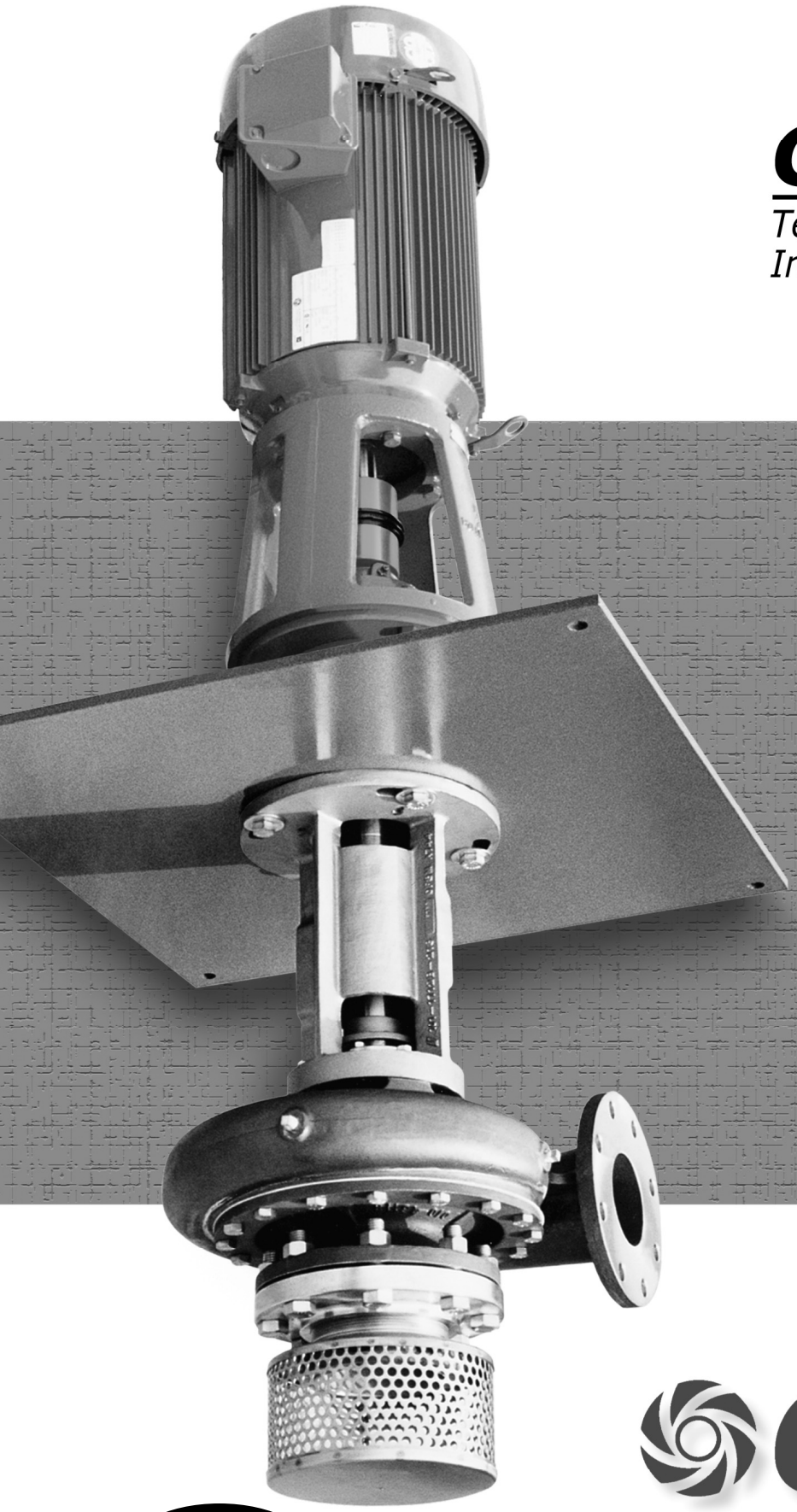


GV Series

Technical Support Information

Carver®

Creating Value.

JANUARY 2004

1.0 Overview

The GV Series is Carver's vertical pump line designed for moderate to high flow rates. It includes a cantilevered (GVC) tank-mounted unit with optional top pull-out (GVT) and extended length, sump (GVS) versions.

The GV is the natural evolution of the LHV, LHT, and LHS Series, which are now non-current. And while the GV was designed for maximum interchangeability with these pumps, it is nonetheless a new series and not necessarily identical to everything that preceded it.

All GV pumps are provided with the wet end, support column, bearing frame, motor mounting bracket and small top plate without discharge piping as standard.

Standard options include discharge piping (standard, oversized and double oversized) with larger top plates to accommodate the discharge piping, 316 SS underliners (0.048" thickness) for contamination and corrosion protection, inlet tail pipes and suction strainers.

1.1 Basic Hydraulic Features

Standard hydraulic features for the GV Series program are shown in the table below.

Basic Hydraulic Features

GV Series Pump		General Design Features				Hydraulic Performance			
Basic Size	*Ordering Code*	*Max RPM*	*Max Solids*	*Casing Volutes*	*Connections*	*Impeller Type*	*Q (GPM) @ BEP*	N_S	N_{SS}
1¼ x 1 x 7	BA	3500	0.187	Single	NPT	Semi-open	40	696	3310
1½ x 1¼ x 7	BB		0.218				80	1065	2783
2½ x 2 x 7	BC		0.313				120	1228	5733
3 x 2½ x 7	BD		0.437		Flanged		176	1433	6943
4 x 3 x 7	BE	1750	0.812	Quad			230	2070	7937
5 x 4 x 7	BF		1.125	Dual			460	2091	5821
1½ x 1¼ x 10	CA	1750	0.218	Single	NPT	Semi-open	60	507	3150
2 x 1½ x 10	CB		0.250				135	733	4275
2½ x 2 x 10	CC		0.218				176	868	4129
3 x 2½ x 10	CD		0.437		Flanged		260	1017	5018
4 x 3 x 10	CE		0.562	Quad			440	1311	5693
5 x 4 x 10	CF		0.500	Dual			640	1687	5808
6 x 5 x 10	CG		1.000				1375	2625	5479
2 x 1 x 11	DA	1750	0.437	Single	Flanged	Enclosed	85	475	2671
4 x 2 x 11	DB		0.500				210	757	7584
4 x 3 x 11	DC		0.531	Quad			390	1061	9015
5 x 4 x 11	DD		0.813				780	1546	7581
8 x 6 x 11	DE		1.625	Dual			1750	2505	10693
2½ x 1½ x 13	EA	1750	0.131	Single	Flanged	Enclosed	75	335	1798
2½ x 2 x 13	EB		0.313				170	519	4797
3 x 2½ x 13	EC		0.387				320	749	7274
4 x 3 x 13	ED		0.531				530	926	9362
5 x 4 x 13	EE		0.750				700	1044	9734
6 x 5 x 13	EF		0.875				1150	1435	8668
8 x 6 x 13	EG		1.250				1900	1926	11142

1.2 Standard Surface Treatment

All GV Series components handling fluids less than 230 ºF are painted to Carver Standard PA-001. This provides one coat of Carver Blue industrial alkyd metal enamel with a 3-5 mils dry film thickness. All paint is applied over a clean, dry, bare metal surface.

All iron castings are spot primed with red oxide sealer over any area exhibiting minor discoloration from rust or oxidation. Pumps handling fluids above 230 ºF can generally only be sold with prior approval of Carver, and will be painted with two coats of modified silicone alkyd resin, aluminum colored, to a total of 2 mils dry film thickness.

1.3 Materials of Construction

The standard GV materials and material specifications are given in the table below:

Key Component Materials		
Component	**Material**	**Specification**
Bearing Frame	Cast iron	ASTM A48, Class 30
Casing	Cast iron	ASTM A48, Class 30
	316 SS	ASTM A744, Grade CF-8M
Impeller	Cast iron	ASTM A48, Class 30
	316 SS	ASTM A744, Grade CF-8M
Motor Bracket	Cast iron	ASTM A48, Class 30
Lineshaft Bearing	Tin bronze	ASTM B30, C90300
	Carbon	Antimony filled
O Ring	Elastomer	Viton
Piping	Steel	ASTM A106
	316 SS	ASTM A312
Shaft	Steel - GVC	ASTM A108, Grade 1215
	Steel - GVS	ASTM A434, Grade 4140
	316 SS	ASTM A276, UNS S31600
Shaft sleeve	416 SS	ASTM A582, Type 416
Slinger	Alloy 20	ASTM A744, Grade CN-7M
	Elastomer	Buna N
Support Column	Composite	Glass filled vinyl ester
	Steel	ASTM A106
	316 SS	ASTM A269, Type 316
Throttle bushing	Teflon	15% glass, 5% molybdenum
	17-4 PH SS	ASTM A564, Type 630
Underliner	316 SS	ASTM A240, Type 316

1.4 Key GVC Data

Many of the key GVC design parameters are specified in the table below:

Key GVC and GVT Data			
Item	**Bearing Frame**		
	1520	1530	1540
Max power (BHP) @ 1750 RPM	20	75	150
@ 3500 RPM	20	N/a	N/a
Radial bearing type	207	210	312
Thrust bearing type	307	5308	5611
Thrust bearing lube (standard)	Grease		
Shaft diameter @ coupling	1.250	1.375	1.875
@ radial bearing	1.378	1.969	2.363
@ thrust bearing	1.378	1.575	2.169
@ impeller hub	0.875	1.250	1.625
Shaft diameter under sleeve	1.000	1.375	1.750
Shaft sleeve O.D.	1.250	1.750	2.125
L_{10} bearing life (hrs) - radial	50,000		
L_{10} bearing life (hrs) - thrust	25,000		

1.5 Key GVS Data

Many of the key GVS design parameters are specified in the table below:

Key GVS Data		
Item	**Bearing Frame**	
	43V - 1	43V - 2
Max power (BHP) @ 1750 - 3500 RPM	20 - 20	75 - n/a
Radial bearing type	Journal	Journal
Thrust bearing type	5307	5308
Thrust bearing lubrication (standard)	Grease	
Line shaft lubrication (options)	Water, oil or product	
Shaft diameter @ coupling	1.250	1.250
@ radial bearing	1.500	1.500
@ thrust bearing	1.378	1.378
@ impeller hub	0.875	1.250
WR^2 of Rotor (lb – in.) – 4' column	7.98	8.20
for each additional 2' add	3.38	3.38
WR^2 of Rotor (lb – in.) – 7" impellers	15.10	15.10
10" impellers	56.67	56.67
11" impellers	137.56	137.56
13" impellers	233.74	233.74
L_{10} bearing life (hrs) - radial	50,000	
L_{10} bearing life (hrs) - thrust	25,000	

1.6 Selecting Vertical Pumps

To successfully select a GV pump the following information must be known:

a. Hydraulics

- *fluid to be pumped*
- *flow rate*
- *tank fluid level (min, normal and max)*
- *discharge pressure*
- *viscosity (min, normal and max)*
- *temperature (min, normal and max)*
- *specific gravity (min, normal and max)*
- *NPSH available*
- *vapor pressure*

b. Materials

- *casing, piping and top plate*
- *shafts*
- *impellers*
- *throttle bushings*
- *wear rings*

c. Configurations / Accessories

- *driver (speed, type, rating, manufacturer)*
- *coupling (torque, type, manufacturer)*
- *top plates (type, options)*

1.7 Vertical Pump Discharge Head

While the flow required of a pump is generally well known, the total head against which it must pump is often more difficult to determine. With vertical pumps one frequently overlooked item is that the pump discharge originates at the pump casing below the tank or pit surface, not at the discharge flange at the tank top. Therefore, to correctly determine the discharge head required, the elevation between the actual pump discharge point and the distance to the tank or pit surface, and the resulting fluid friction losses encountered along this length of pipe, must also be considered.

1.8 NPSH & Submergence

The ***minimum*** net positive suction head (NPSH) required is the net amount of hydraulic energy above vapor pressure needed to overcome elevation and friction losses and deliver fluid into the eye of the impeller. NPSH is generally understood with horizontal pumps, but with vertical pumps one other related consideration is the concept of ***submergence***. Submergence is the height of a fluid above the pump's inlet, or conversely, the depth of the vertical pump's inlet below the fluid surface. Submergence is not the same as NPSH, and it must always be large enough to maintain sufficient NPSH available and prevent ***vortexing***.

