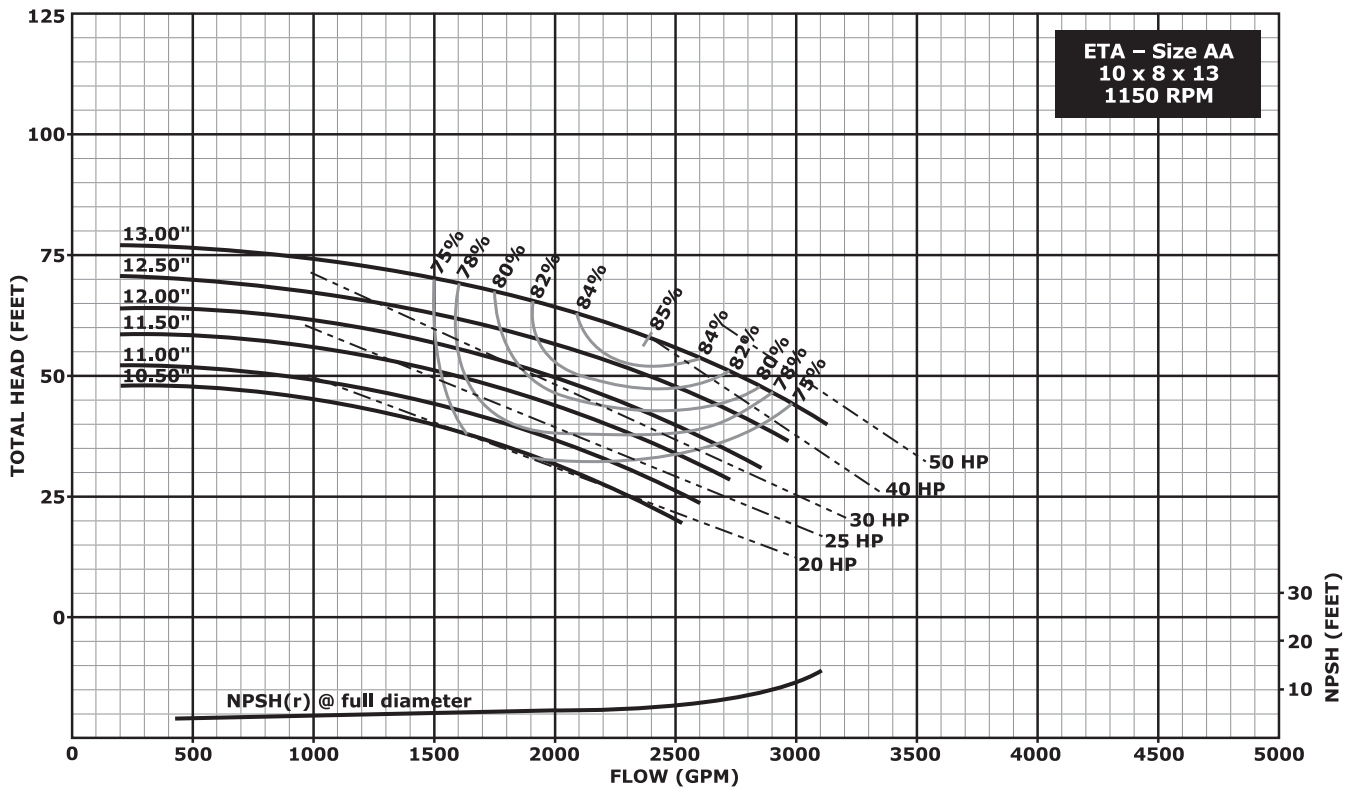
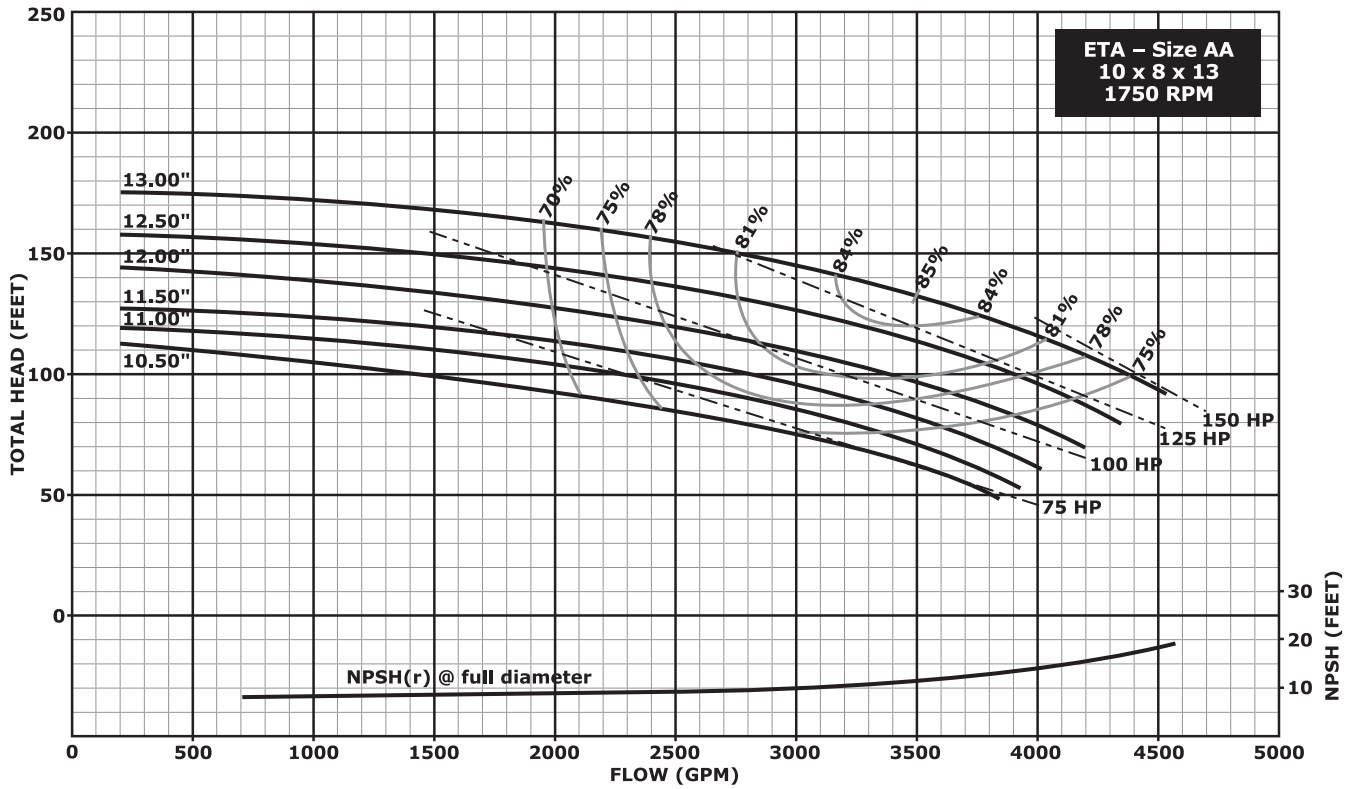
2.0 ETA Hydraulic Coverage

ETA hydraulic performance extends to 9,500 GPM and 380 feet of head and is covered by thirteen sizes in.



Other sizes and allowable speeds may also be possible. Contact Carver Sales and Marketing department.

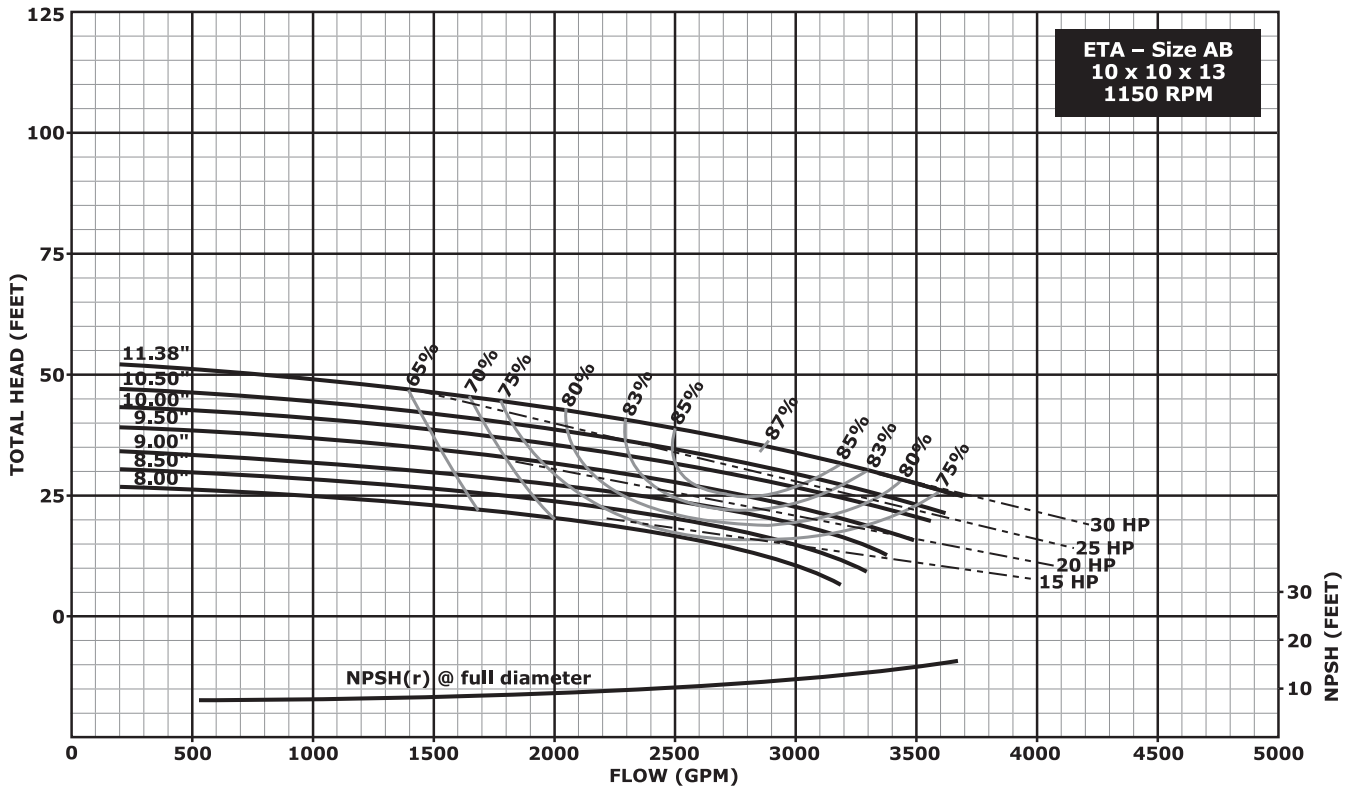
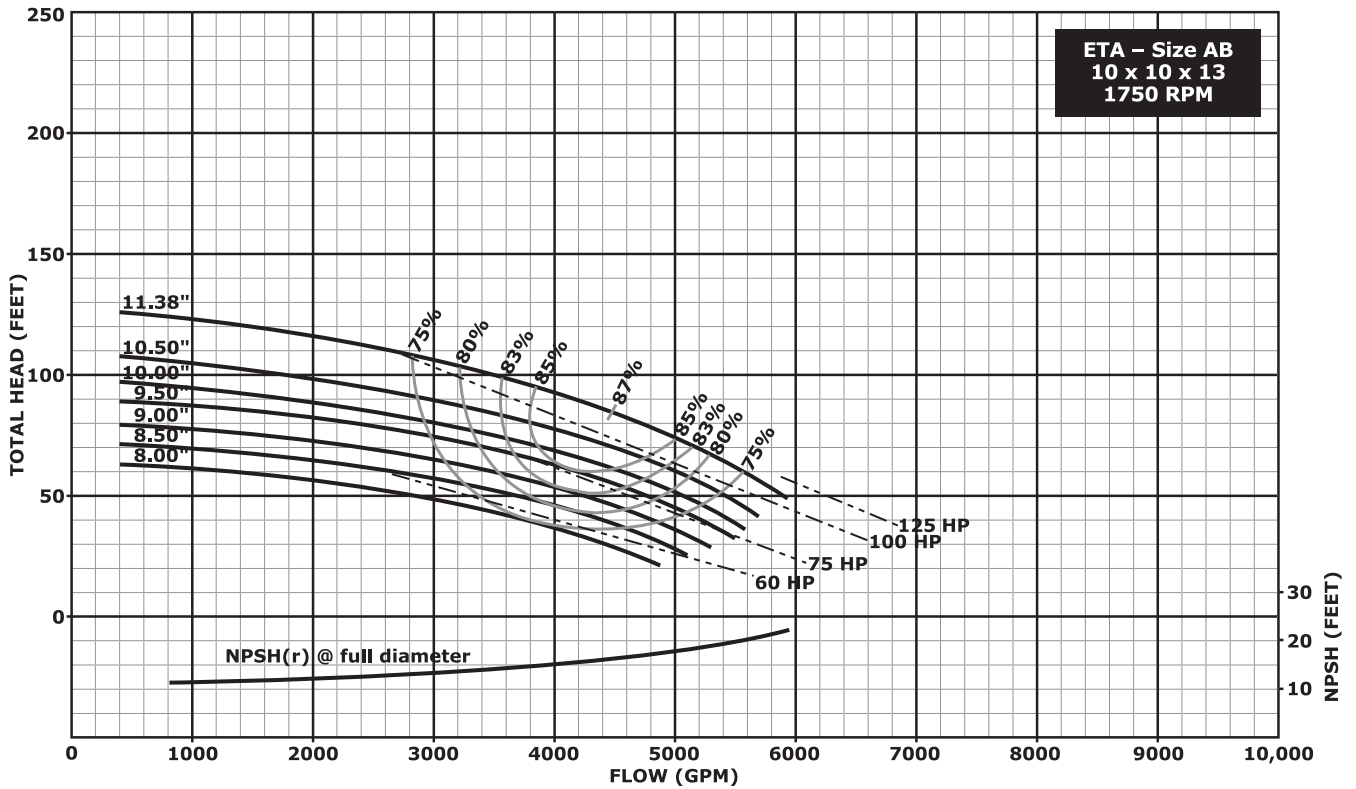
Hydraulic Performance – 13" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.