When a surface vortex develops in a vertical pump installation, air is pulled down from the fluid surface into the pump inlet.

This in turn can be a serious problem, and some of its consequences are:

- *rotor assembly imbalance and vibration*
- *accelerated wear due to dry running*
- *accelerated wear due to hydraulic shock loads as the air passes through the pump*
- *erratic performance, with loss of flow and head*

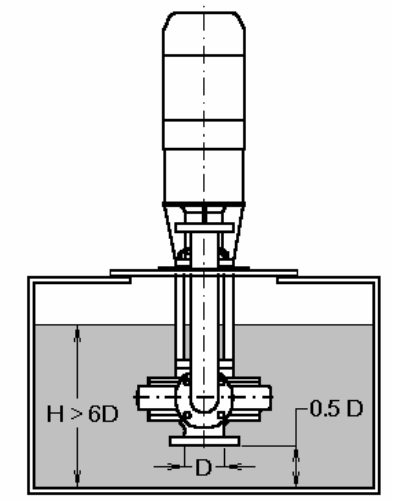
This last point is often overlooked, since air entrainment as little as a one percent by volume will produce a noticeable drop-off in pump performance, and a two percent by volume air entrainment on the inlet can reduce the pump flow rate by as much as 10%.

The two most common conditions for vortex formation are insufficient submergence depth and excessive suction piping fluid velocity. System design guidelines for overcoming this are published by the Hydraulic Institute and others.

In addition to the various (and often contradictory) published recommendations on this, a simple rule of thumb often used is to set the submergence depth to 6 times the nominal inlet size diameter of the pump (i.e., set H > 6D). For smaller pumps less than 100 GPM this is often simplified to H > 18", and for larger pumps over 1,200 GPM this is simplified to H > 8D – see sketch below.

The pump inlet, whether it is the pump casing or an extended inlet pipe, should be sized to a distance of 0.3 to 0.8 D to the tank bottom, with 0.5 D considered optimal, where D is the nominal inlet diameter.

This is important because if this inlet to tank bottom distance is too great, the submergence depth is lessened. On the other hand, if the distance is too small, debris and other foreign matter on the tank bottom can be drawn in to the pump, in effect making the pump a vacuum cleaner for the tank.

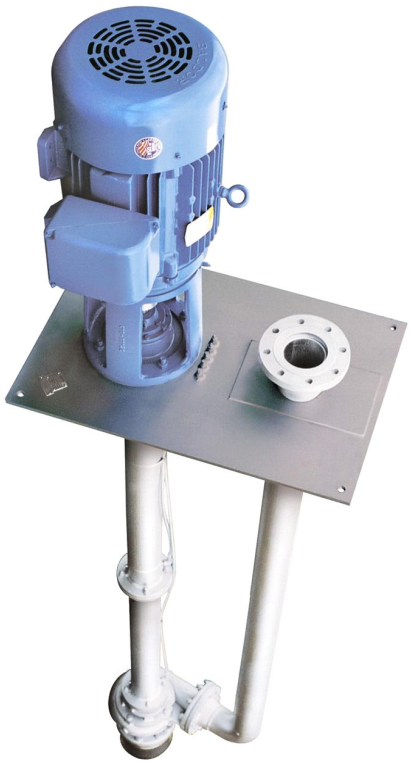


Lastly, vortex breakers in the form of inlet baffles, weirs and/or suction strainers can be very effective in preventing vortices from forming in the system. Therefore, it is recommended that every GV pump be equipped with a suction strainer. When pumping fluids over 1,000 SSU, the finest strainer screen practical is about 1/8" perforation. It is also advisable to monitor the strainer with a differential pressure gauge or switch, since a clogged strainer will cause a pump to cavitate.

1.9 A Typical GV Series Specification - *(Specifier's options in parentheses)*

Each pump shall be a vertical, end suction, centrifugal pump capable of developing (500) US GPM at a total head of (200) feet when pumping (water) at a temperature of (100) °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 (10) feet and a hydraulic operating efficiency at the normal duty point of at least (70.0)% as defined by the Hydraulic Institute Level A requirements, which includes all mechanical seal, lineshaft bearing and/or throttle bushing losses.

The pump shall include separate liquid end, support column and bearing frame sections for ease of maintenance. The liquid end shall be cast iron (316 stainless steel), with all components below the top plate surface fully compatible with the temperature, corrosion and abrasion properties of the fluid being pumped.



The impellers shall be precision cast iron (316 stainless steel) and positively keyed to the pump drive shaft for more positive driving and to prevent the impeller from spinning off the shaft and damaging itself and/or the pump casing 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 bearing frame shall be located above the top mounting surface for ease of access. It shall consist of a minimum of two matched grease-lubricated ball bearings to handle all radial and axial loads. The thrust bearing shall have a minimum L_{10} life of 25,000 hours and the radial bearing shall have a minimum L_{10} life of 50,000 hours.

For added reliability, the bearings shall be protected from any fluid vapors by means of a spring-loaded lip seal. The bearings and shaft shall be designed to provide minimum deflection throughout the entire range of pump operation.

For optimum efficiency and to assure long life without degradation in performance over time, the bearing frame assembly shall have the means of externally adjusting the impeller axial position without disassembling the pump or otherwise removing it from the system.

The pump shall have a replaceable Teflon throttle bushing at the outboard (impeller) end and the option for a hardened 17-4 stainless steel throttle bushing with a hardened 416 stainless steel shaft sleeve when pumping fluids with dirt or abrasives present. In all cases, the throttle bushing shall not be used as a bearing surface, and the maximum deflection at the throttle bushing shall not exceed 0.010 inches. All extended length sump pumps shall have as a minimum one lineshaft bearing for each 4.0 foot of column length. The lineshaft bearing shall be bronze (carbon) and capable of being either permanently grease lubricated or externally lubricated and flushed by either oil, water or the fluid being pumped.

The pump shall be supplied complete with an electric motor, top plate, (discharge piping), (inlet strainer), coupling and coupling guard. It shall be capable of operating throughout the entire range of its performance curve without exceeding the nameplate horsepower rating of its motor.

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

1.10 Comments, Clarifications and/or Exceptions to API Standard 610, 8th Edition

Section 1 – General

None

Section 2 - Basic Design

2.1.18 Cooling Jacket Cleaning and Flushing – Clarification
2.1.19 Cooling jackets, when provided, must be drained and flushed through the cooling jacket inlet and outlet connections. The jackets must be removed for further cleaning.

2.1.26 Vibration - Comment
Vibration criteria used for the GV Series are the Hydraulic Institute Standards for vertical sump pumps:

a. 1200 RPM - 4.0 mils peak-peak displacement
b. 1800 RPM - 3.0 mils peak-peak displacement
c. 3600 RPM - 1.8 mils peak-peak displacement

HI criteria calls for taking vibration measurements at the top motor bearing. Vibration at the pump thrust bearing will be significantly less. Any requirements for lower than H.I. standards will be examined on a case by case basis.

2.2.1 Pressure Vessel Stresses – Comment
Pressure containing parts are the pump casing, suction cover, discharge elbow, and discharge pipe. These pressure containing components are designed in accordance to ASME Section III including a 1/8" corrosion allowance. ASME Section VIII regarding welding of fabricated pressure components does not apply.

2.2.12 Jackscrews - Clarification
Jackscrews are not required for vertical sump pumps per API-610 Paragraph 5.3.1.1.

2.2.13.3 Internal Bolting – Clarification
Internal bolting on cast iron units is carbon steel. 316 SS bolts must be used to be fully resistant when pumping corrosive fluids. For all 316 SS bolting below the top plate refer to factory for price adder.

2.3.1.2 Flush connections – Exception
Flush connections are 1/4" NPT as standard. For larger flush connections refer to factory for price adder.

2.3.3.4 Auxiliary Connections – Exception
We do not weld fittings to the casings. If a line shaft bearing flush from the casing is supplied, it will be a threaded compression fitting.

2.4 External Nozzle Forces and Moments – Exception
The orientations for vertical sump pumps are not specifically addressed in the API-610, 8th edition. This section is very difficult to apply to a GVS series.

2.5.1 Impeller Design – Exception
5.3.2.1 Impellers on the 7” & 10” GVS’s are semi-open as standard. For feasibility of supplying enclosed impellers on GVS’s refer to factory.

2.5.7 Shaft Run Out - Clarification
5.3.11.8 Nominal run out at the stuffing box will be 0.004" TIR or less when operating under normal operating circumstances.

2.6.1 Wear Rings - Exception
Wear rings are not applicable for semi-open impellers.

2.7 Mechanical Shaft Seals – Clarification
The GVS Series is sealless design. For high temperatures and/or vapor proof applications, a packed box is available. For mechanically sealed pumps refer to factory for selection and pricing.

2.7.3.1 Mechanical Shaft Seals – Clarification
When mechanical seals are provided, the driver must be removed to replace the seal.

2.7.3.6 Mechanical Shaft Seals – Clarification
2.7.3.8 Seal dimensions and chamber bores will be per the seal manufacturers' recommendations.

2.7.3.18 Float Bushings and Throttle Bushings – Exception
2.7.3.20 Seals on the GVS do not see the pumpage. Throat bushings and throttle bushings 2.7.3.21 are only required on inside seals to contain the flush fluid and contain it in the stuffing box area.

2.8.4.1 Balancing – Clarification
Standard balancing on the GVS Series is to ISO G6.3. For optional G2.5 balancing refer to factory for price adder.

2.9.1.5 Thrust Bearings - Exception
All GVS Series thrust bearings are Duplex 5300 series

2.9.2.1 Bearing Housings – Clarification
The motor must be removed to change bearings.

2.9.2.5 Bearing Housings Materials – Exception
Motor supports and bearing housings are cast iron as standard.

2.9.2.6 Bearing Housing Labyrinth Seals Materials – Exception
The lower bearing shell seal on the GVS Series is a lip seal.

2.9.2.10 Bearing Housing Vibration Measurements – Exception
The standard bearing housing shell is not dimpled. For dimpled bearing housing shell refer to factory for price adder.

2.10 Lubrication – Exception
The thrust bearing is grease lubricated. For optional oil lubrication refer to factory for price adder.

2.11.1.5 Material Identification – Clarification
The customer must specify when low carbon grades are required. Refer to factory for price adders.

2.11.3.2 Welding Procedures – Exception
2.11.3.3 To comply with these welding procedure refer to factory for price adder.
2.11.3.4.2
2.11.3.5.5

2.11.3.5.1 Flange Welding – Clarification
The GVS discharge flange at the top will be welded. The submerged suction flange is a non-piped casting integral to the pump casing.

2.12.2 Nameplates – Clarification
Custom nameplates require information from the customer - refer to factory for price adders.

Section 3 - Accessories

3.2.2 Spacer Couplings – Exception
3.2.10 Spacer couplings serve no practical advantage with vertical sump pumps, and so are not offered.

3.2.4 Coupling Hubs – Clarification
Coupling hubs are supplied with clearance fits, per Paragraph 5.3.11.11.

3.2.6 Coupling Balancing – Clarification
3.2.7 This section requires API couplings. For suitable API coupling refer to factory for price adder.

Section 4 - Inspection, Testing, and Preparation for Shipment

5.3.7.2 Coupling Alignment - Exception
3.2.11 The normal procedure is to ship the pump with the motor off and the coupling separate.

4.3.1.1 NPSH Tests – Clarification
4.3.4.1 NPSH tests cannot be performed on vertical sump pumps.

4.3.2.1 Hydrostatic Tests – Clarification
The standard hydrotest is for the casing only. To hydrotest the suction cover and discharge piping (by definition the pressure casing components), refer to factory for price adder.

4.3.2.3 Chloride Content of Test Water – Exception
All tests are done using the local water supply and cannot guarantee a chloride content of 50 PPM or less.

4.4.3.4 Surface Rust Prohibitor – Clarification
4.4.3.5 We do not provide a surface rust prohibitor or internal surface protection as standard. For surface rust prohibitor or internal surface protection refer to factor for price adder.

4.4.3.6 Standard Flange Covering – Clarification
The standard flange cover for the GVS is wafer board secured to the flange. For metal coverings refer to factory for price adder.

Section 5 - Specific Pump Types

5.3.2.2 Shaft Straightness – Exception
Our standard shaft straightness is 0.006". For shafts that comply with 0.003" maximum total indicated run out (TIR) refer to factory for price adder.

5.3.5.1 Lineshaft Bearing Spacing – Clarification
The maximum spacing between lineshaft bearings in a GVS column is 48".

GVS Lineshaft Bearing Flush and Lubrication Options

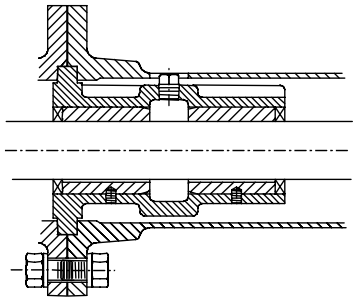


Fig. 1 Greased for Life

Bronze (standard) or carbon (optional) bearings, sealed at both ends, flush connection drilled, tapped and plugged, with no external flush

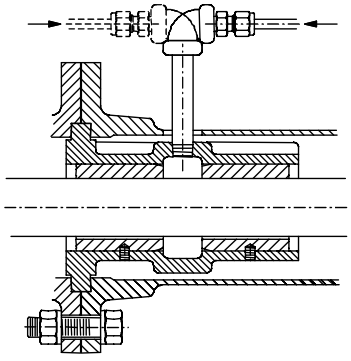


Fig. 2 Water or Product Lubed

Bronze (standard) or carbon (optional) bearings, open at both ends. Product flush from point on pump discharge, water flush from external source (by others)

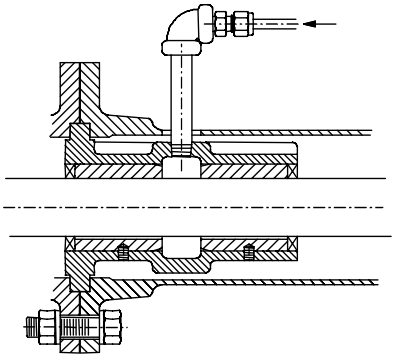
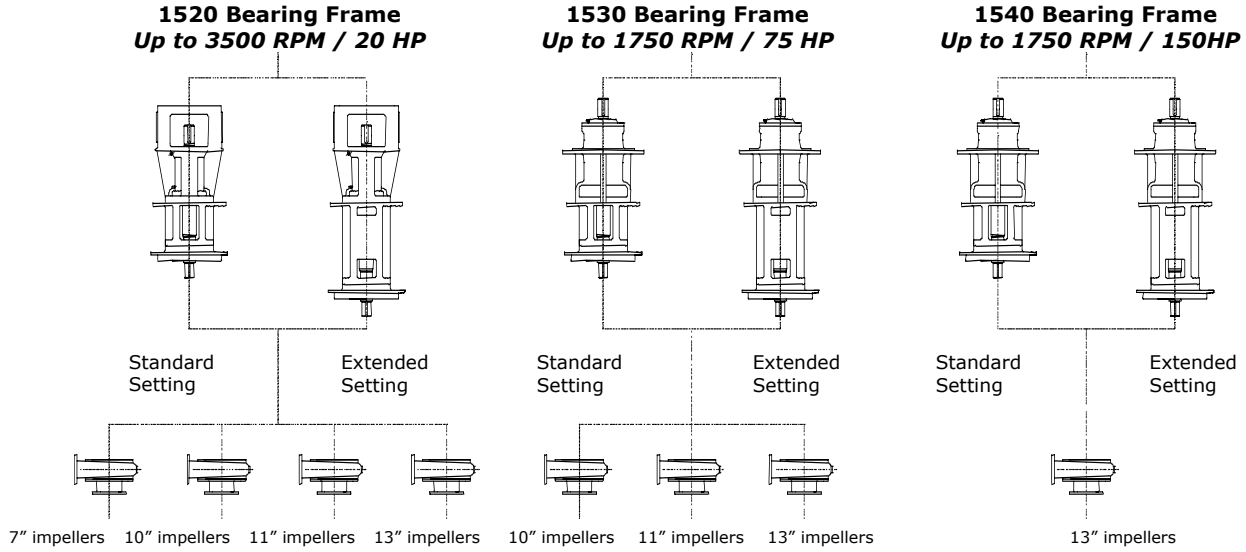


Fig. 3 Oil Lubricated

Bronze (standard) or carbon (optional) bearings, sealed at both ends, oil pumped down from external source (by others)

1.11 GV Series Bearing Frame Designations

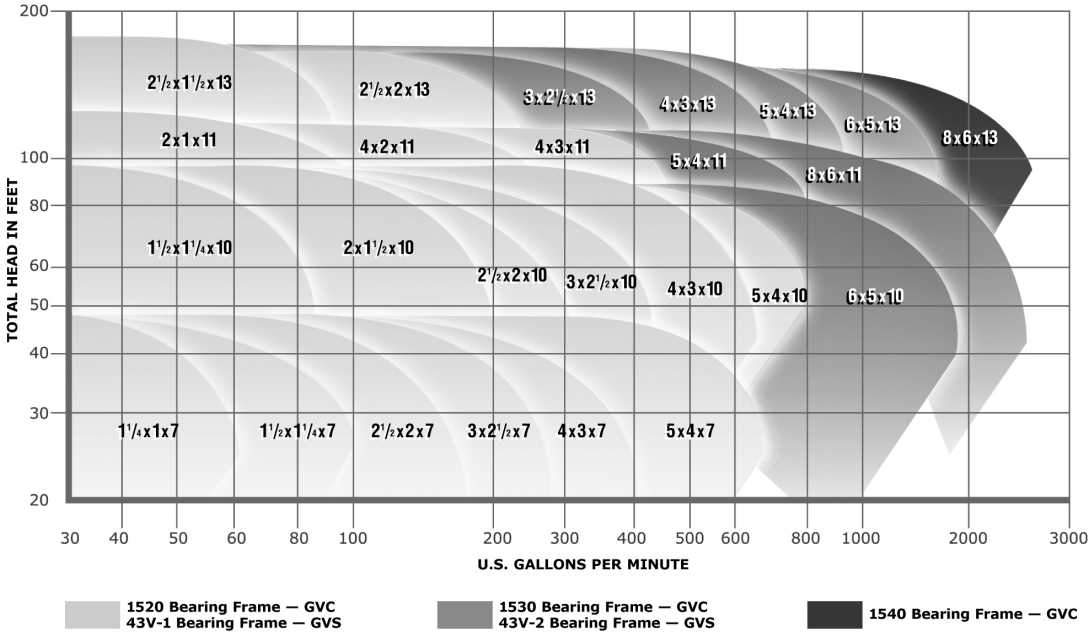
The standard GV bearing frames can be seen in the chart above. The ***standard*** GVC setting is 12 inches long, giving a 12 inch drop between the bottom of the mounting plate and back of the pump casing while the ***extended*** column setting has a 24 inch drop between the bottom of the mounting plate and back of the pump casing.



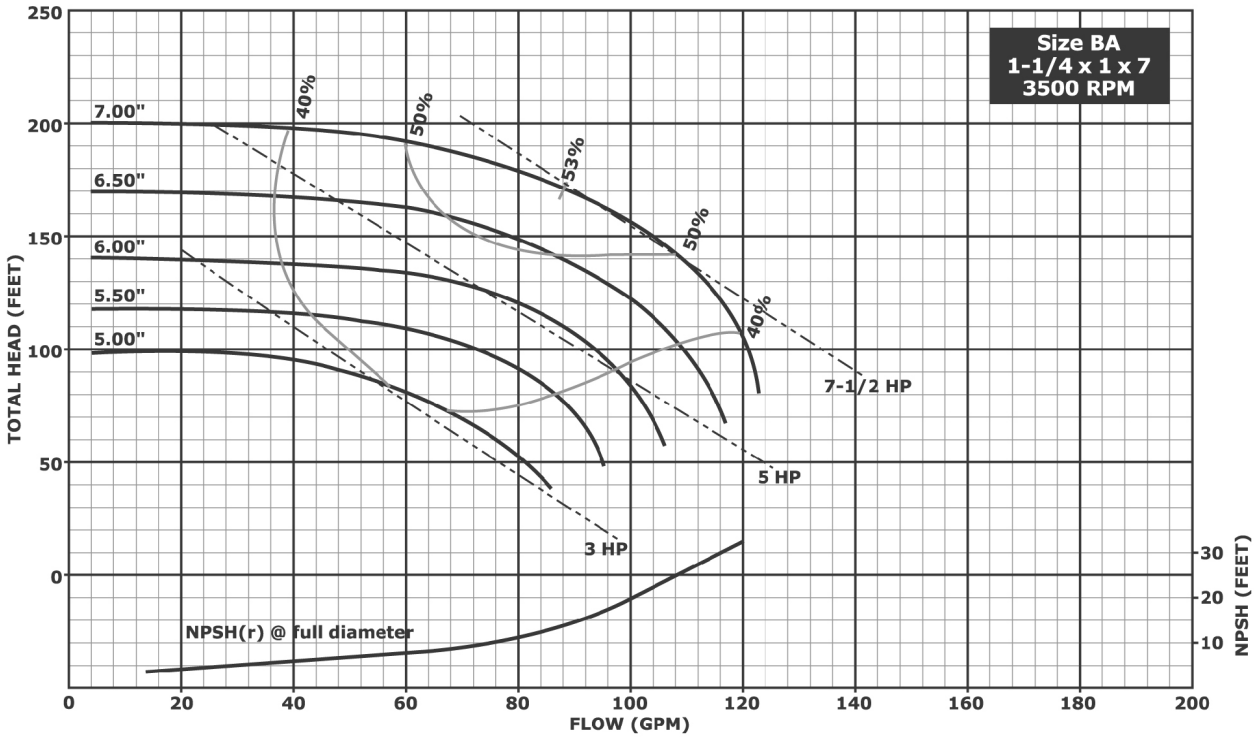
Note: 1530 and 1540 bearing frame motor brackets omitted for clarity.

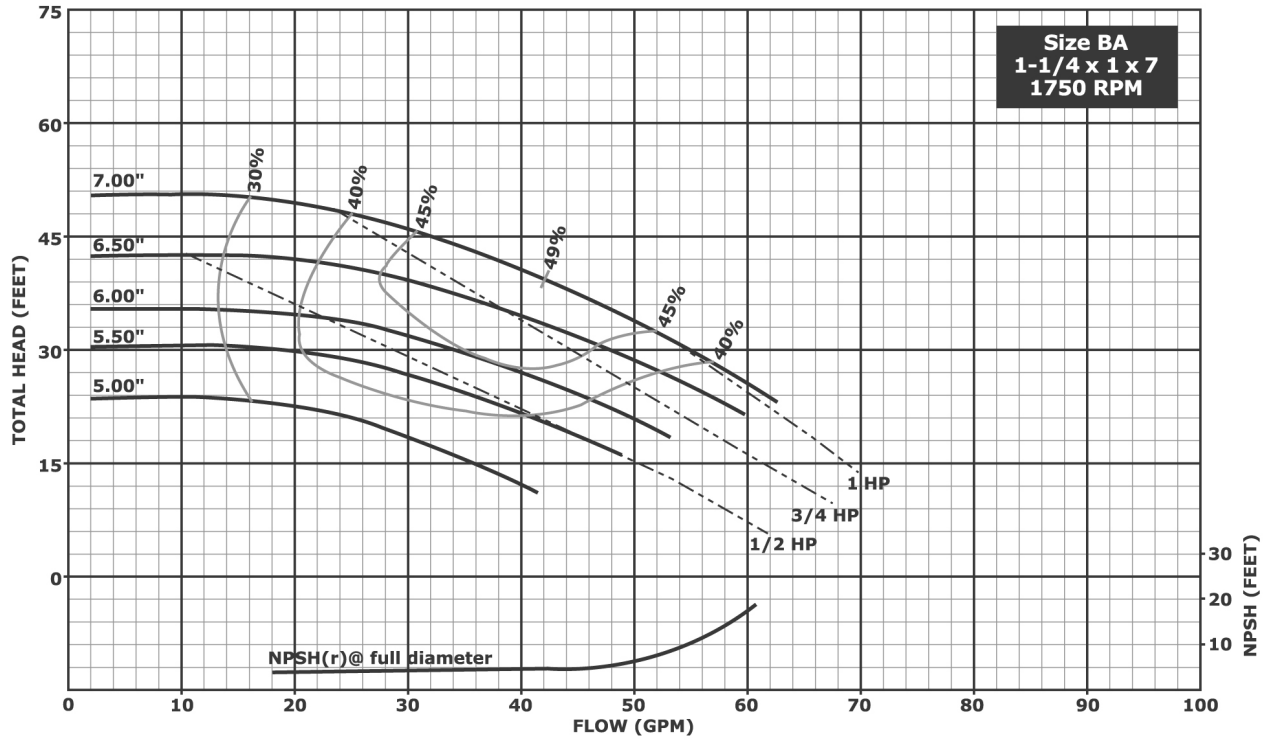
1.12 GV Series Hydraulic Coverage and Performance by Individual Size

GV hydraulic performance extends to flows of 2500 GPM at 1750 RPM with twenty five sizes in cast iron, 316 SS fitted cast iron, or all 316 stainless steel. Pumps with 7" and 10" impellers and discharge connections 2" and smaller are provided with NPT connections. All others have ANSI flange connections. Replaceable 17-4 PH front and rear wear rings are standard with all stainless units with enclosed impellers (i.e., 11" diameter and above) as standard, except for the sizes 2 x 1 x 11 and 2½ x 1½ x 13, which have front wear rings only.