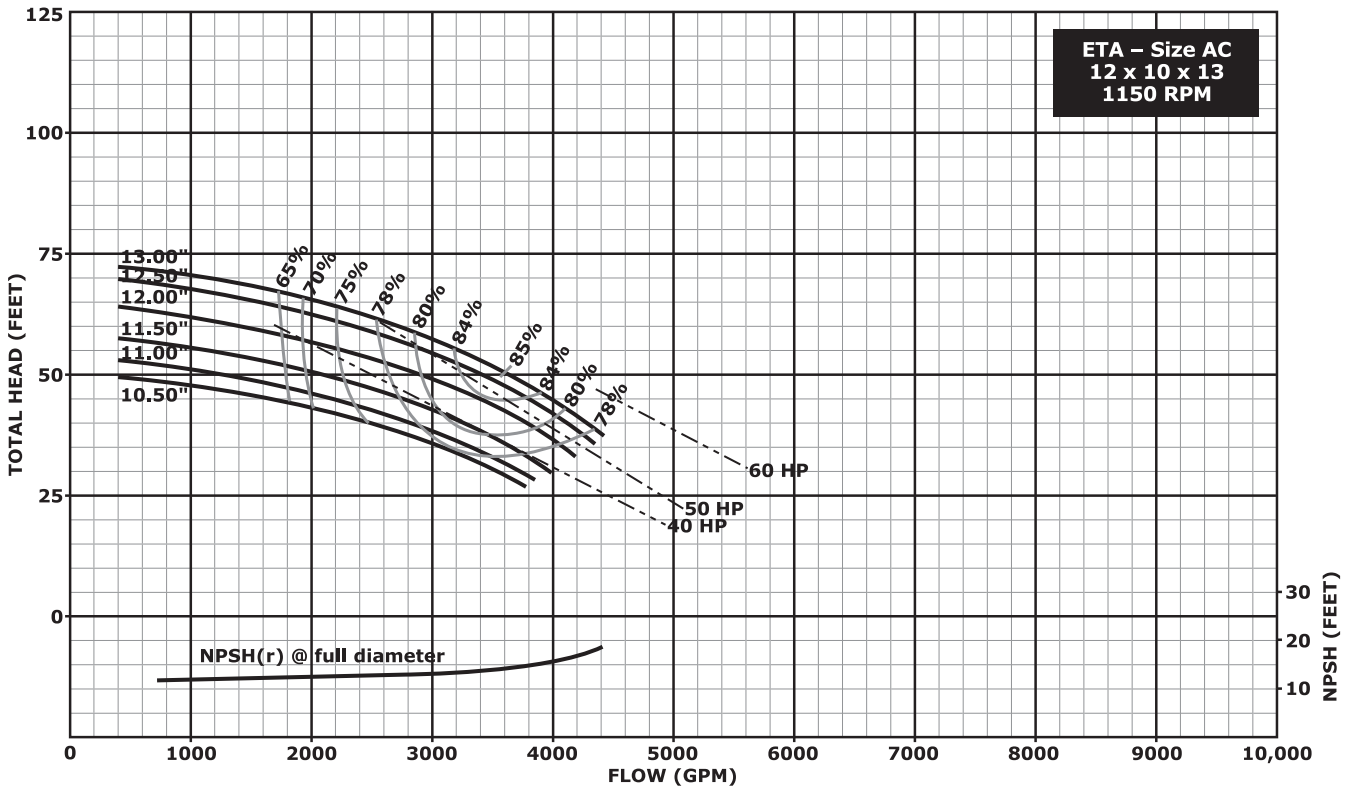
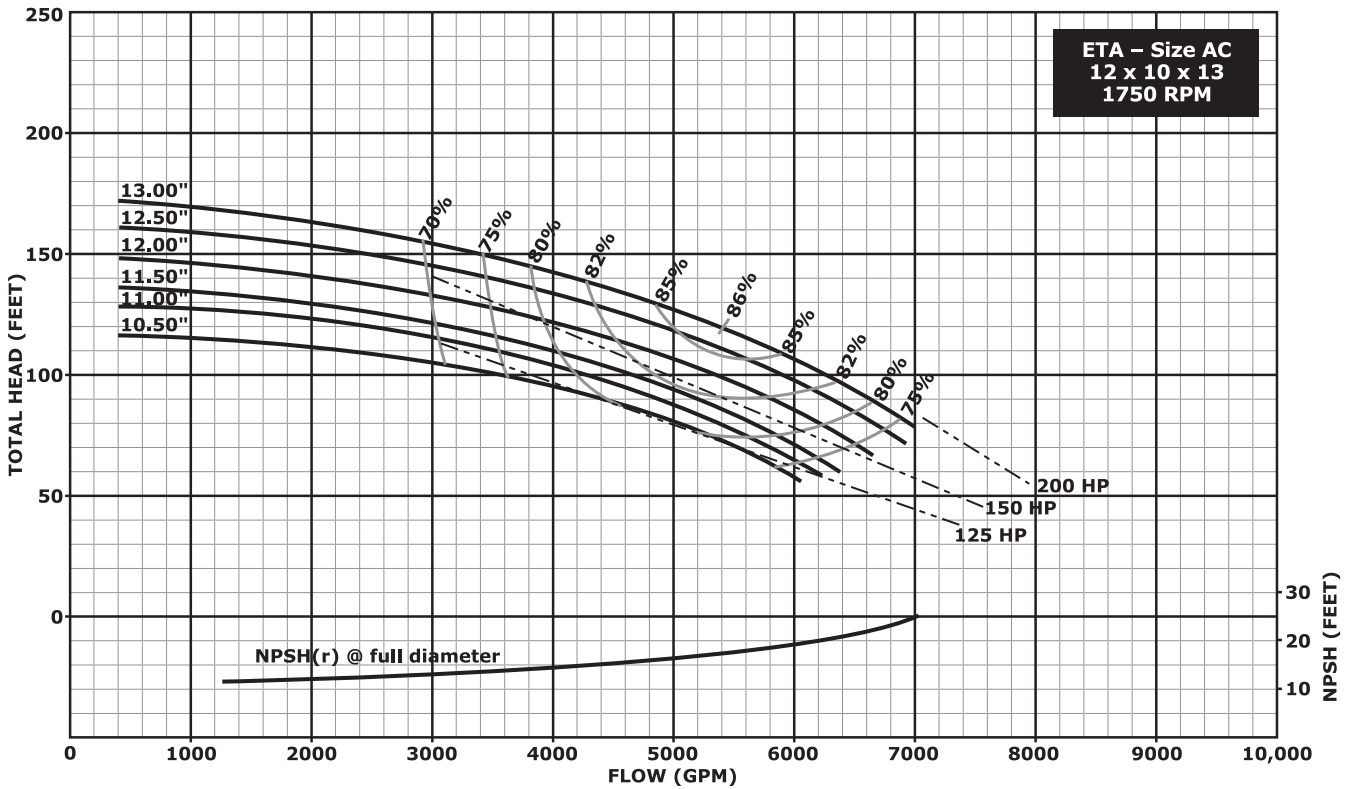
Hydraulic Performance – 13" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. For this pump, impeller trims may also be done with angular vane cuts. Impeller diameter trims shown are approximations only.

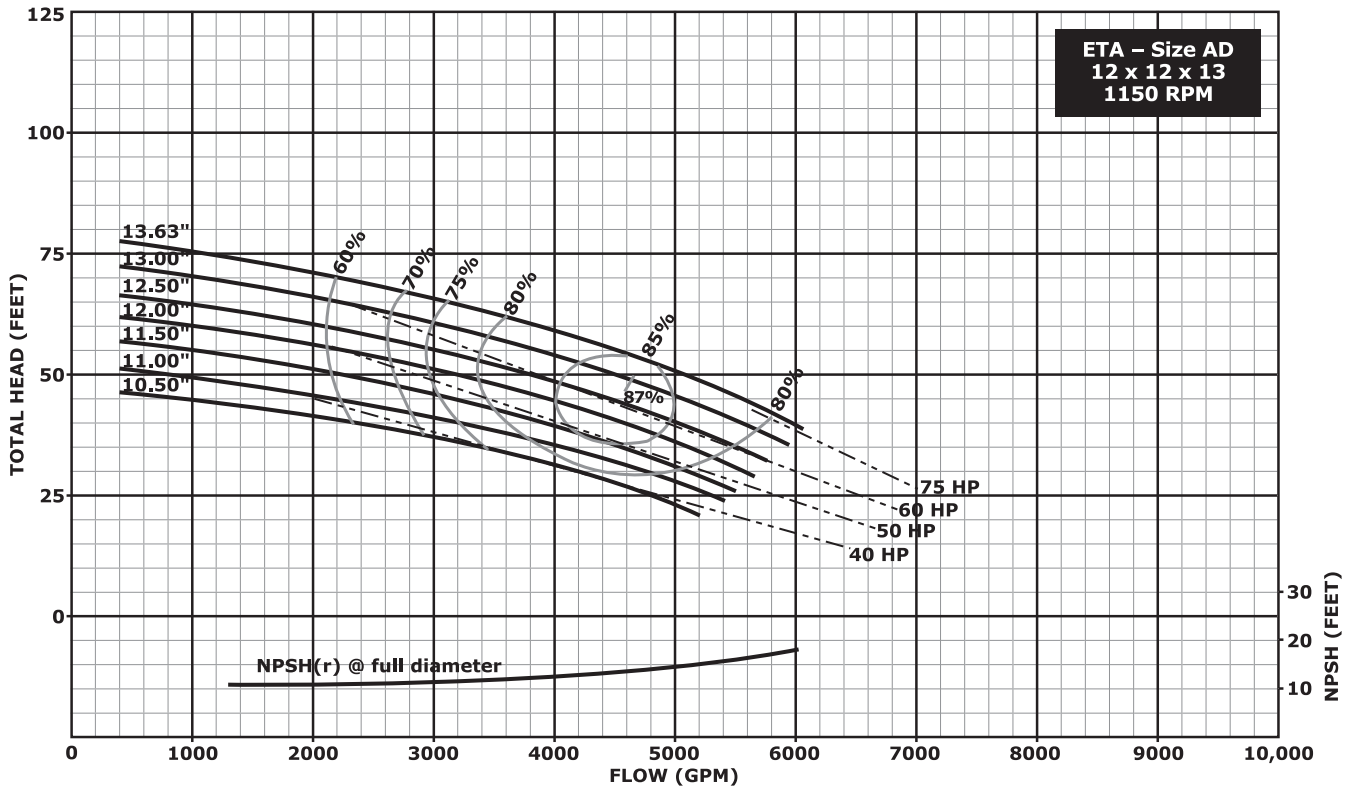
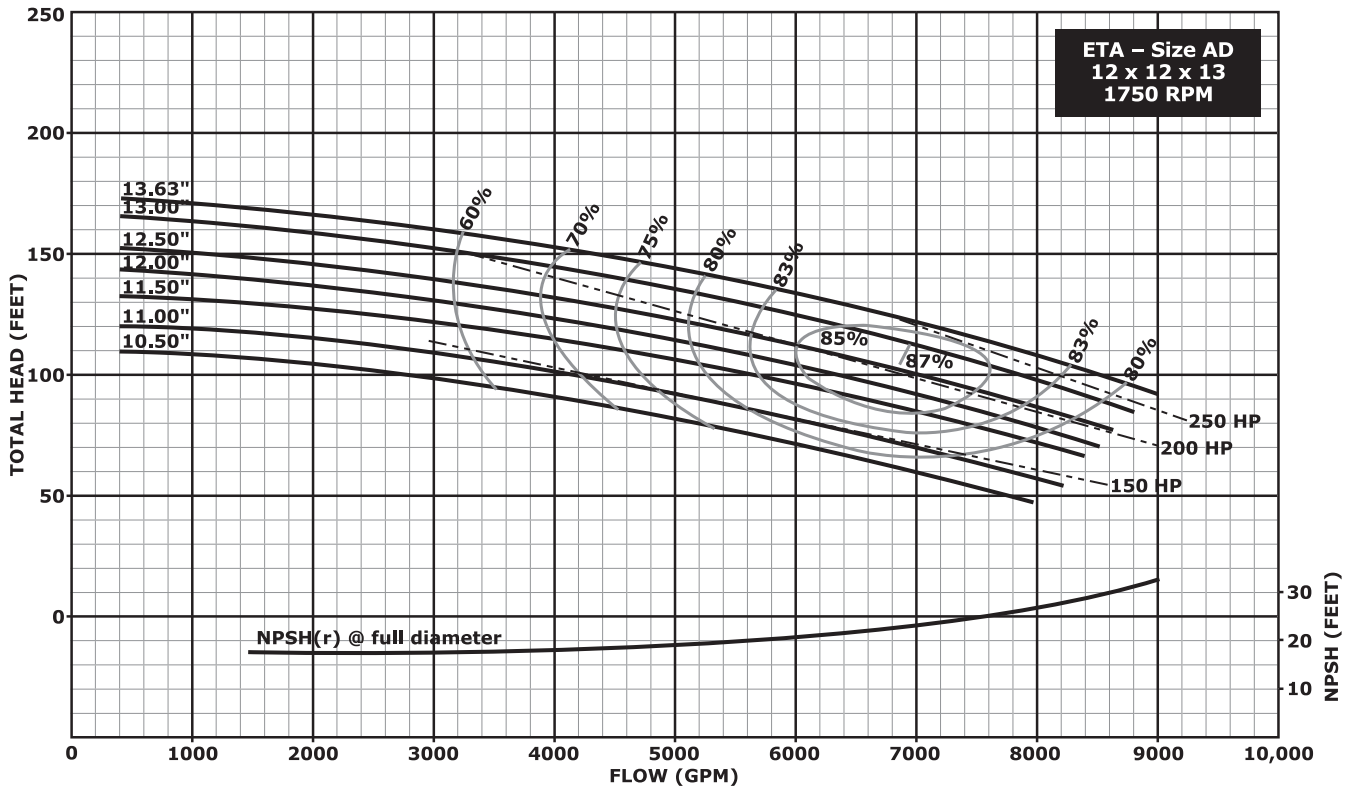
Hydraulic Performance – 13" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. For this pump, impeller trims may also be done with angular vane cuts. Impeller diameter trims shown are approximations only.

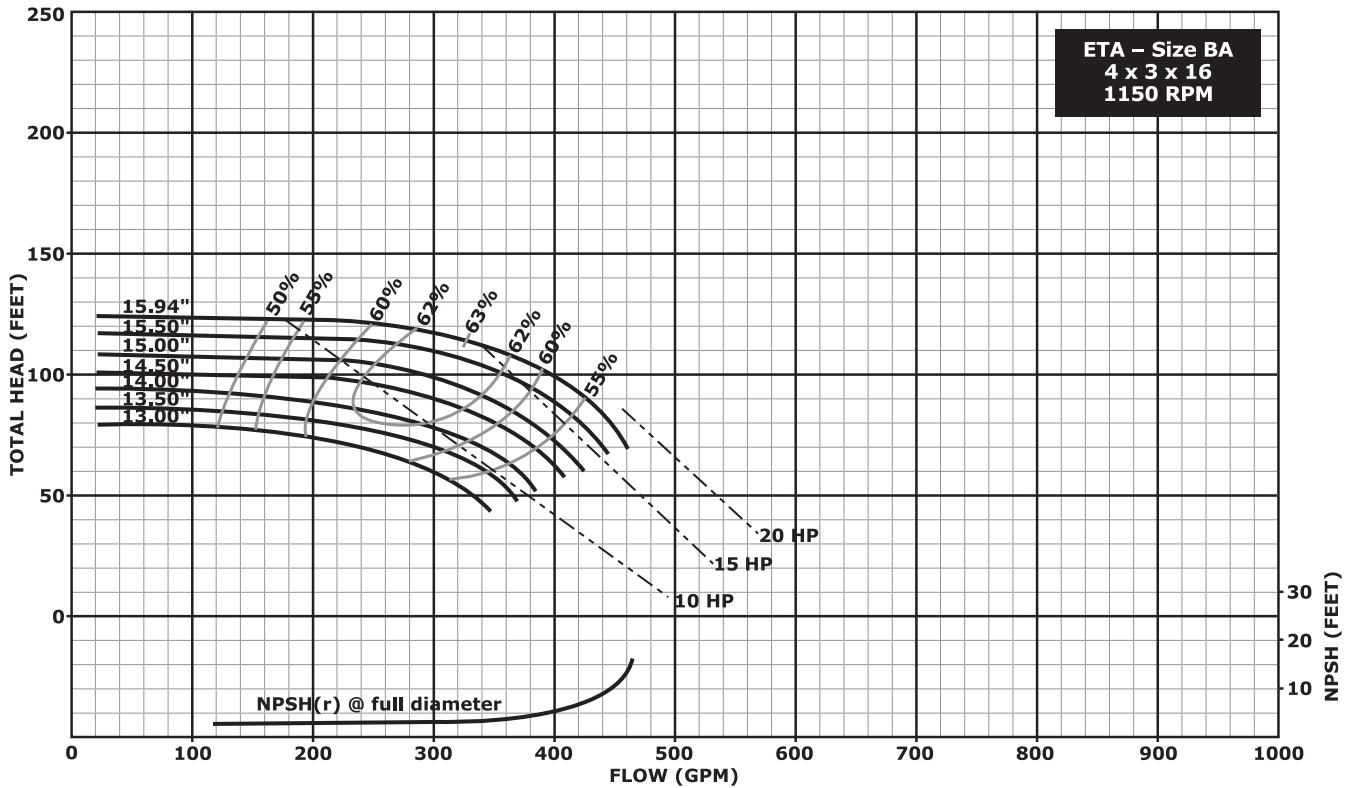
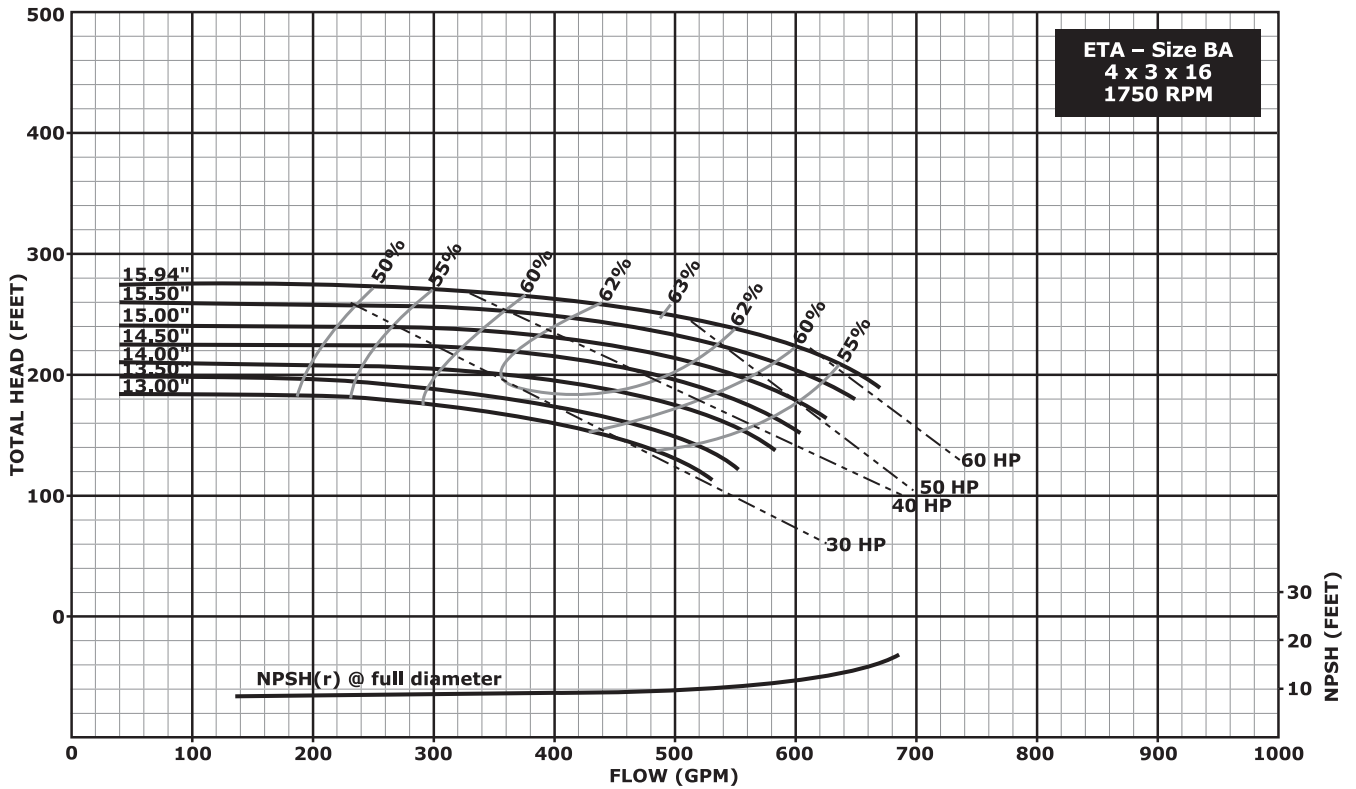
Hydraulic Performance – 13" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. For this pump, impeller trims may also be done with angular vane cuts. Impeller diameter trims shown are approximations only.

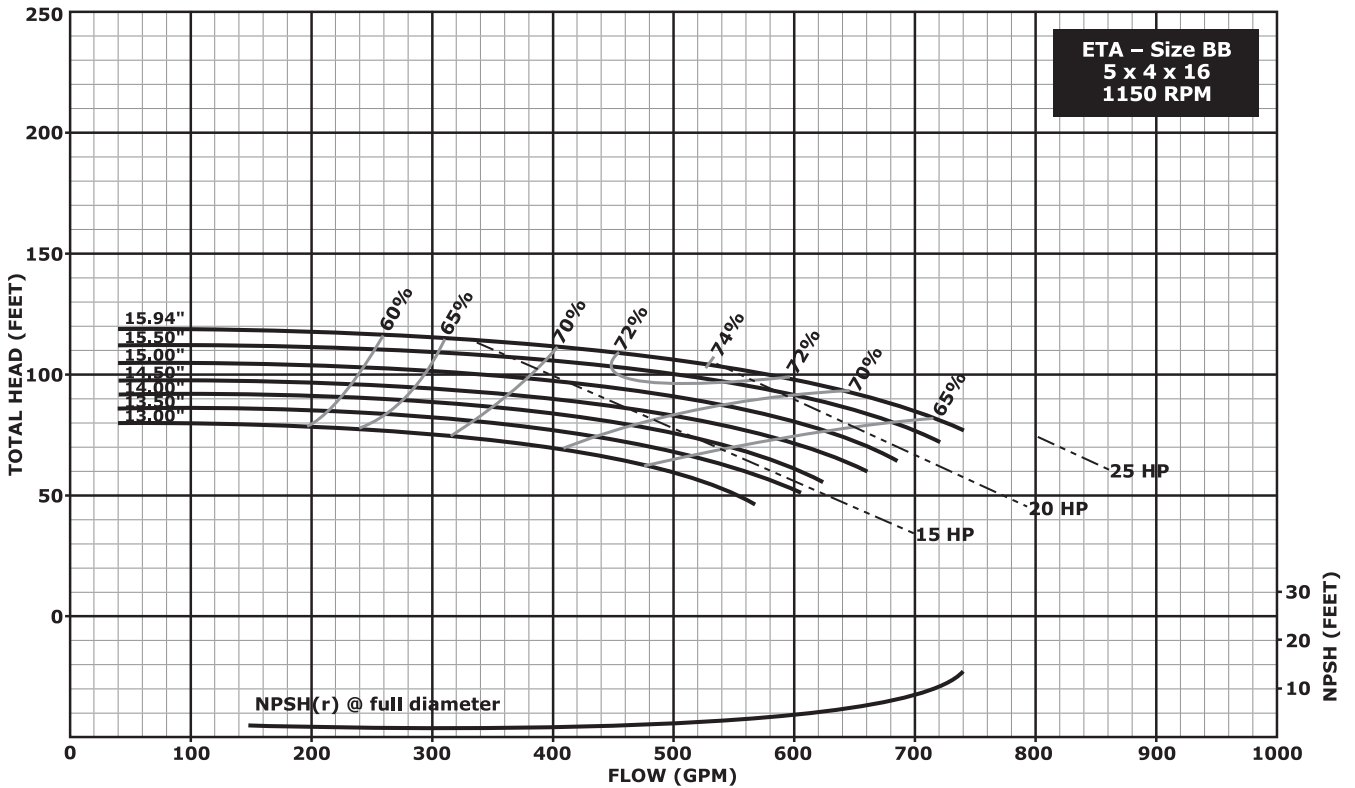
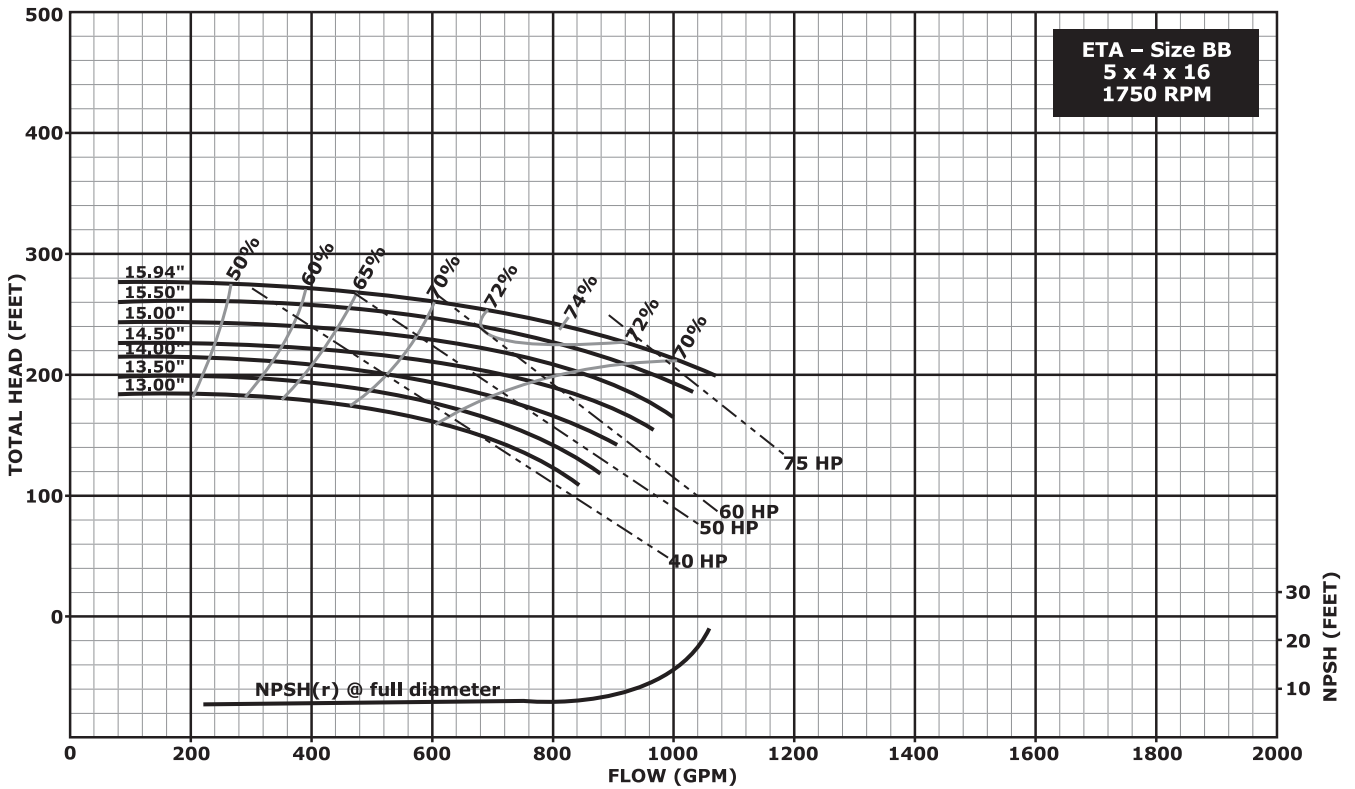
Hydraulic Performance – 16" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.

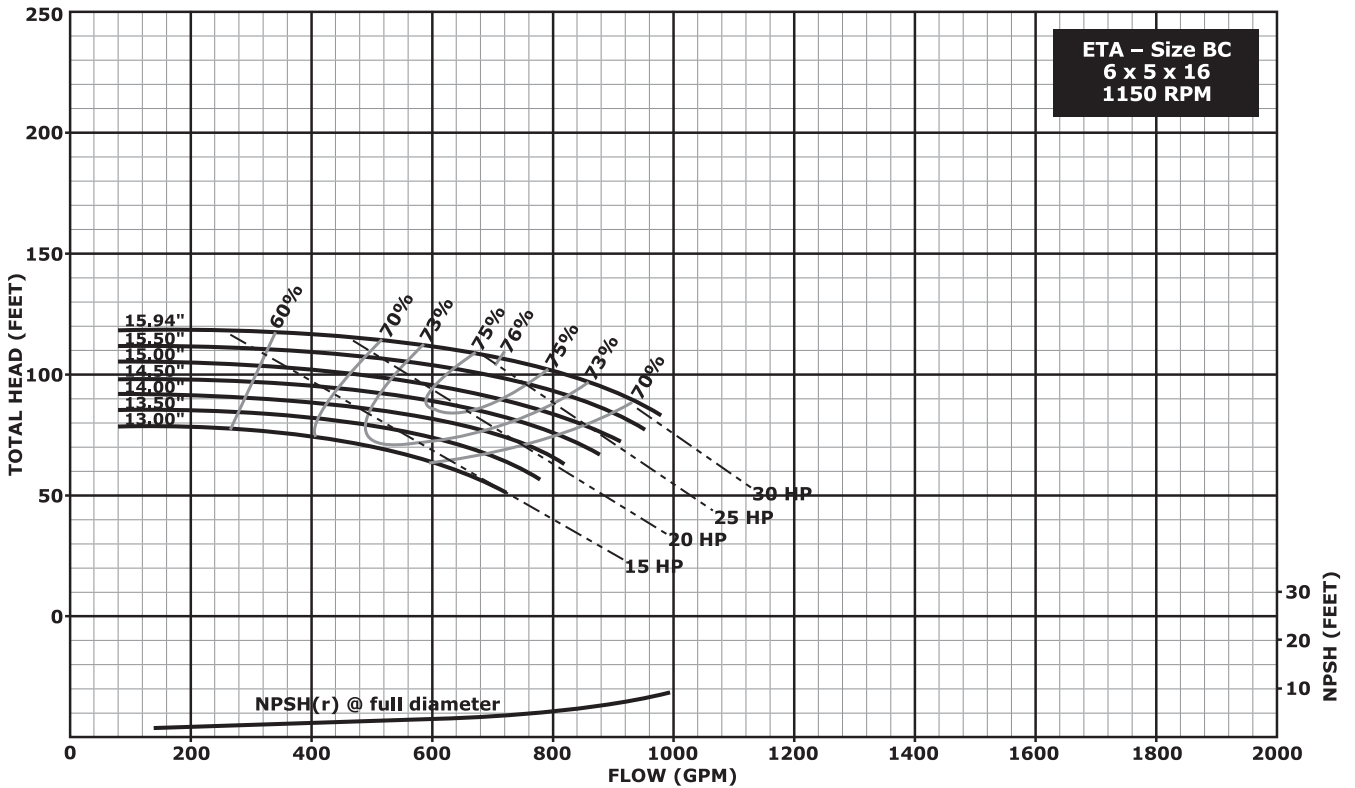
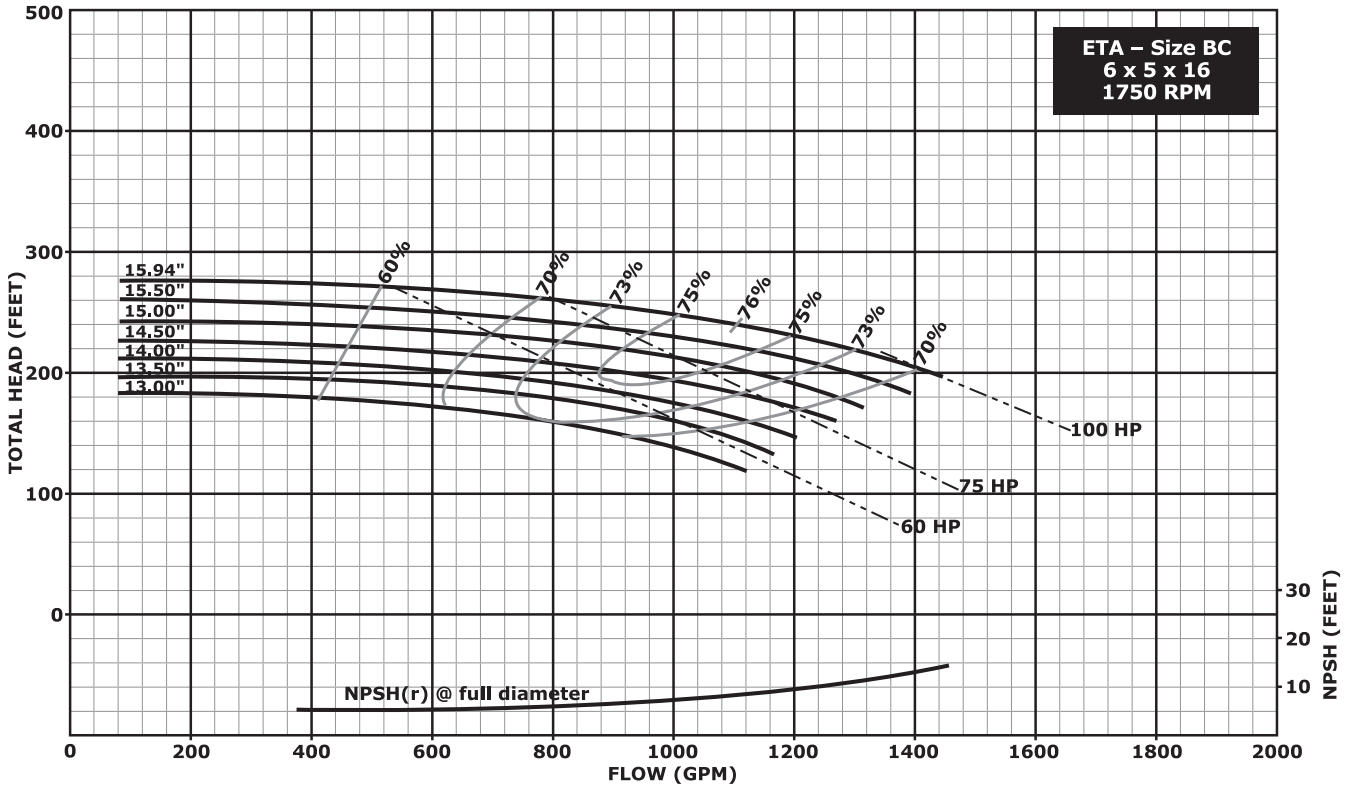
Hydraulic Performance – 16" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.