Hydraulic Performance - 7 Inch Impellers

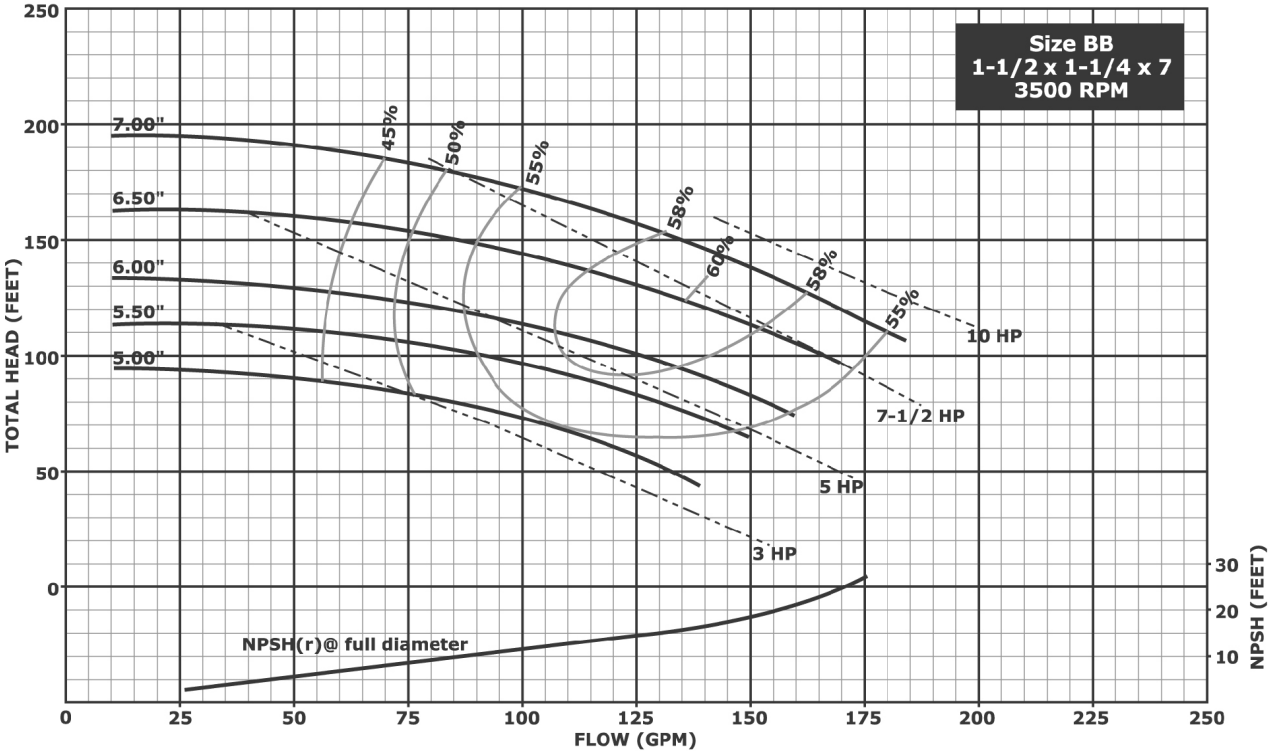


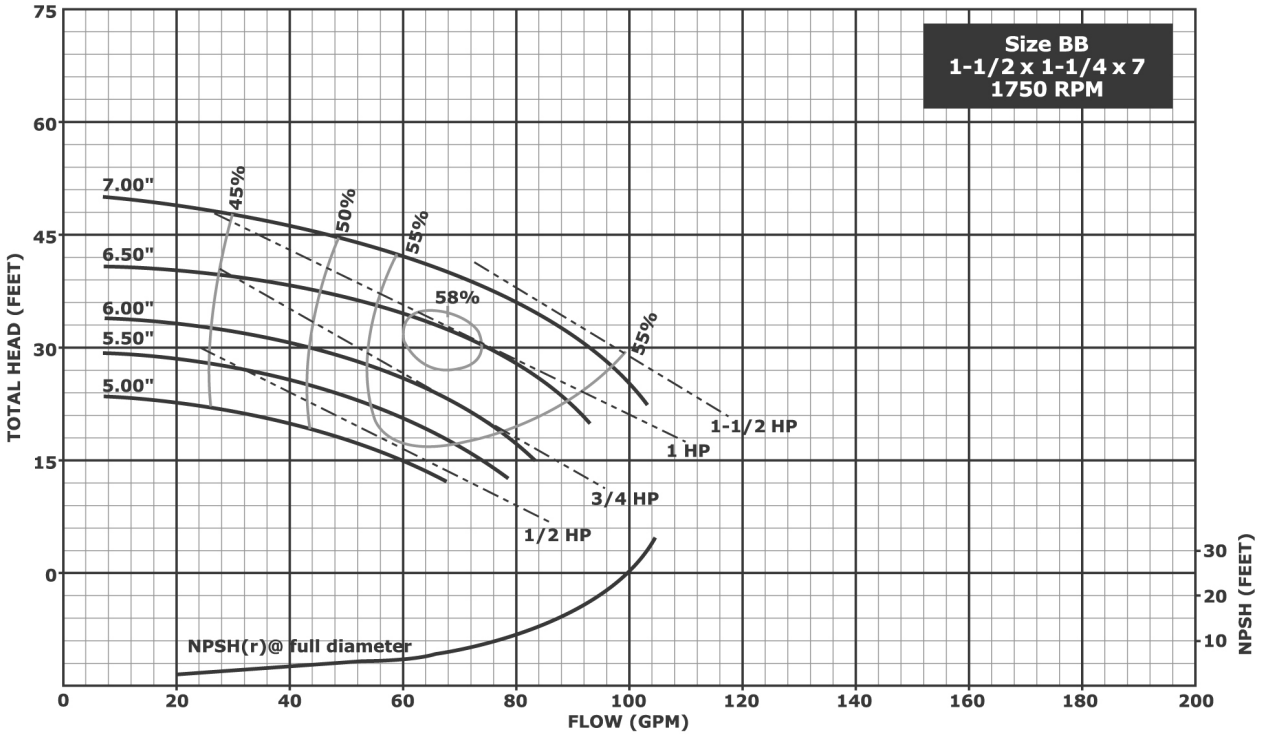


Notes:

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.
3. For special GVS requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 7 Inch Impellers





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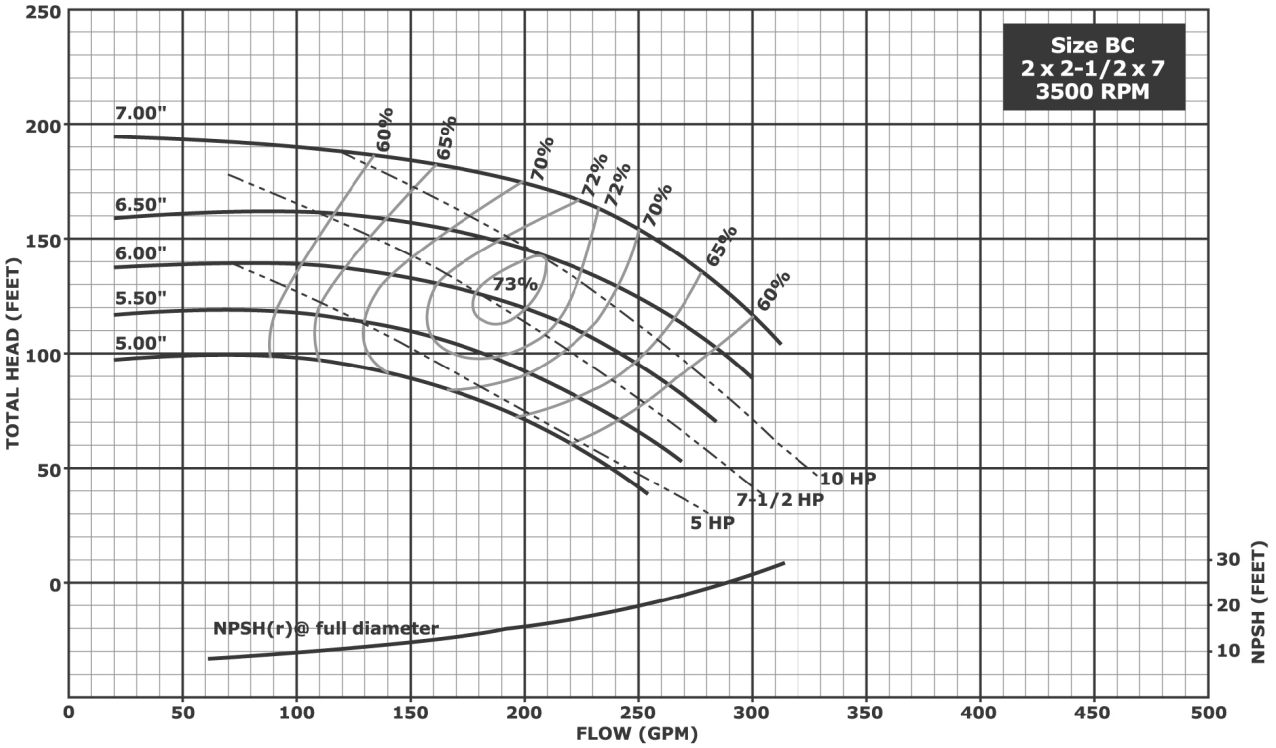
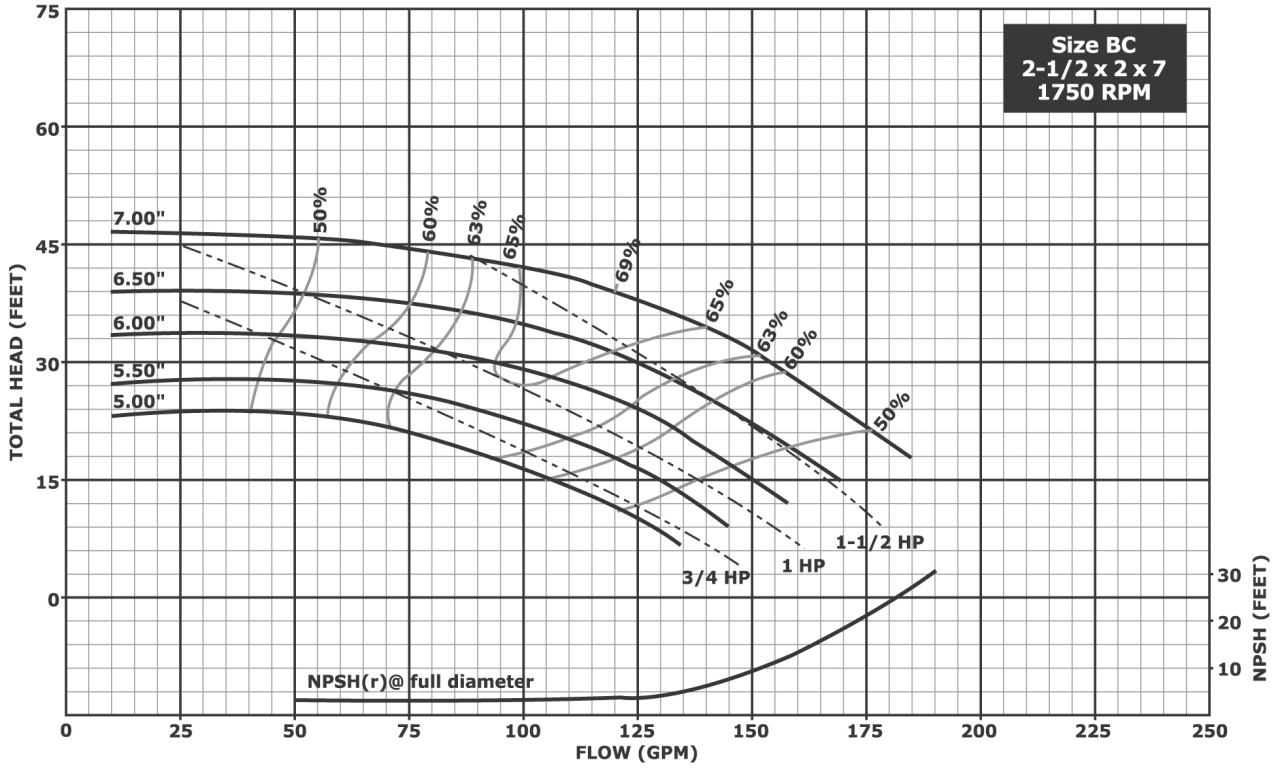
Hydraulic Performance - 7 Inch Impellers