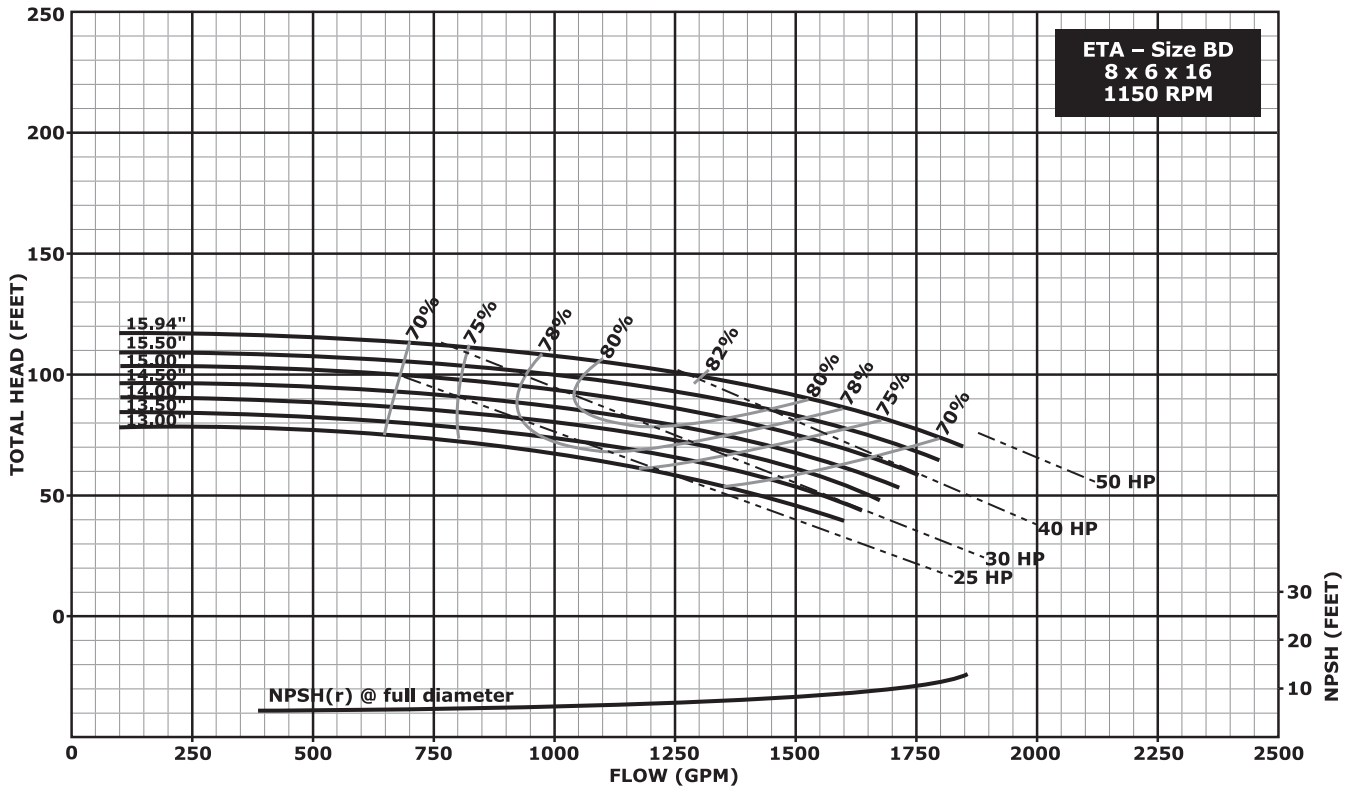
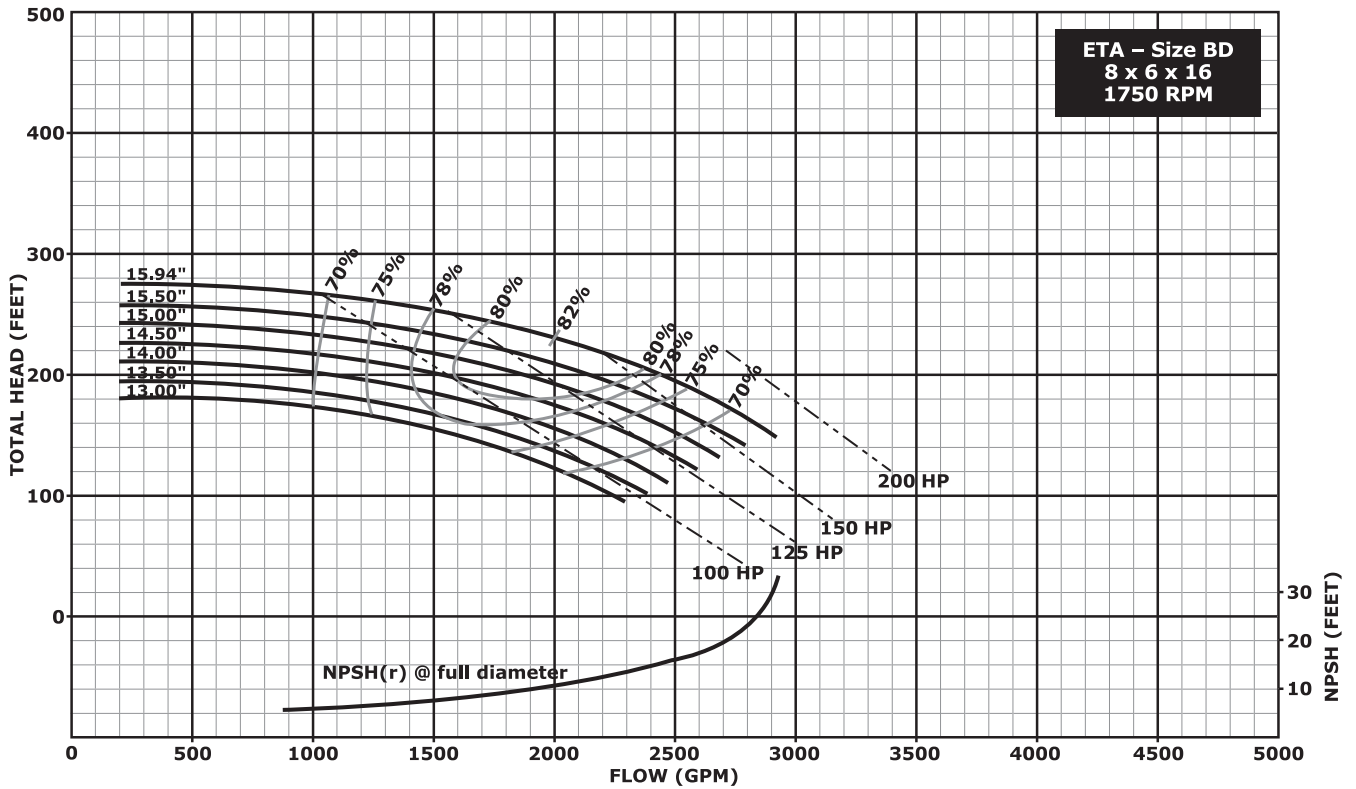
Hydraulic Performance – 16" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.

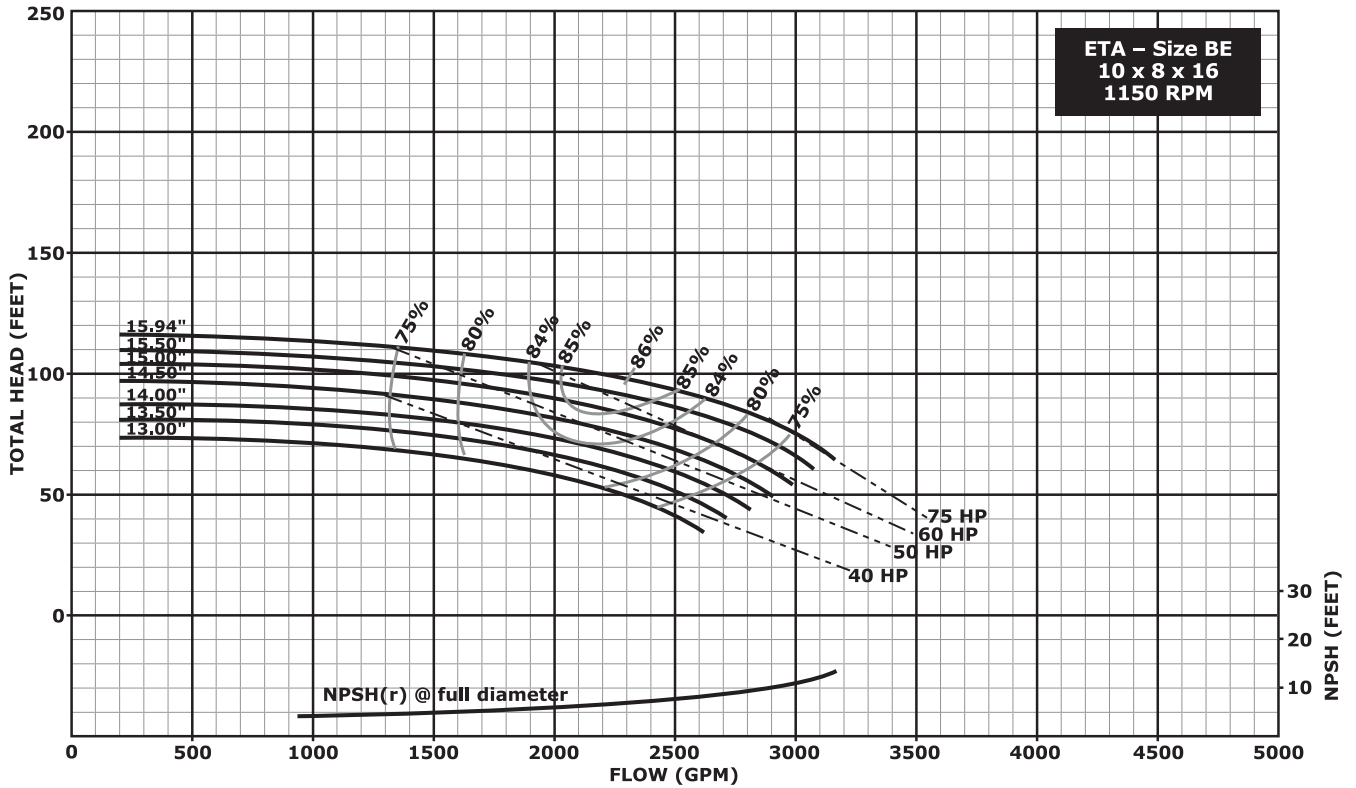
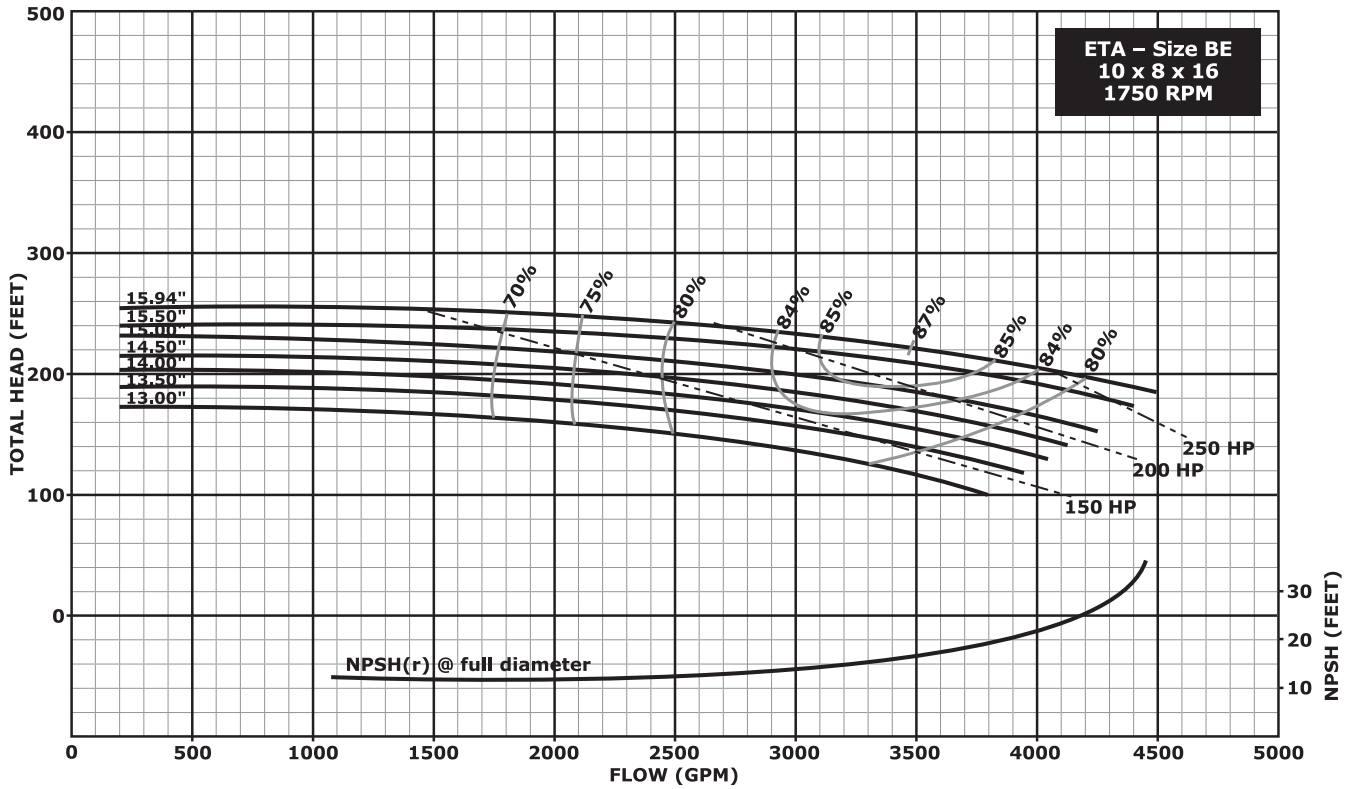
Hydraulic Performance – 16" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.

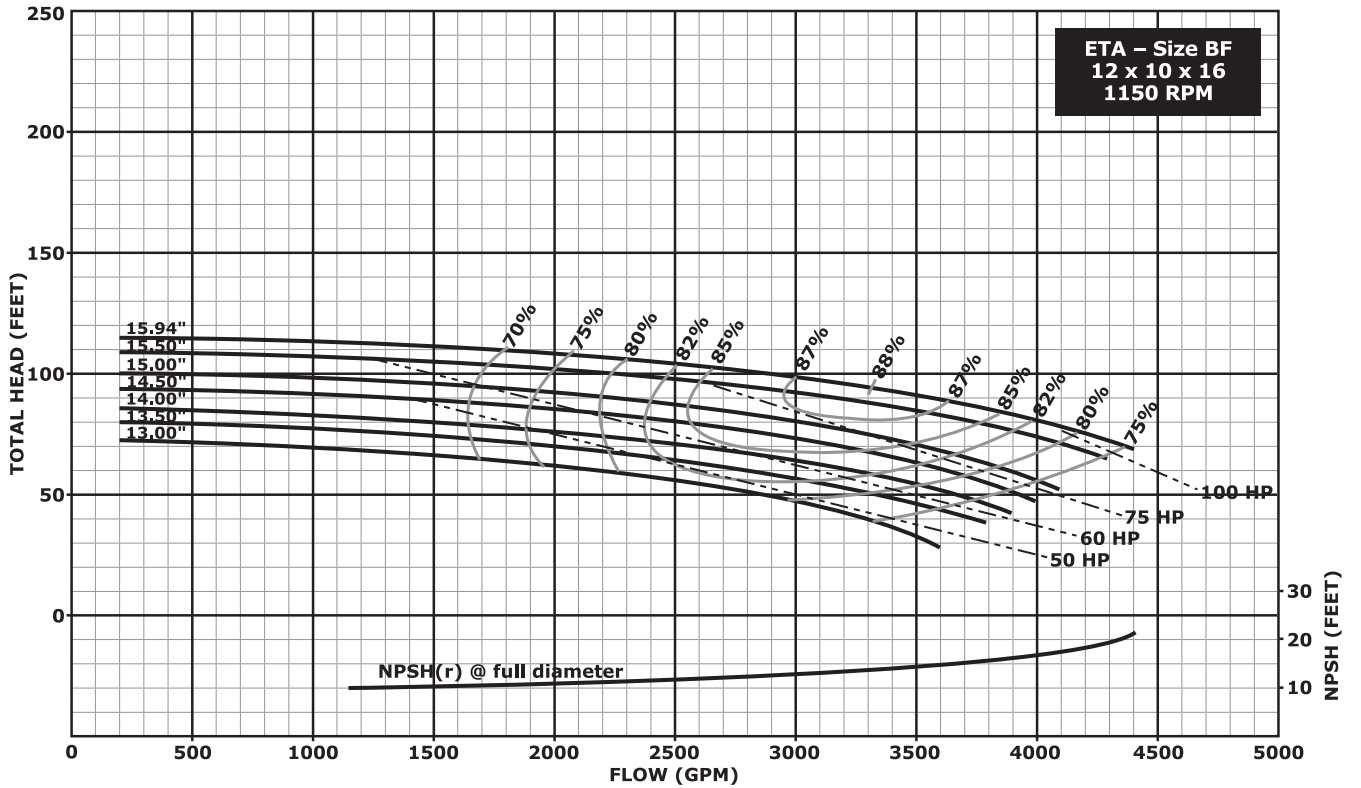
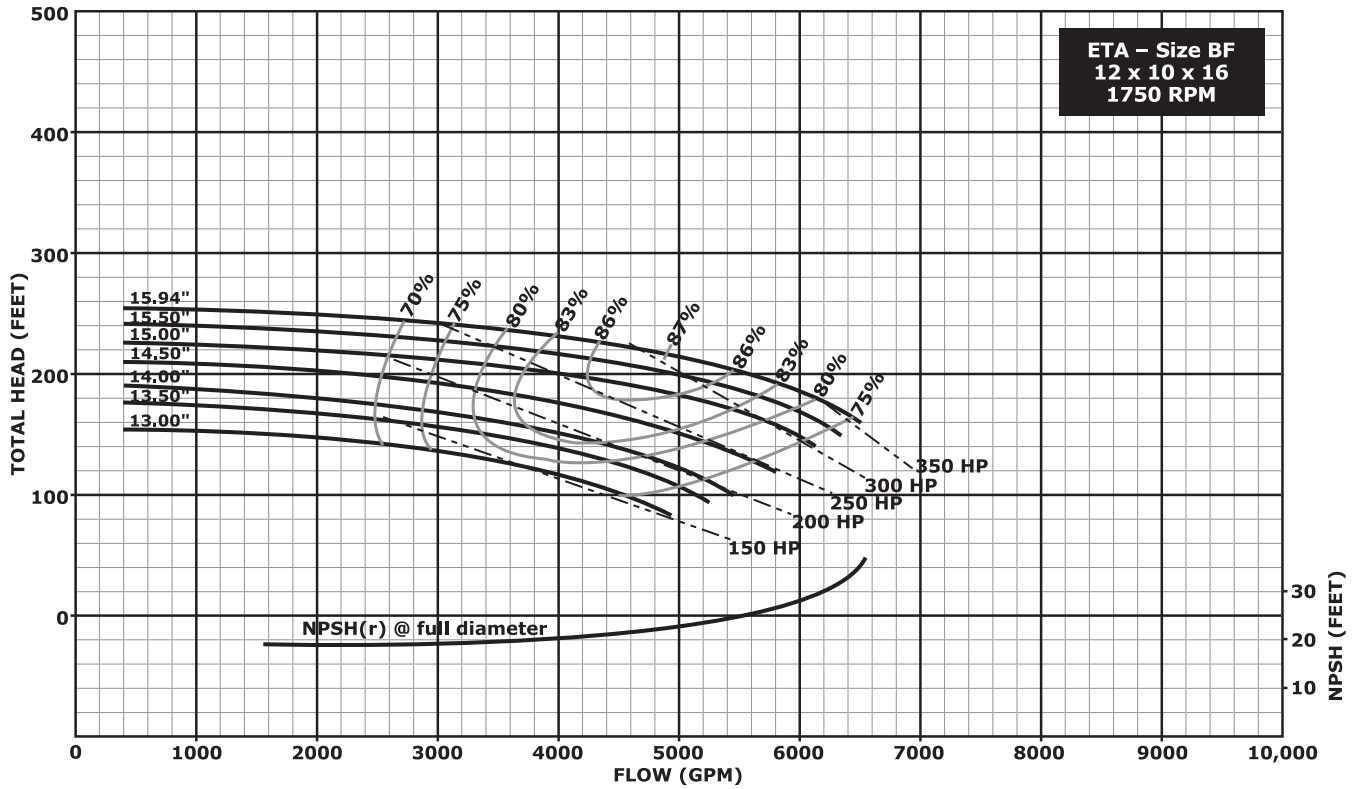
Hydraulic Performance – 16" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. For this size pump, impeller trims are accomplished by angular vane cuts. Impeller diameter trims shown are approximations only.

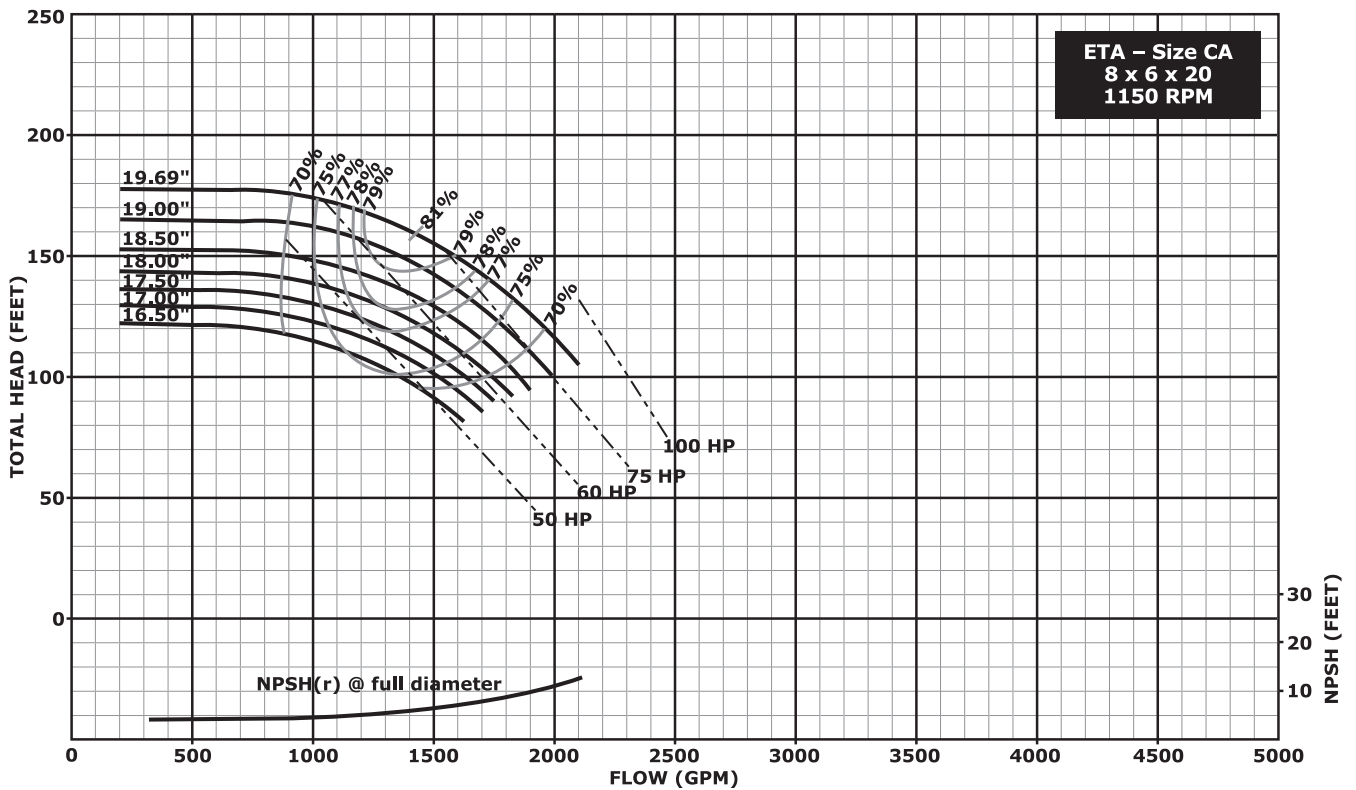
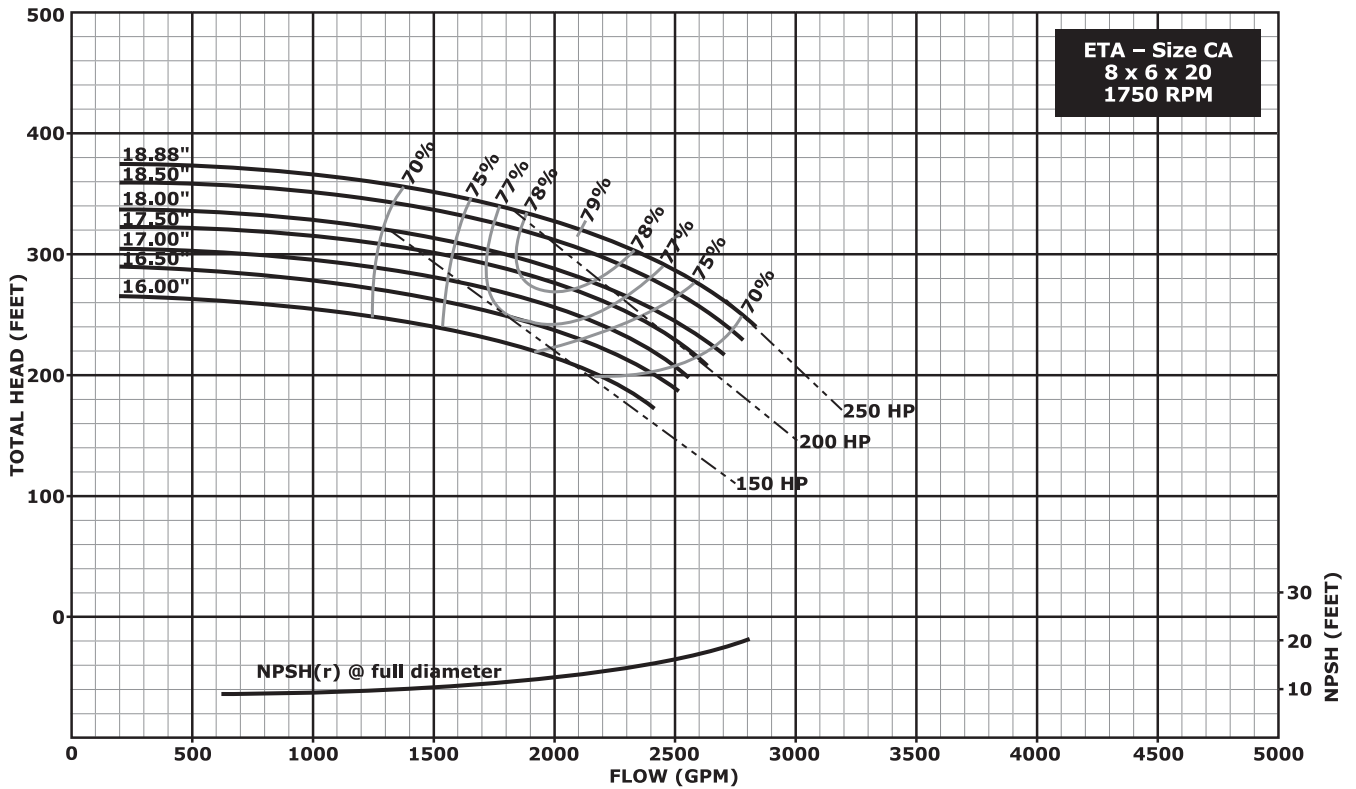
Hydraulic Performance – 16" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. For this pump, impeller trims may also be done with angular vane cuts. Impeller diameter trims shown are approximations only.