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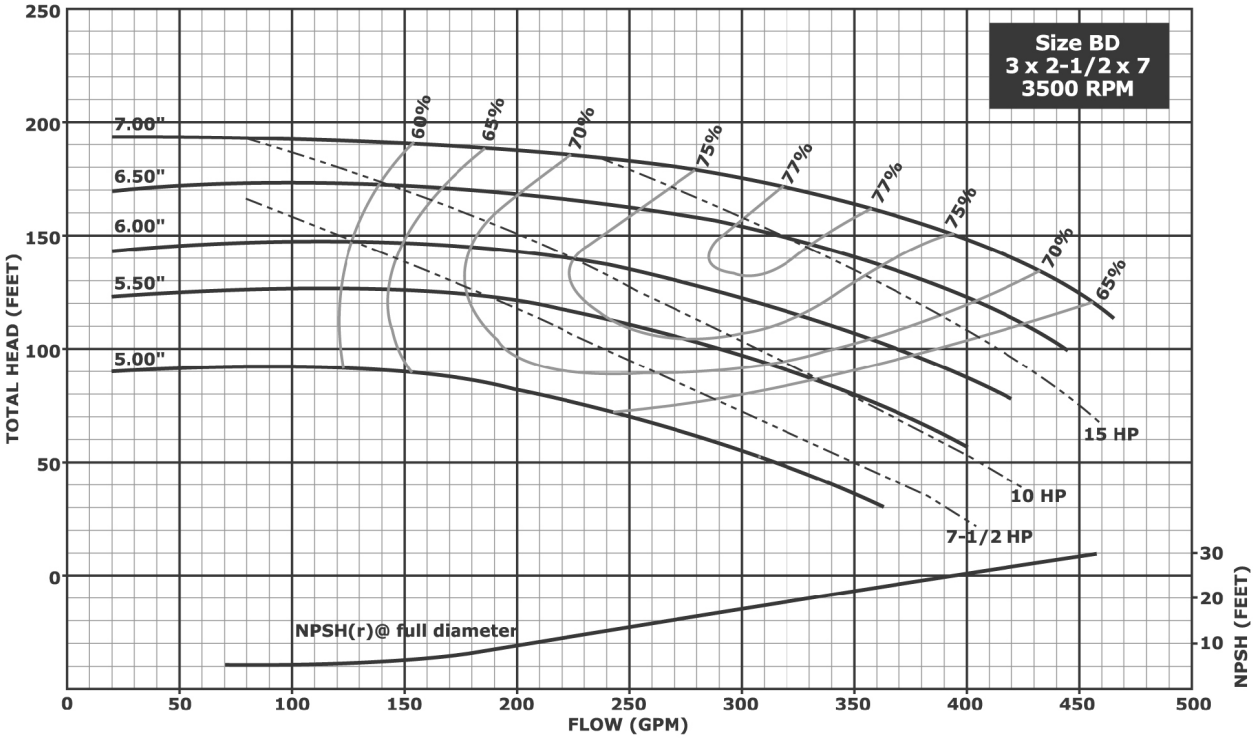
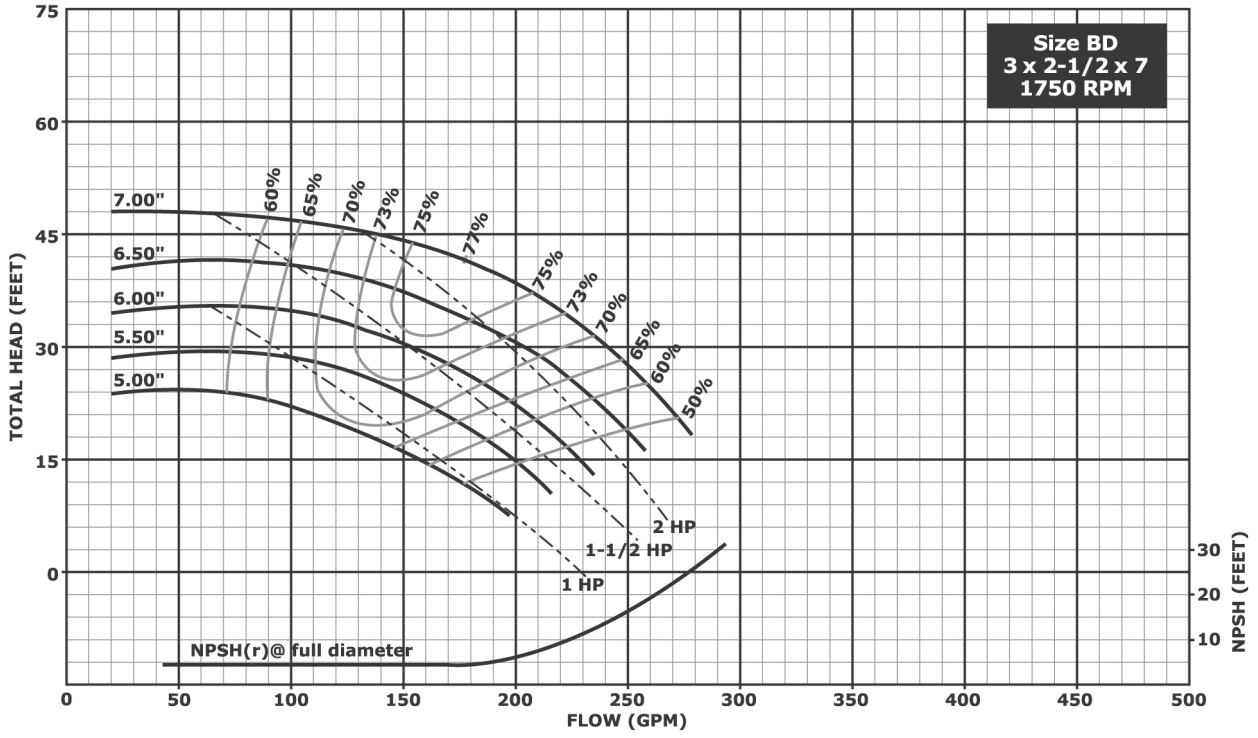
1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.
3. For special GVS requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 7 Inch Impellers