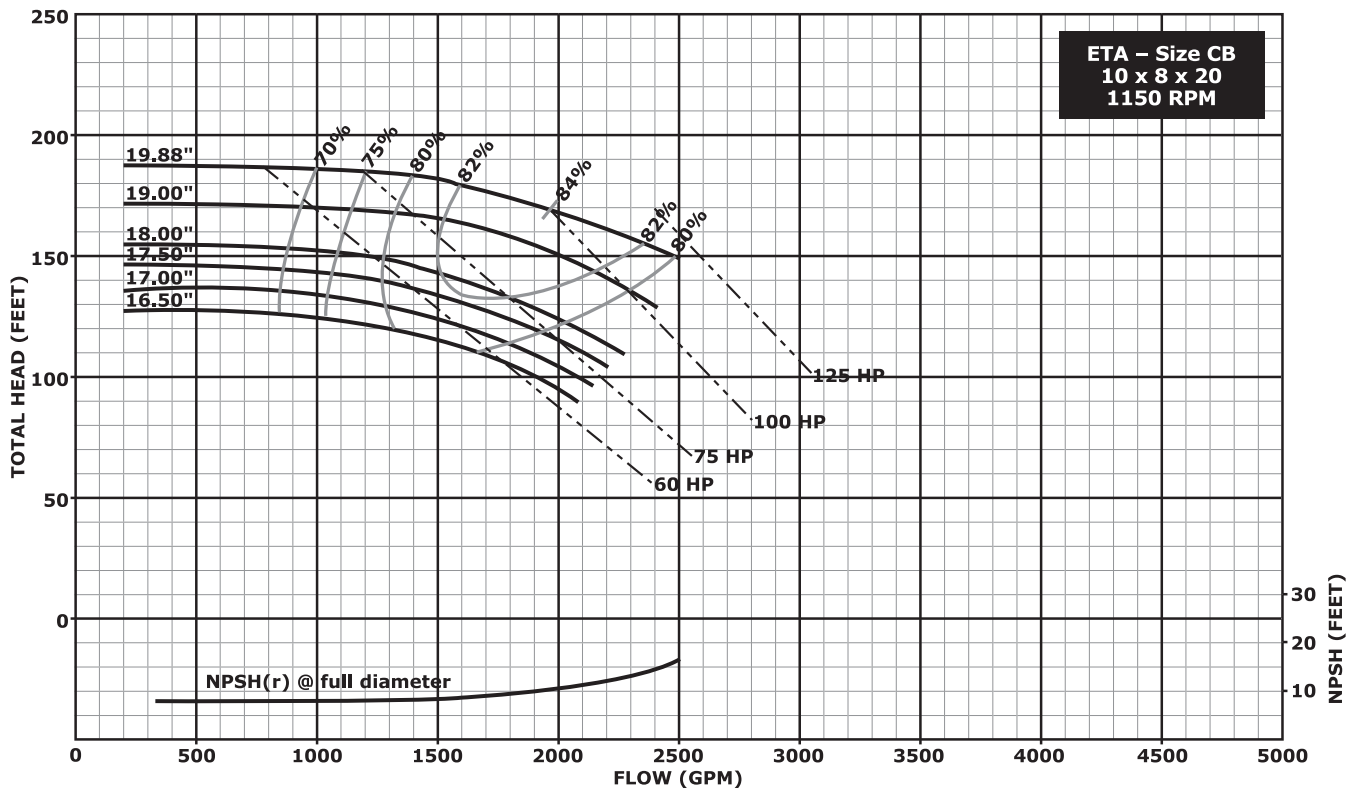
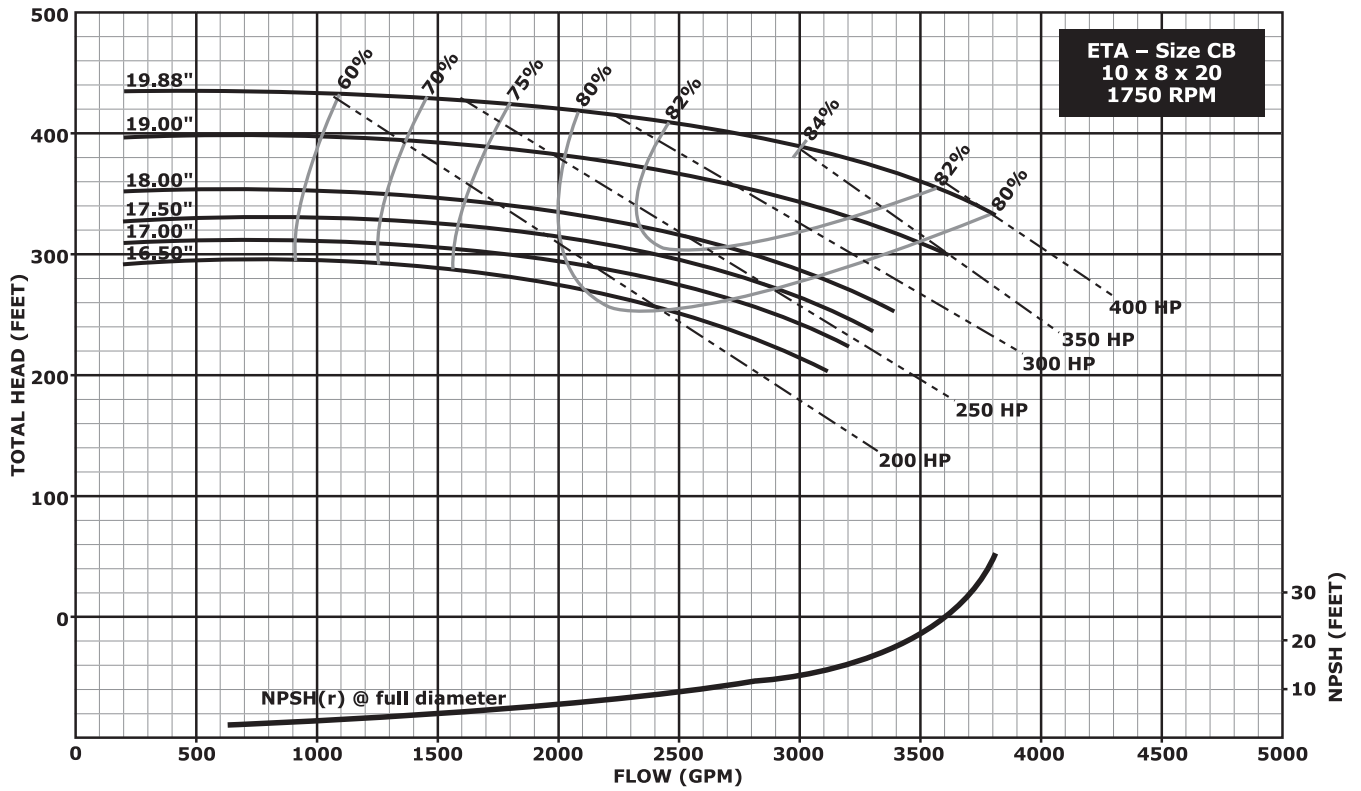
Hydraulic Performance – 20" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.

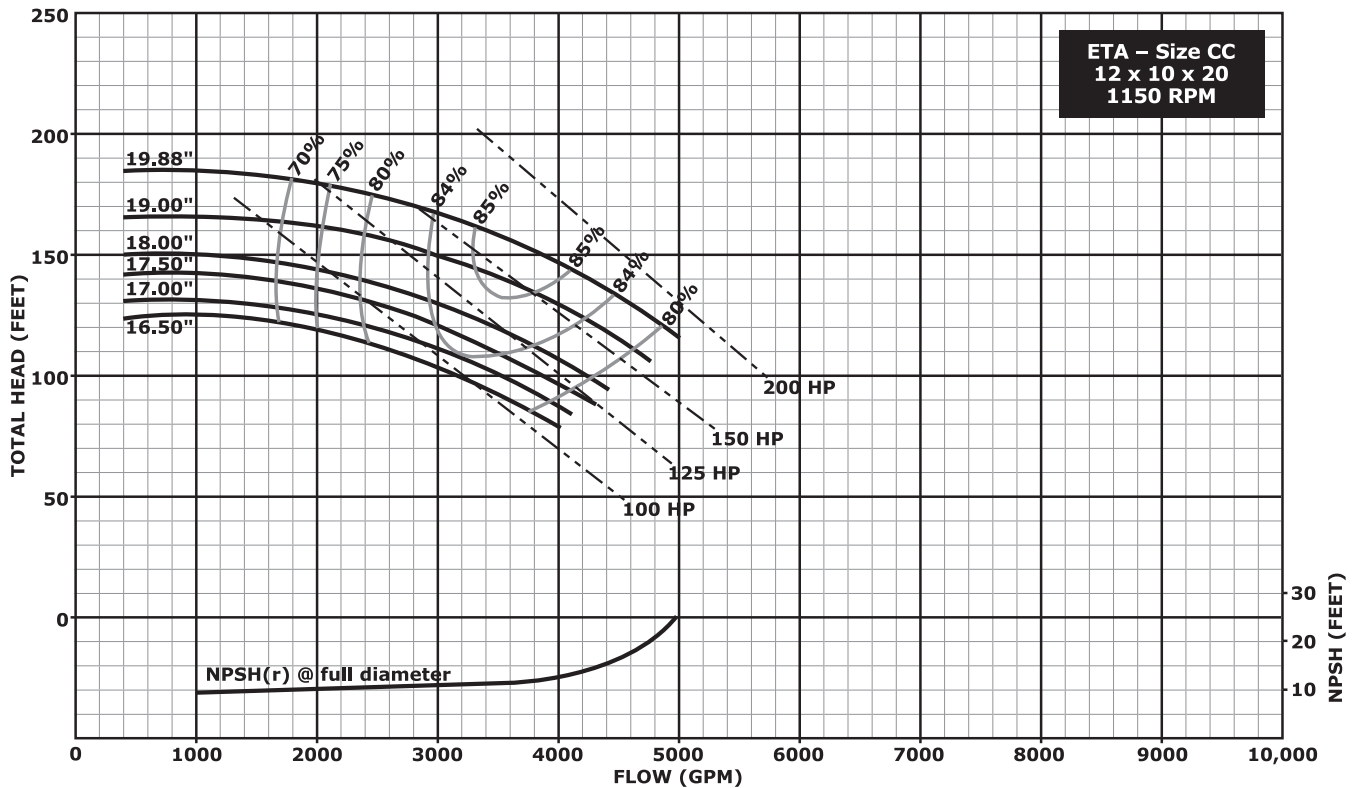
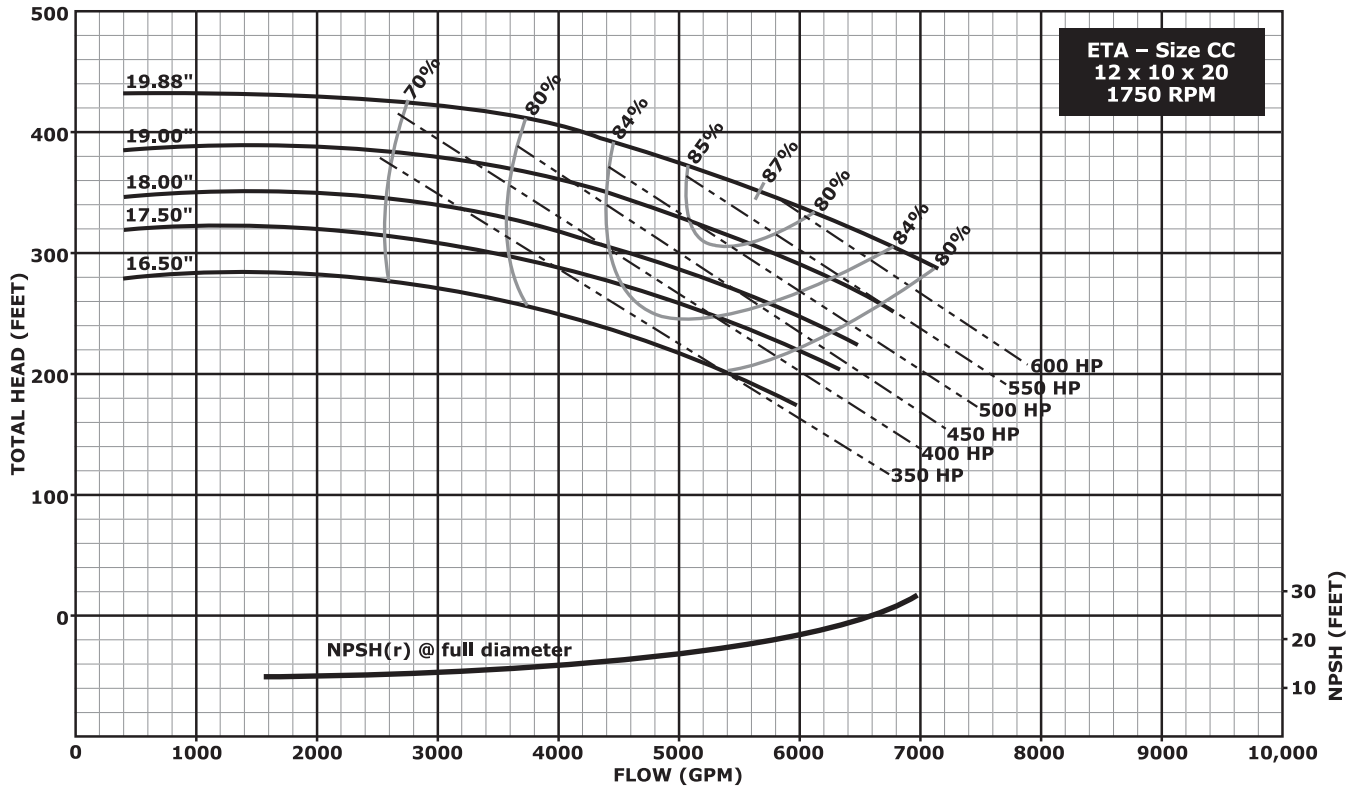
Hydraulic Performance – 20" Impeller Pumps



Notes:

1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. For this pump, impeller trims may also be done with angular vane cuts. Impeller diameter trims shown are approximations only.