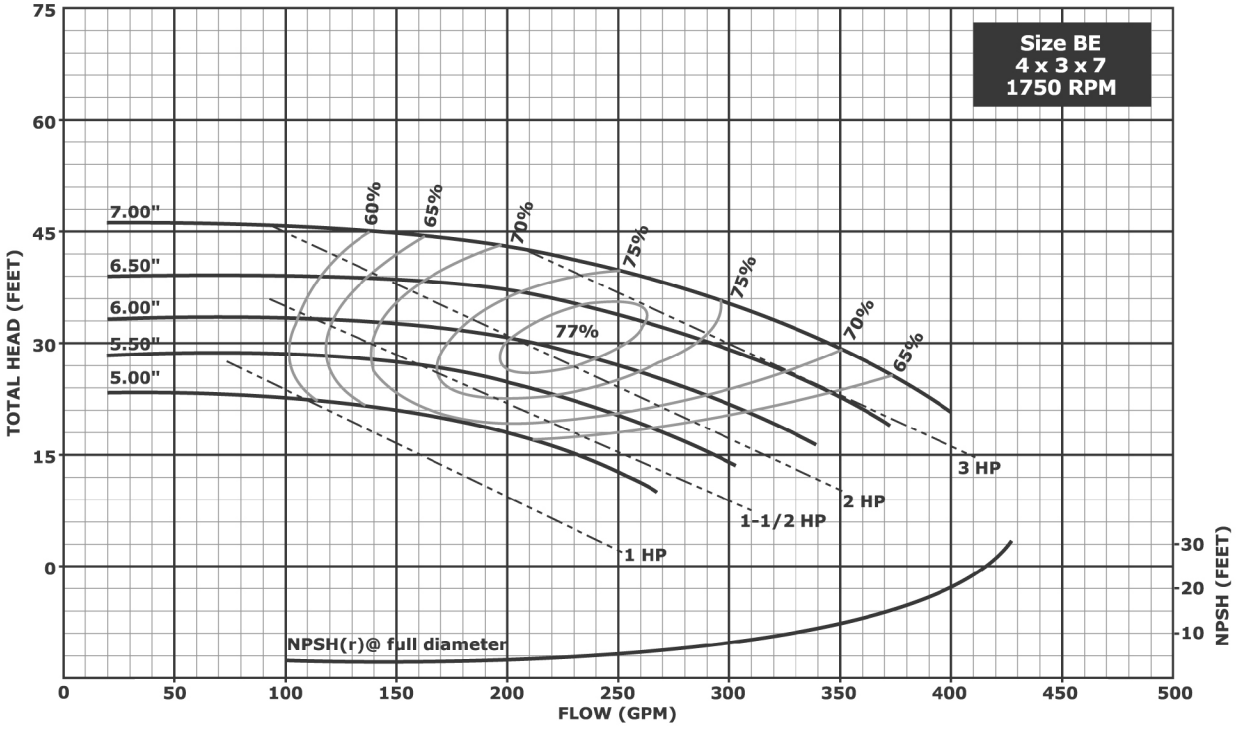


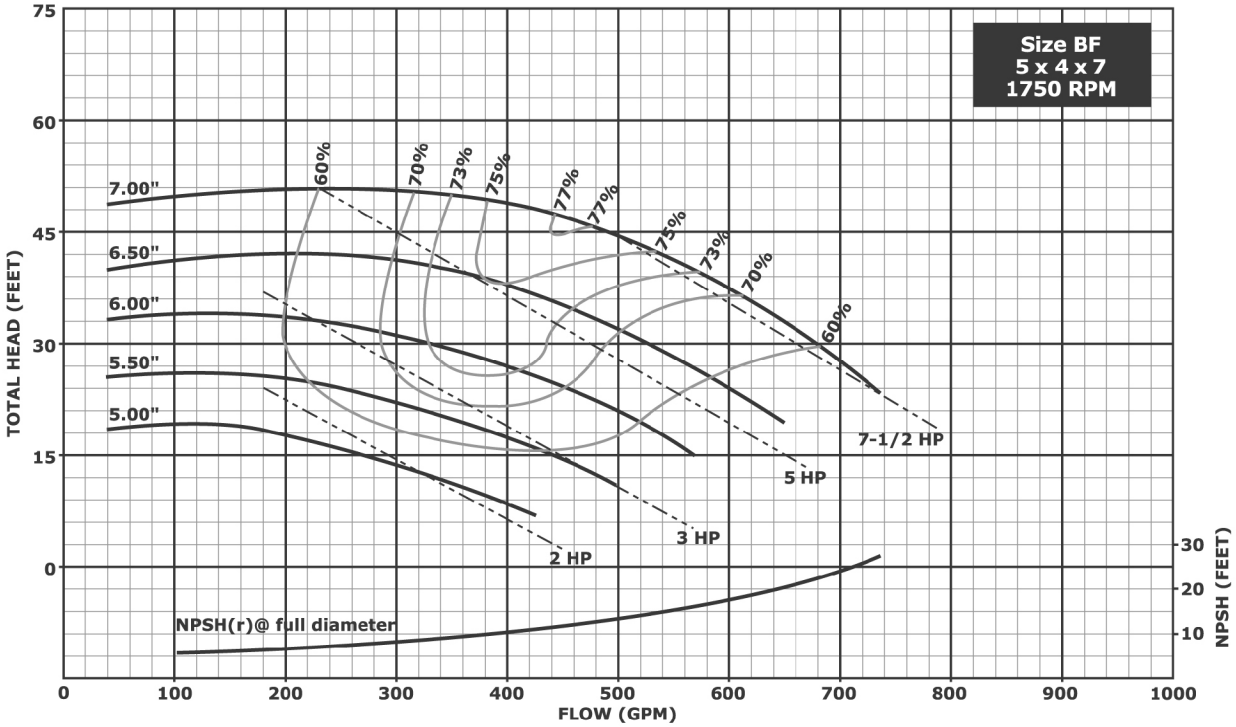


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 7 Inch Impellers

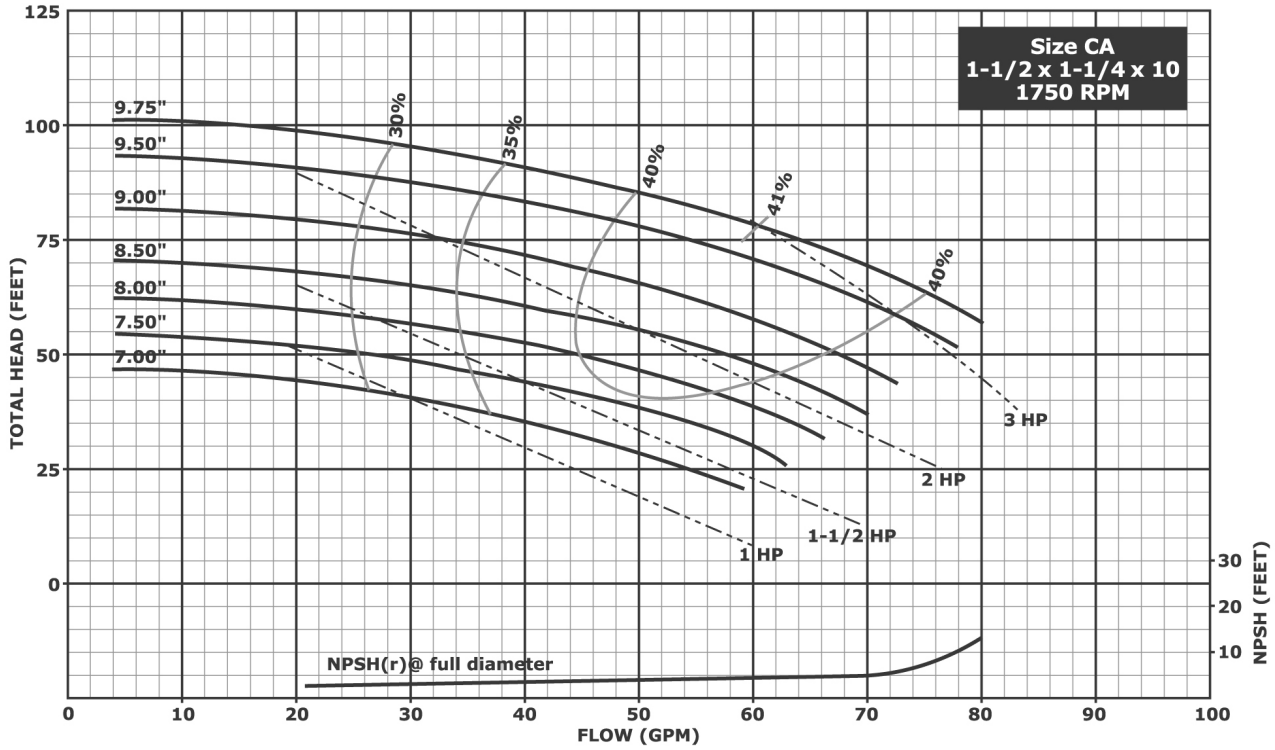


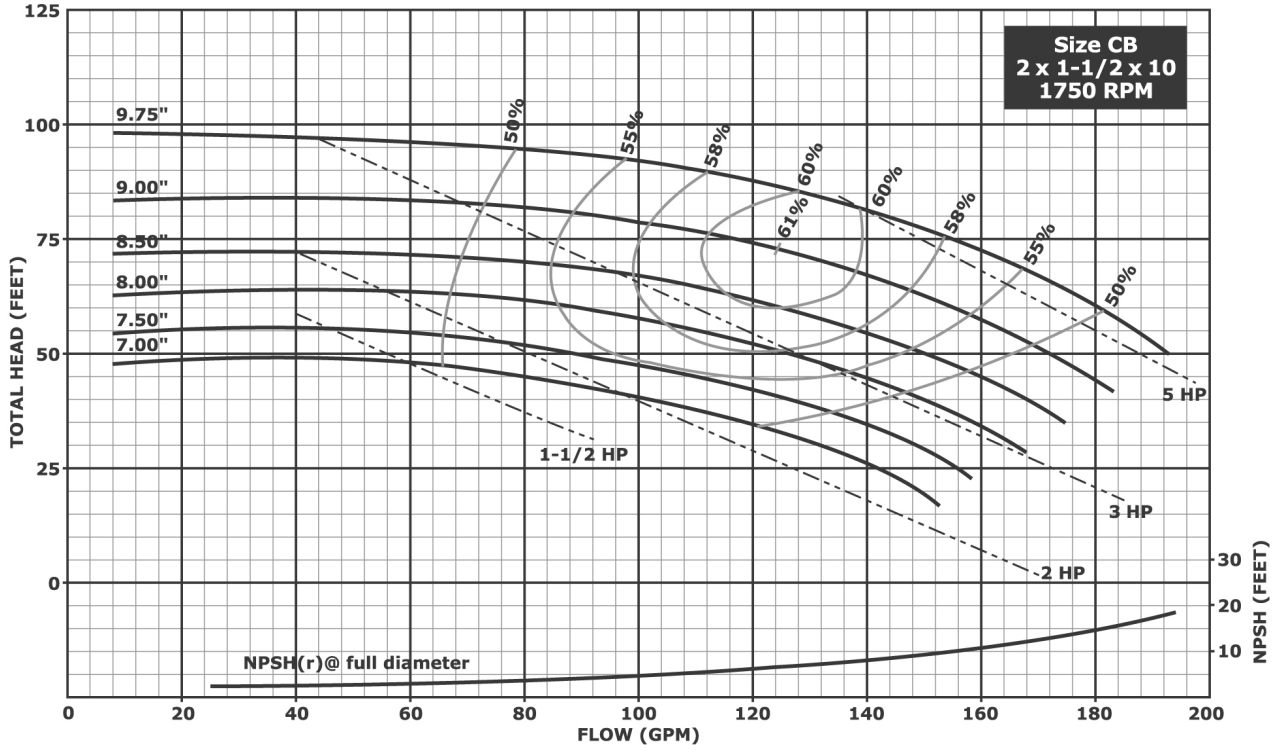


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 10 Inch Impellers

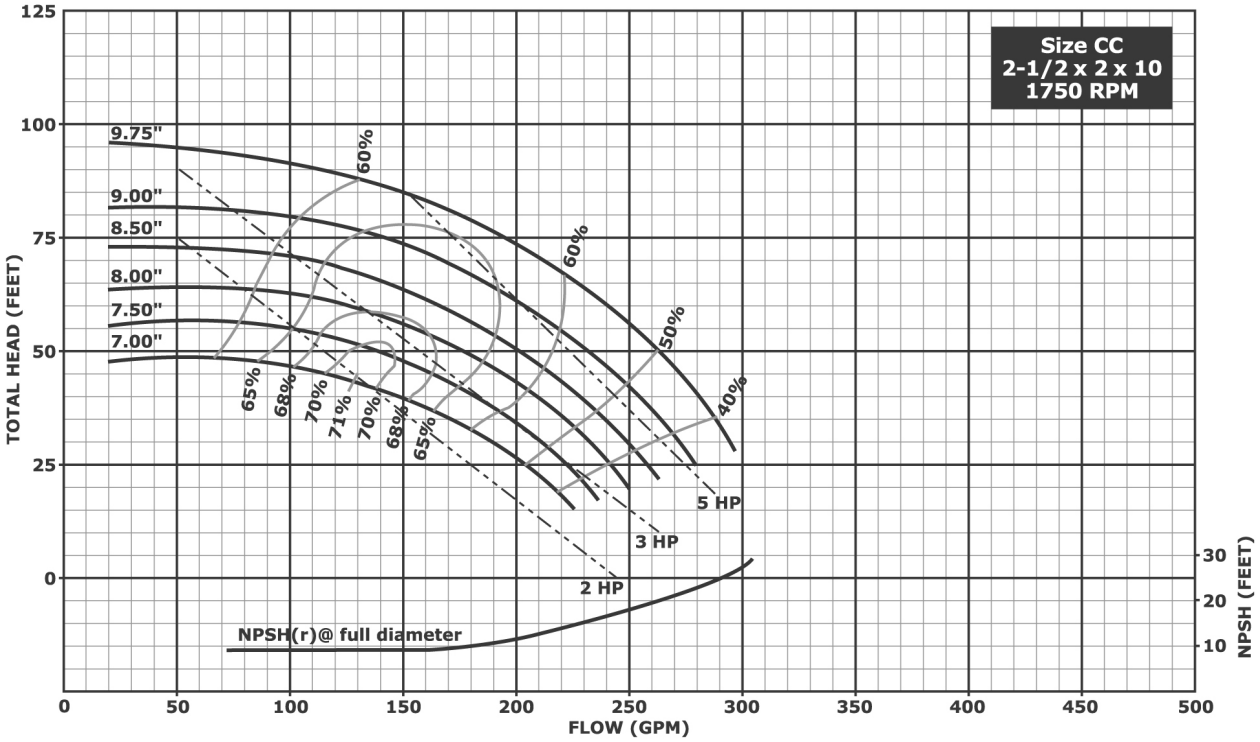