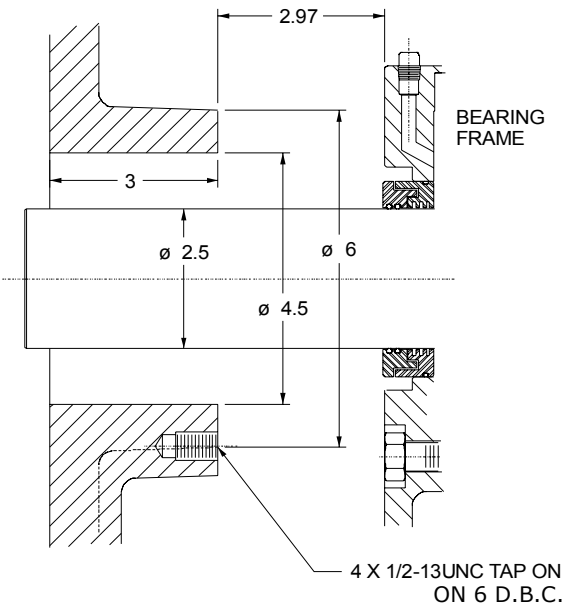
Hydraulic Performance –20" Impeller Pumps



Notes:

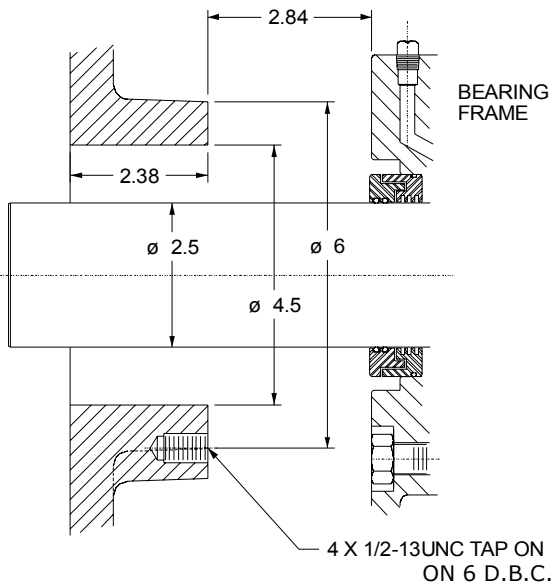
1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. For this pump, impeller trims may also be done with angular vane cuts. Impeller diameter trims shown are approximations only.

Stuffing Boxes Dimensions for "C" and "45" Bearing Frames



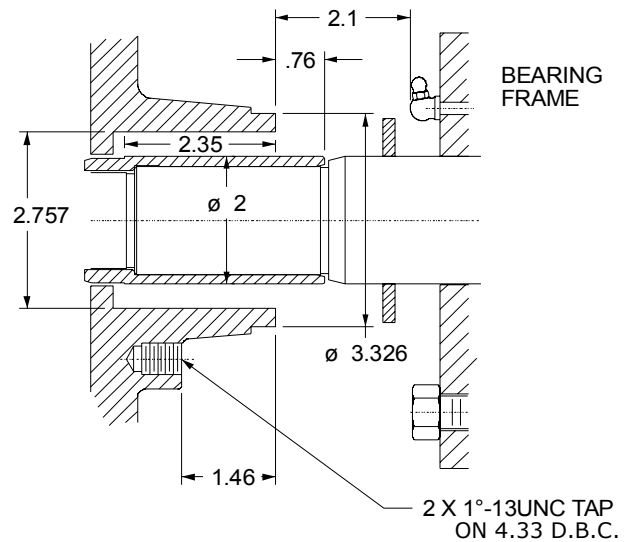
Sizes 10 x 8 x 13, 12 x 10 x 13, and 12 x 12 x 13

ETA "C" Bearing Frame



Size 10 x 10 x 13

ETA "C" Bearing Frame



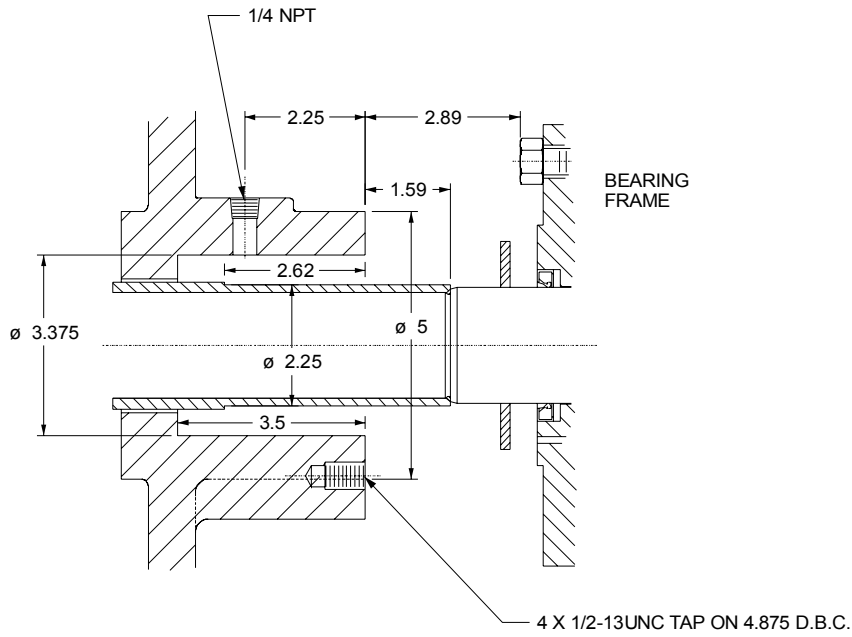
ETA "45" Bearing Frame



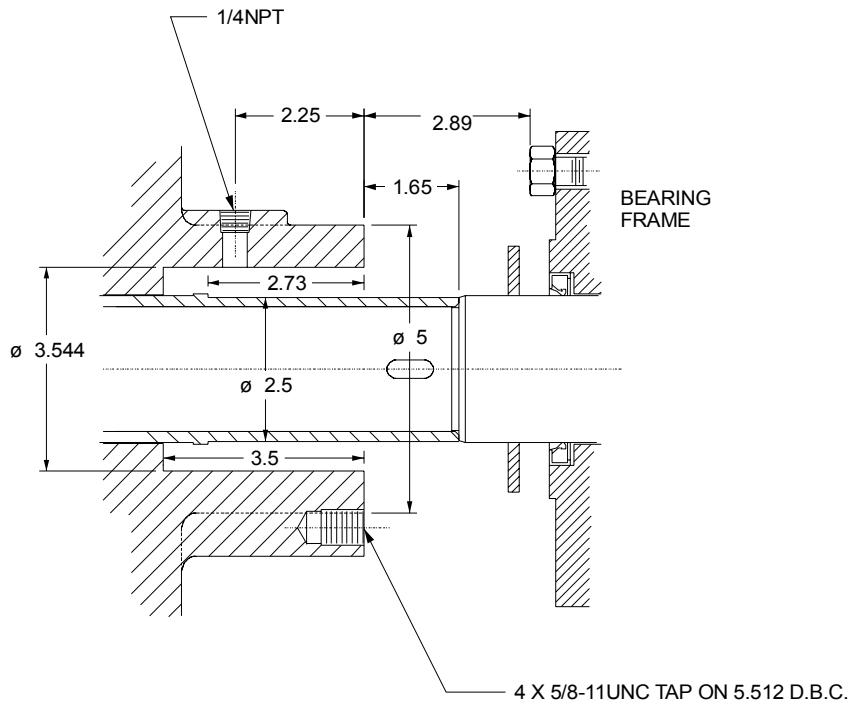
1. All dimensions in inches unless otherwise noted.
2. All tolerances +/- 0.010 inch.
3. Not valid for construction unless certified.

Dwg: SP-ETA-1, Rev: 0

Stuffing Boxes Dimensions for "D" and "DS" Bearing Frames



ETA "D" Bearing Frame



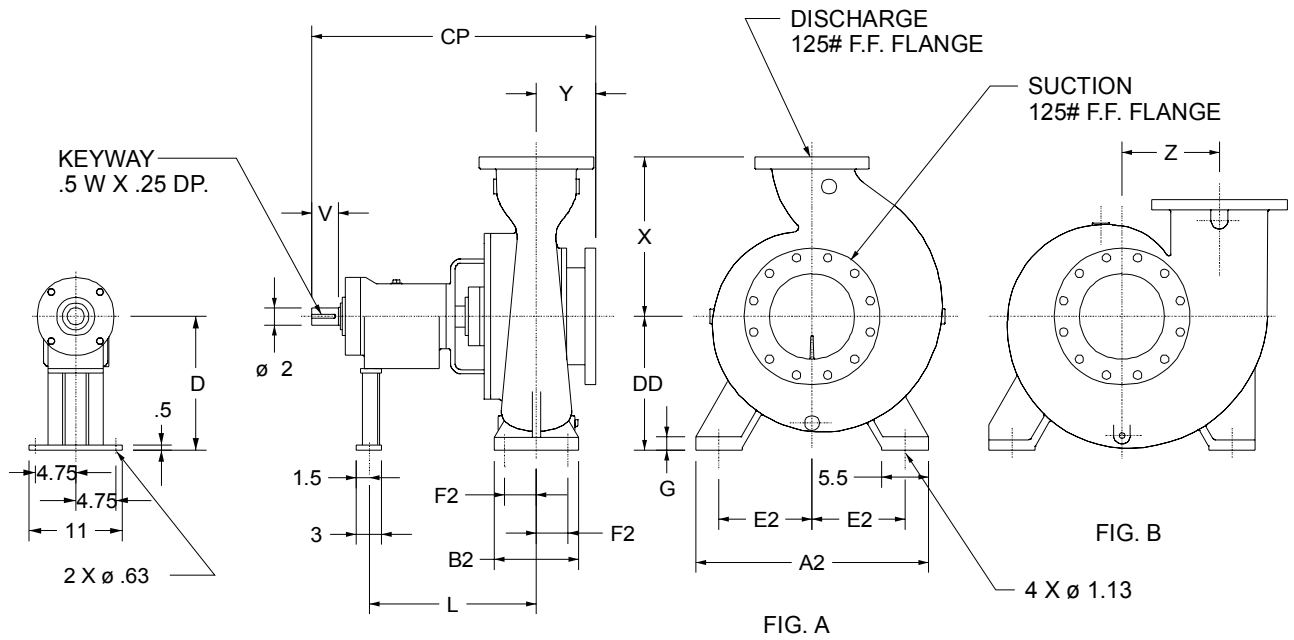
ETA "DS" Bearing Frame



1. All dimensions in inches unless otherwise noted.
2. All tolerances +/- 0.010 inch.
3. Not valid for construction unless certified.

Dwg: SP-ETA-2, Rev: 0

All "C" Bearing Frame Sizes



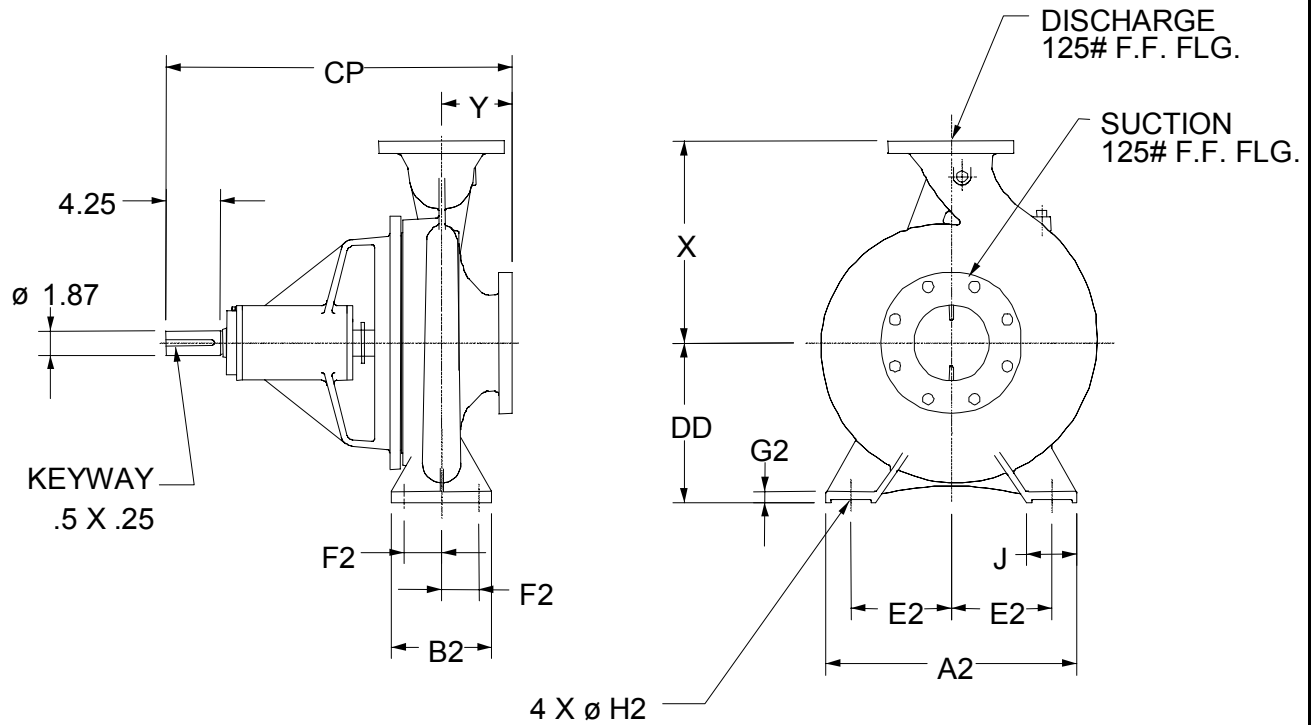
Pump Size	Pump Dimensions													
	Fig.	X	Y	Z	CP	A2	B2	D	DD	E2	F2	G2	E2	L
AA - 10 x 8 x 13	A	18.75	7.00	-	33.50	27.50	10.00	15.69	15.75	11.00	3.75	1.60	1.38	19.72
AB - 10 x 10 x 13	B	13.75	8.68	11.5	33.75	31.50	10.00	15.69	15.75	13.00	3.75	1.25	1.38	18.33
AC - 12 x 10 x 13	A	21.00	9.68	-	35.30	27.00	10.00	15.69	15.75	11.00	3.75	1.50	1.38	18.86
AD - 12 x 12 x 13	B	17.75	11.8	13.88	38.15	31.50	11.50	19.44	19.50	13.00	4.25	1.25	1.38	19.56



1. All dimensions in inches, unless otherwise noted.
2. All tolerances +/- 0.010 inch.
3. Not valid for construction unless certified.