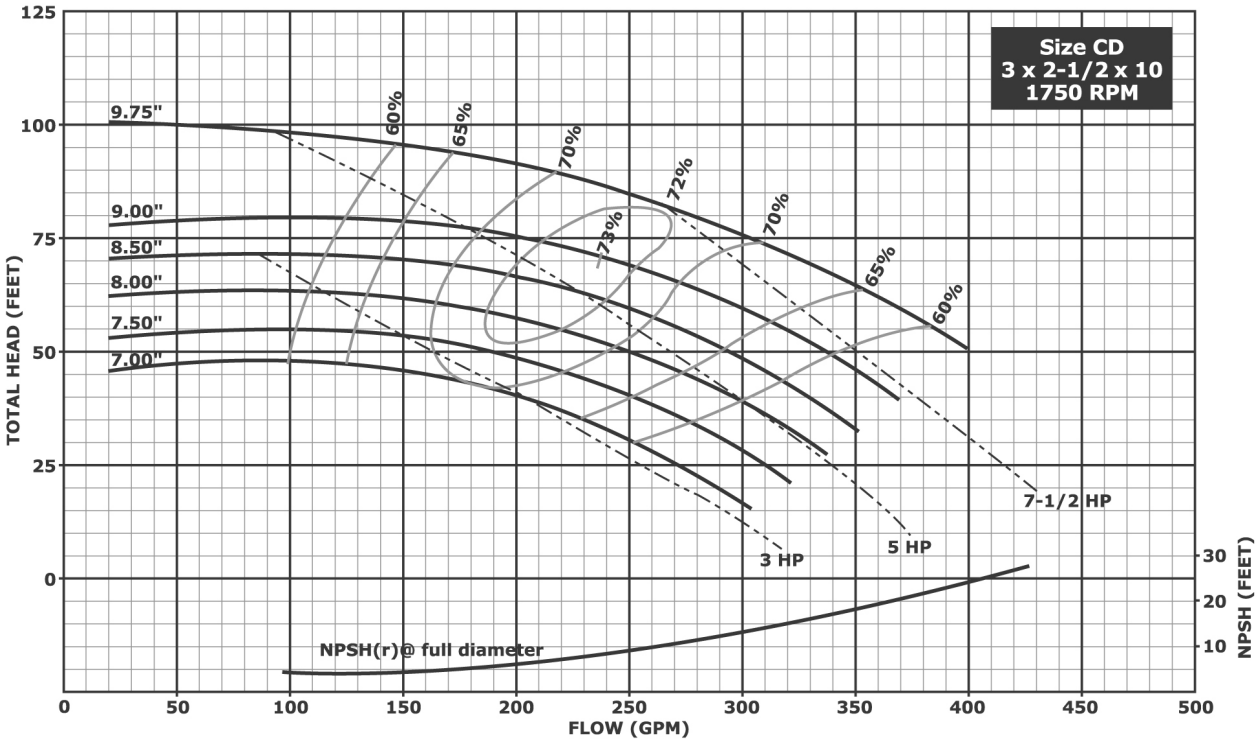


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 10 Inch Impellers

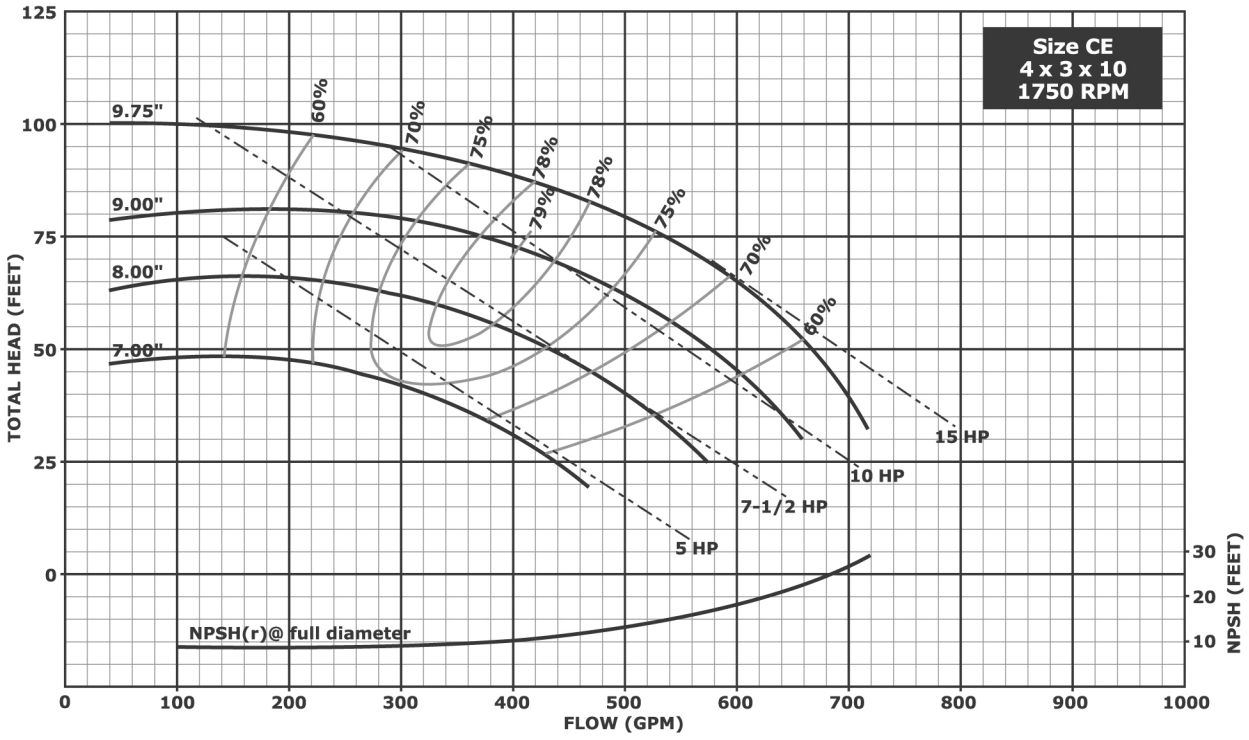


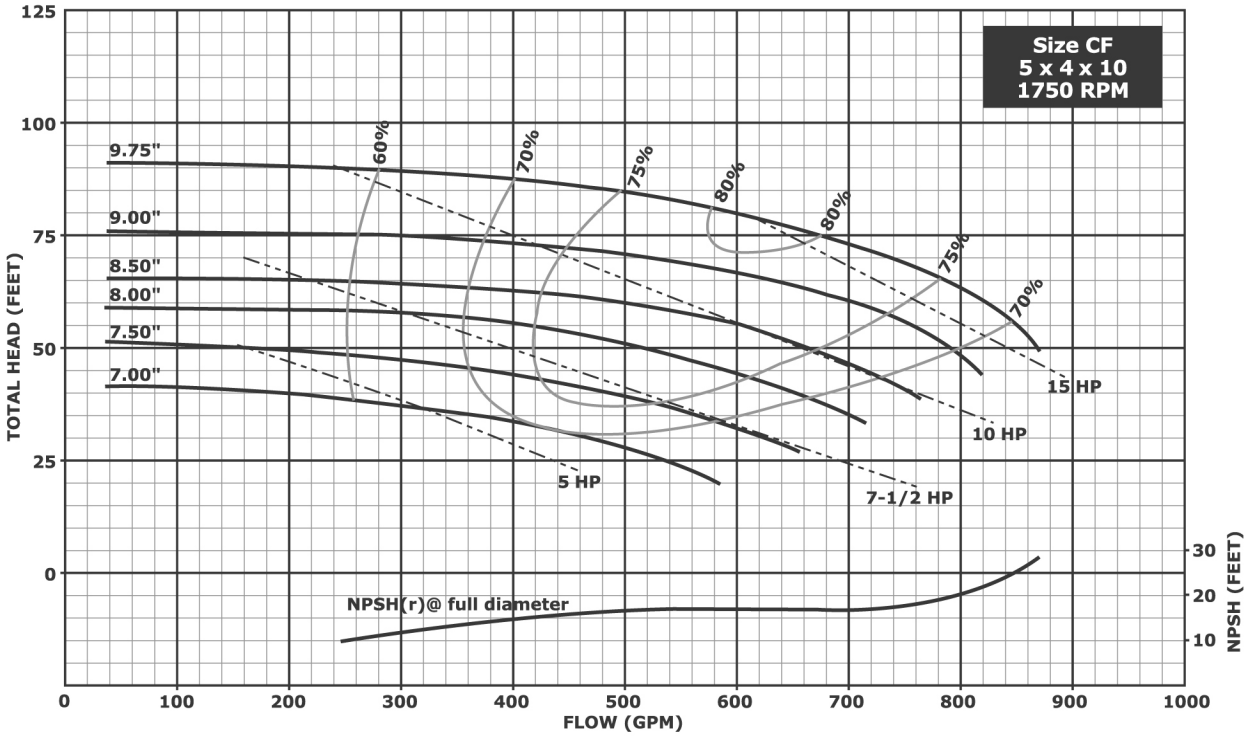


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 10 Inch Impellers

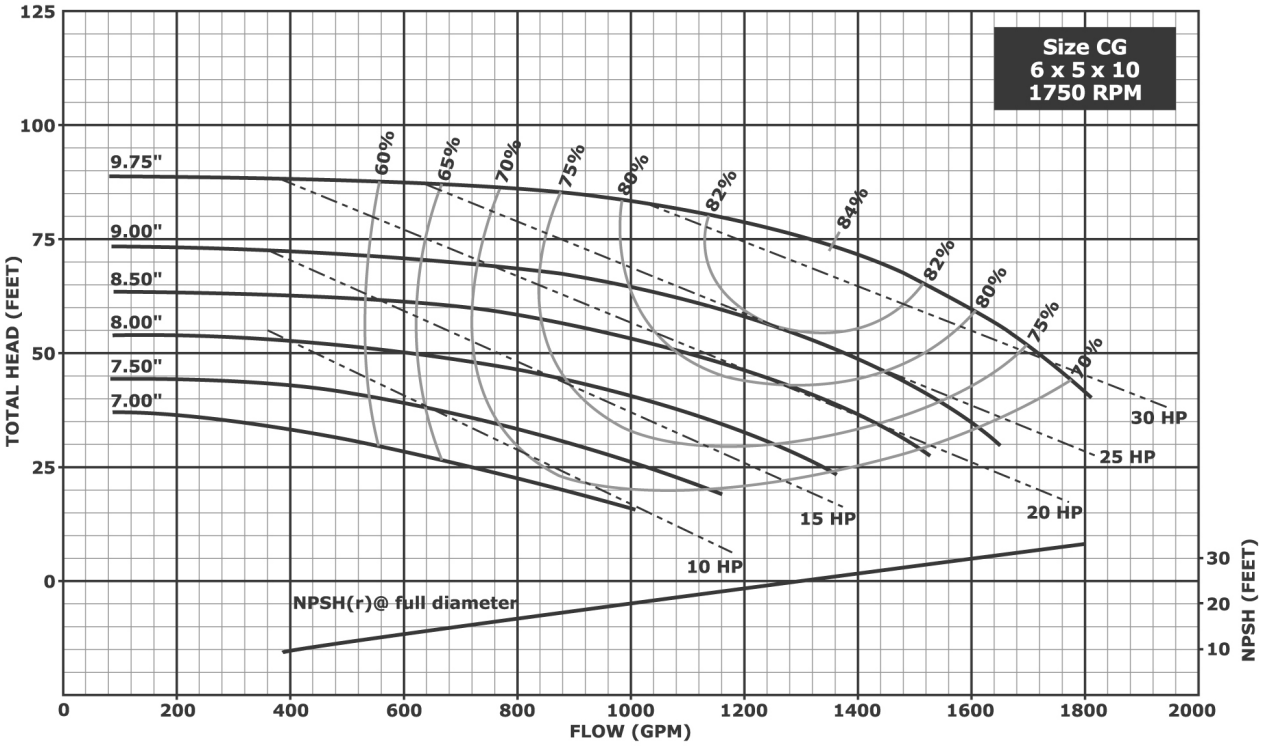


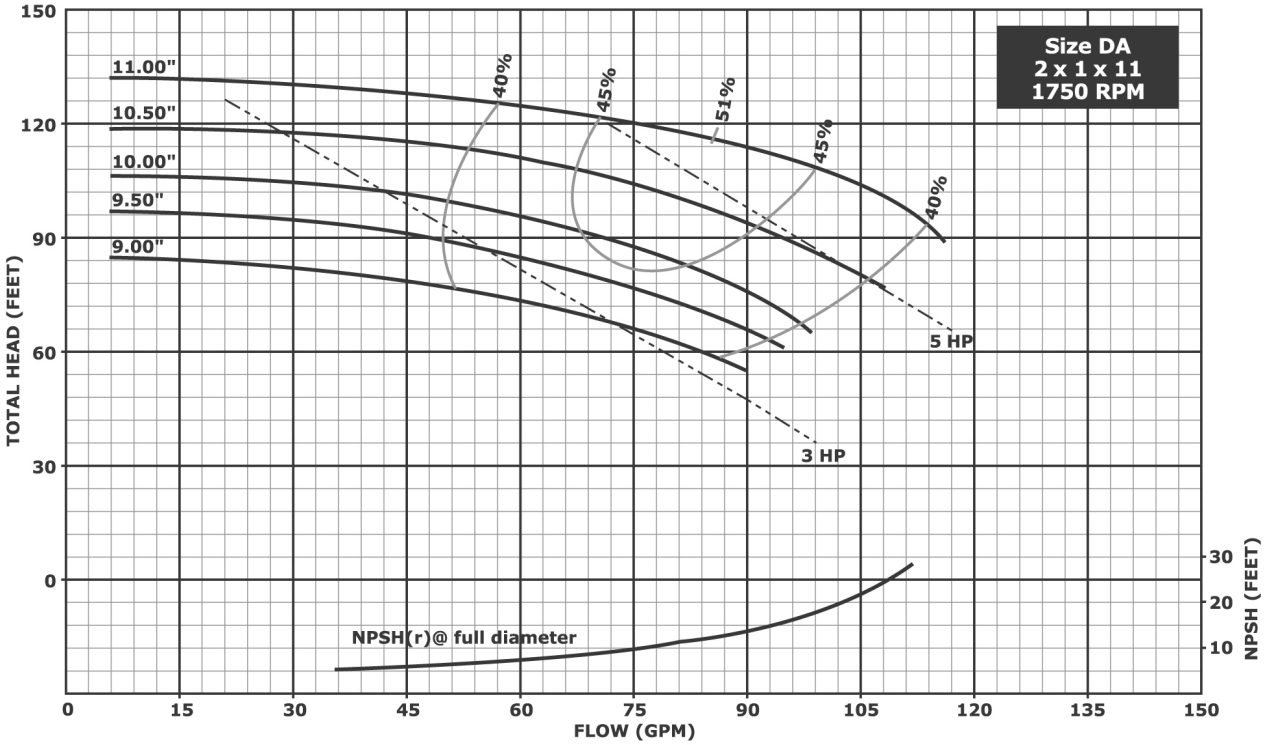