Dwg: SP-ETA-3, Rev: 0

All "45" Bearing Frame Sizes



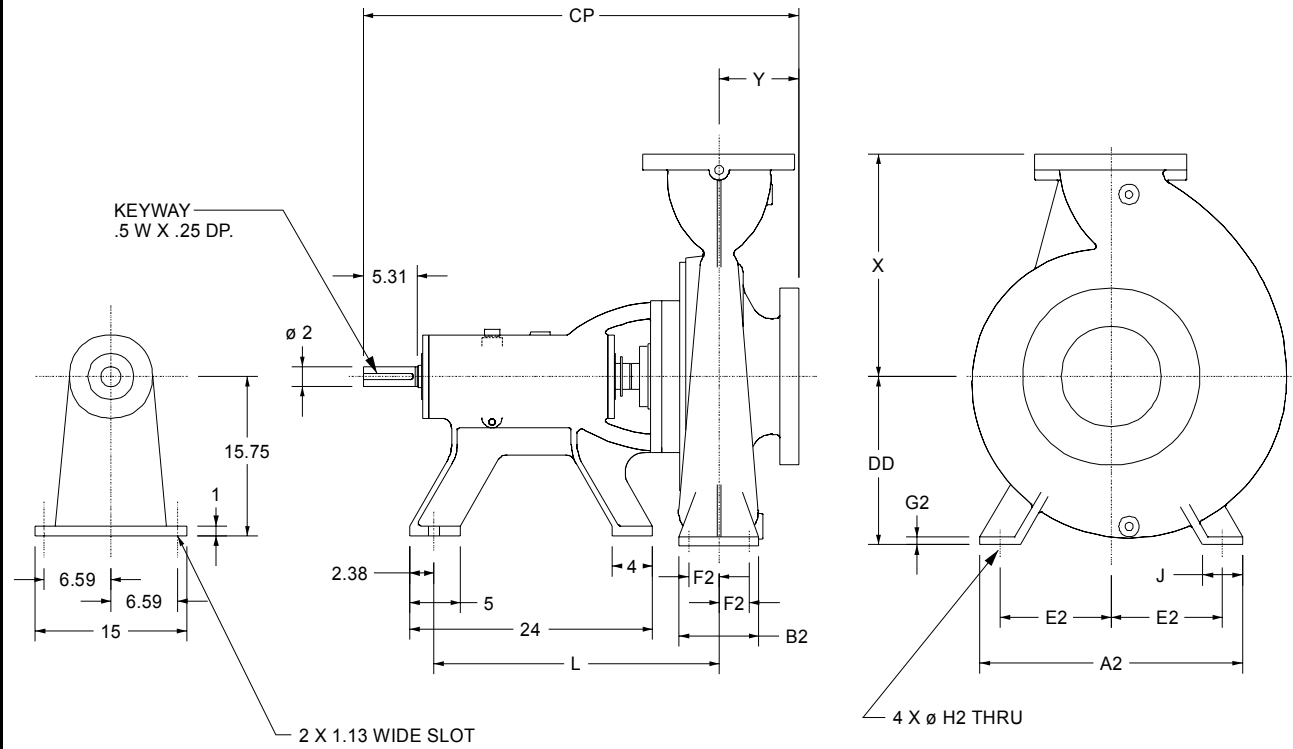
Pump Size	Pump Dimensions										
	X	Y	CP	A2	B2	DD	E2	F2	G2	H2	J
BA - 4 x 3 x 16	14.00	4.93	26.50	17.13	6.30	11.02	7.00	2.36	0.55	0.75	3.17
BB - 5 x 4 x 16	14.00	5.50	27.08	19.68	7.88	11.02	7.88	2.95	0.79	0.94	3.94
BC - 6 x 5 x 16	15.75	5.50	27.08	19.68	7.88	12.38	7.88	2.95	0.79	0.94	3.94
BD - 8 x 6 x 16	15.75	6.30	27.88	21.68	7.88	12.38	8.86	2.97	0.79	0.94	3.94



1. All dimensions in inches, unless otherwise noted.
2. All tolerances +/- 0.010 inch.
3. Not valid for construction unless certified.

Dwg: SP-ETA-4, Rev: 0

All "D" Bearing Frame Sizes



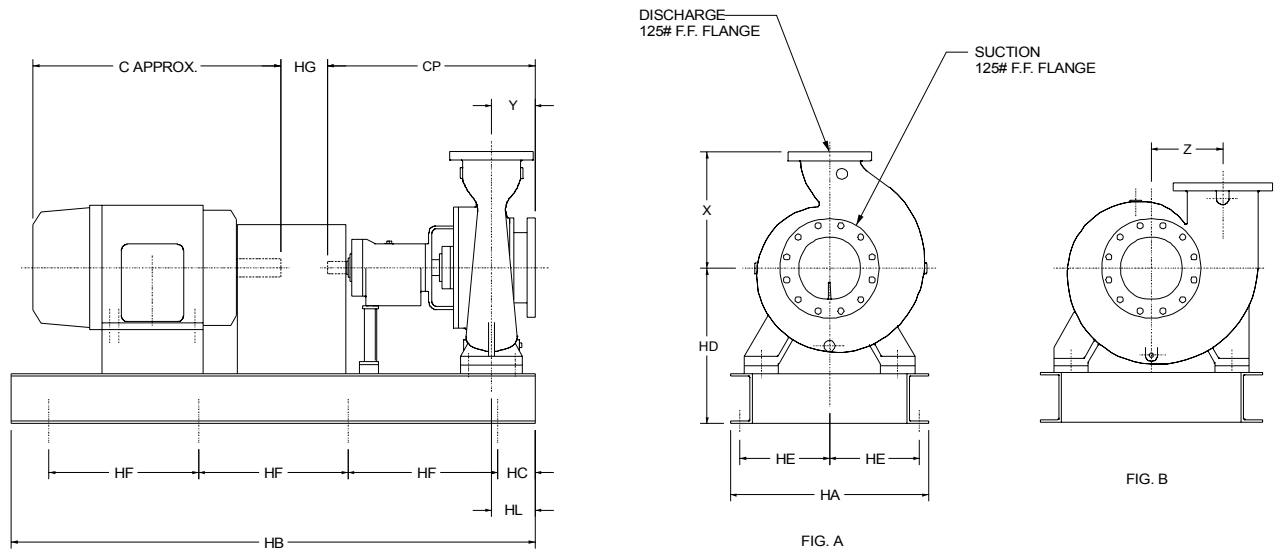
Pump Size	Pump Dimensions									
	X	Y	CP	A2	B2	DD	E2	F2	G2	L
BE - 10 x 8 x 16	20.63	7.13	41.75	27.5	9.875	15.75	11.0	3.75	5.50	27.66
BF - 12 x 10 x 16	23.63	7.13	41.55	31.5	10.00	18.00	13.0	3.75	5.50	27.46
CA - 8 x 6 x 20	22.00	7.00	41.27	29.0	10.00	15.75	12.5	3.75	5.00	27.29
CB - 10 x 8 x 20	22.00	7.87	43.07	26.0	7.875	16.63	11.0	3.75	4.00	28.21
CC - 12 x 10 x 20	26.38	7.87	43.62	31.5	10.24	18.70	14.0	3.75	5.75	28.76



1. All dimensions in inches, unless otherwise noted.
2. All tolerances +/- 0.125 inch.
3. Not valid for construction unless certified.

Dwg: SP-ETA-5, Rev: 0

Standard Pump and Motor Assembly Dimensions



Pump Size	Pump Dimensions								Baseplate Number by Motor Frame Size								
	Fig.	X	Y	Z	CP	HD	HG	HL	254 - 256T	284 - 286T	324 - 326T	364 - 365T	404 - 405T	444 - 445TS	444 - 445T	449TS	449T
AA - 10 x 8 x 13	A	18.75	7.00	-	33.50	24.88	7.25	7.00	-	8	9	10	11	11	12	-	-
AB - 10 x 10 x 13	B	13.75	8.68	11.50	33.75	24.88	7.25	9.00	-	18	18	19	20	20	21	-	-
AC - 12 x 10 x 13	A	21.00	9.68	-	35.30	24.88	7.25	10.0	-	-	10	10	11	11	12	-	-
AD - 12 x 12 x 13	B	17.75	11.8	13.88	38.15	28.63	7.25	12.0	-	-	-	19	20	21	22	-	-
BA - 4 x 3 x 16	A	14.00	4.93	-	26.50	15.77	5.00	6.38	1	1	2	2	-	-	-	-	-
BB - 5 x 4 x 16	A	14.00	5.50	-	27.08	14.77	5.00	7.00	3	3	3	4	-	-	-	-	-
BC - 6 x 5 x 16	A	15.75	5.50	-	27.08	16.15	5.00	7.00	-	3	3	4	5	-	-	-	-
BD - 8 x 6 x 16	A	17.75	6.30	-	27.88	16.15	5.00	8.00	-	-	4	4	5	6	7	-	-
BE - 10 x 8 x 16	A	20.63	7.13	-	41.80	24.88	7.25	7.00	-	-	10	11	12	12	13	-	-
BF - 12 x 10 x 16	A	23.63	7.13	-	41.55	27.13	7.25	7.00	-	-	-	20	21	21	22	23	23
CA - 8 x 6 x 20	A	22.00	7.00	-	41.27	24.88	7.25	7.00	-	-	-	15	16	16	17	-	-
CB - 10 x 8 x 20	A	22.00	7.87	-	43.07	25.75	7.25	8.00	-	-	-	-	12	13	13	14	14
CC - 12 x 10 x 20	A	26.38	7.87	-	43.62	27.83	7.25	8.00	-	-	-	-	-	22	22	23	23

Baseplate Number	Baseplate Dimensions					
	HA	HB	HC	HE	HF	D
1	24.0	55.00	5.5	11.0	22.00	6.00
2	24.0	61.00	5.5	11.0	25.00	6.00
3	30.0	61.00	5.5	14.0	25.00	6.00
4	30.0	66.50	6.0	14.0	27.25	6.00
5	30.0	72.50	6.0	14.0	30.25	6.00
6	30.0	78.50	6.0	14.0	33.25	6.00
7	30.0	84.50	6.0	14.0	24.16	8.00
8	32.0	66.50	6.0	14.5	27.25	6.00
9	32.0	72.50	6.0	14.5	30.25	6.00
10	32.0	78.50	6.0	14.5	33.25	6.00
11	32.0	84.50	6.0	14.5	24.16	8.00
12	32.0	90.50	6.0	14.5	26.16	8.00

Baseplate Number	Baseplate Dimensions					
	HA	HB	HC	HE	HF	D
13	32.0	96.50	6.0	14.5	28.16	8.00
14	32.0	102.5	6.0	14.5	23.10	10.0
15	34.0	84.50	6.0	15.5	24.16	8.00
16	34.0	90.50	6.0	15.5	26.16	8.00
17	34.0	96.50	6.0	15.5	28.16	8.00
18	36.0	72.50	6.0	16.5	30.25	6.00
19	36.0	78.50	6.0	16.5	33.25	6.00
20	36.0	84.50	6.0	16.5	24.16	8.00
21	36.0	90.50	6.0	16.5	26.16	8.00
22	36.0	96.50	6.0	16.5	28.16	8.00
23	36.0	102.5	6.0	16.5	23.10	10.0

NEMA Motor Dimensions (Approximate)

NEMA Frame	C	NEMA Frame	C	NEMA Frame	C	NEMA Frame	C	NEMA Frame	C	NEMA Frame	C
254T	23	286T	27	364T	31	405T	40	445TS	42	449TS	50
256T	25	324T	28	365T	32	444TS	42	445T	46	449T	54
284T	25	326T	29	404T	38	444T	46				

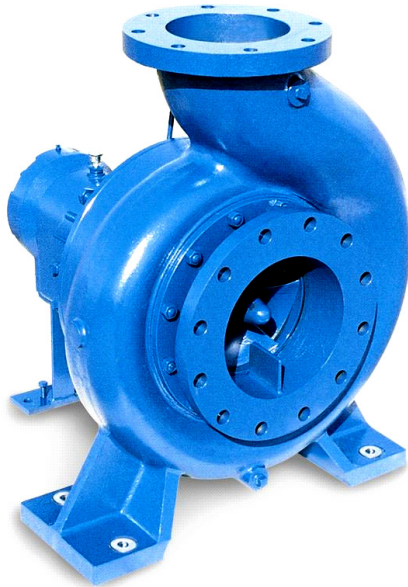


1. All dimensions in inches, all tolerances +/- 0.125 inch.
2. All motor dimensions are approximate.
3. Not valid for construction unless certified.

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3.0 A Typical ETA Series Specification - (Options in parentheses)

Each pump shall be a horizontal, end suction, frame mounted centrifugal unit capable of developing (9,500) US GPM at a total head of (435) feet when pumping (water) at a temperature of (125) °F with a fluid specific gravity of (1.00) without the use of special clearances, materials, or other internal or external modifications. In meeting these hydraulic conditions, the pump shall have an NPSH requirement of not more than (20) feet and a hydraulic operating efficiency at the normal duty point of at least (80.0)% as defined by the Hydraulic Institute Level A requirements, which includes all mechanical seal and bearing losses.



The pump shall include separate liquid end, mechanical seal, and bearing frame sections for ease of maintenance. The liquid end shall be cast iron, with all components fully compatible with the temperature, corrosion and abrasion properties of the pumped fluid. All pressure retaining parts of the pump shall be hydrostatically tested to 150% of its operating pressure and all piping connections shall be ANSI Class 150 lb. rated flanges.

The impellers shall be the enclosed type in cast iron (bronze) for highest efficiencies without the need for axial adjustments to compensate for wear, as is typical with other impeller types. The impellers shall be positively keyed to the pump drive shaft for more positive driving and to prevent the impeller from spinning off the shaft in the event of accidental reverse rotation. As a further means of assuring longer component life, all impellers shall be dynamically balanced in accordance with ISO G2.5 guidelines. The drive shaft shall be AISI 108 or ASTM A311 grade high strength steel with a replaceable 316 stainless steel sleeve for added protection from erosion and corrosion over the life of the pump.

The bearing frame shall consist of a minimum of (2) matched, grease-lubricated ball bearings to handle all radial and axial loads. Both bearings shall have a minimum L10 life of 50,000 hours. The bearings, together with the shaft, shall be designed to provide minimum deflection throughout the entire range of pump operation. In all cases, the shaft deflection shall meet or exceed the requirements of ANSI Specification B73.1M-1991, "Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process."

The pump shall have one mechanical seal, and be capable of accepting either component or cartridge-type mechanical seals. The seals shall have Viton elastomers, 316 stainless steel metal components, carbon on ni-resist (silicone carbide) faces, and capable of operating up to 230 °F without external cooling. When conditions warrant, the pump shall also be equipped with a 316 stainless steel balance line to facilitate flushing and cooling in the stuffing box area of the pump.

For added ease of operation, the entire pump casing shall be the back pull-out type to allow disassembly, inspection, and assembly without otherwise disturbing the pump mounting or system piping.

The pump shall be supplied complete with a baseplate, coupling, and coupling guard. If an electric motor is also provided, it shall be sized to operate throughout the entire range of the pump performance curve without exceeding the nameplate horsepower rating of the motor.

In all cases, the pump shall be a heavy-duty, industrial design, ETA Series as manufactured by Carver Pump Company of Muscatine, Iowa, or ISO-9001 certified, United States manufactured approved equal.



Since we built our first pumps in 1938, the Carver name has become synonymous with value. Today we are recognized as one of the world's leading centrifugal pump companies, building pumps to the most demanding engineering specifications and military standards in the world.

Our company is located in Muscatine, Iowa, 25 miles southwest of the Quad Cities area. Our operations there include some of the most modern manufacturing equipment and pump development software available, and we are committed to the highest quality possible in our products and our people. Along these lines, Carver was also one of the first American pump companies to attain ISO 9001 certification—the most recognized standard for quality in the world.

From an applications standpoint Carver has traditionally built pumps for water, oil, and chemicals for both the public and private sectors. Our product line includes both horizontal and vertical end suction, multistage, axial split case, self-priming, API, and solids-handling pumps that all carry the same Carver trademark: lasting value from solid, straightforward designs engineered to provide many years of service.

These pumps are also backed by unparalleled aftermarket support. Our network of stocking distributors, manufacturer's representatives and certified service centers throughout the world means that no matter where your pump may be installed, there are local sales and service people ready to support your aftermarket needs.



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