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 10 and 11 Inch Impellers

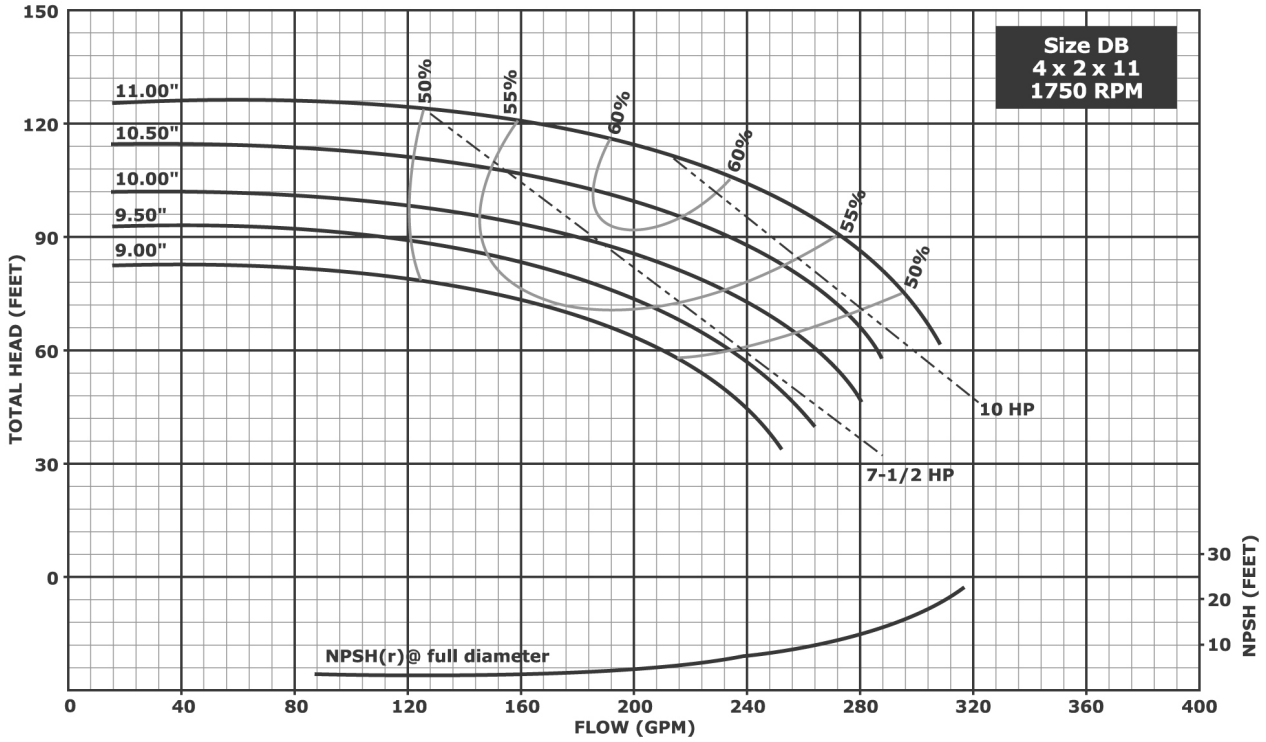


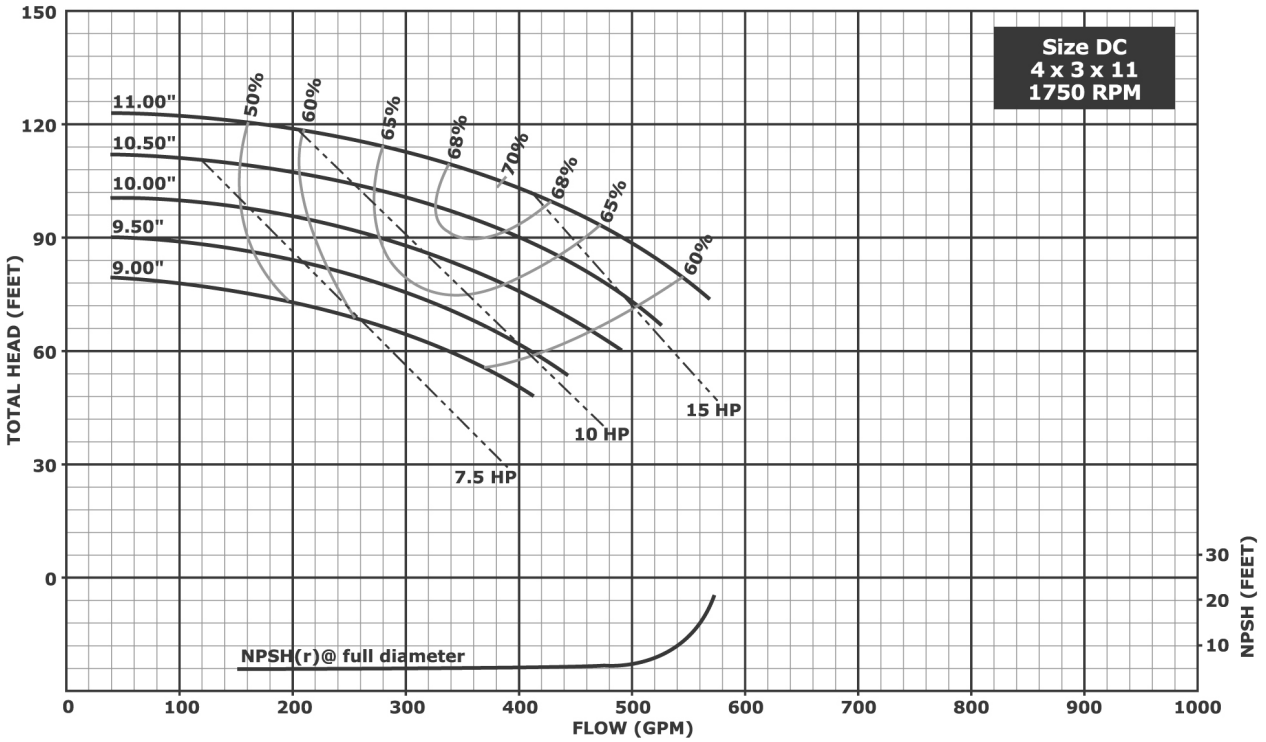


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 11 Inch Impellers

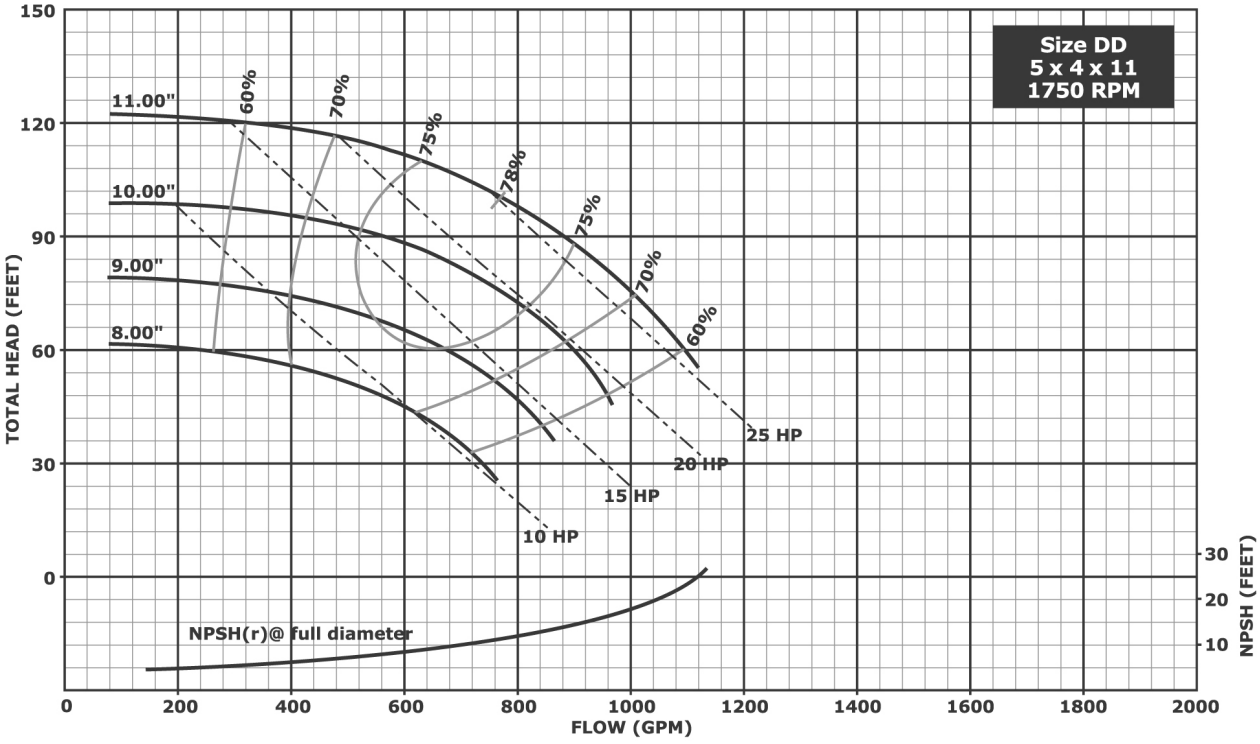


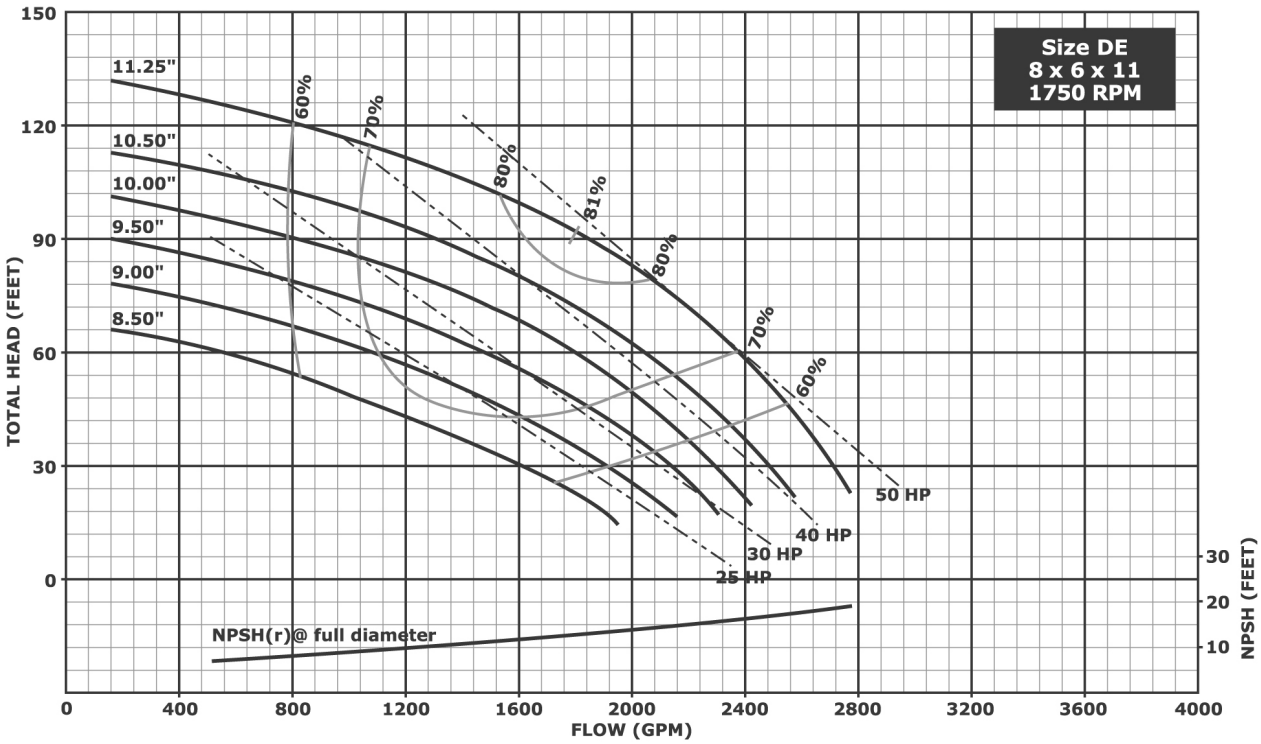


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 11 Inch Impellers

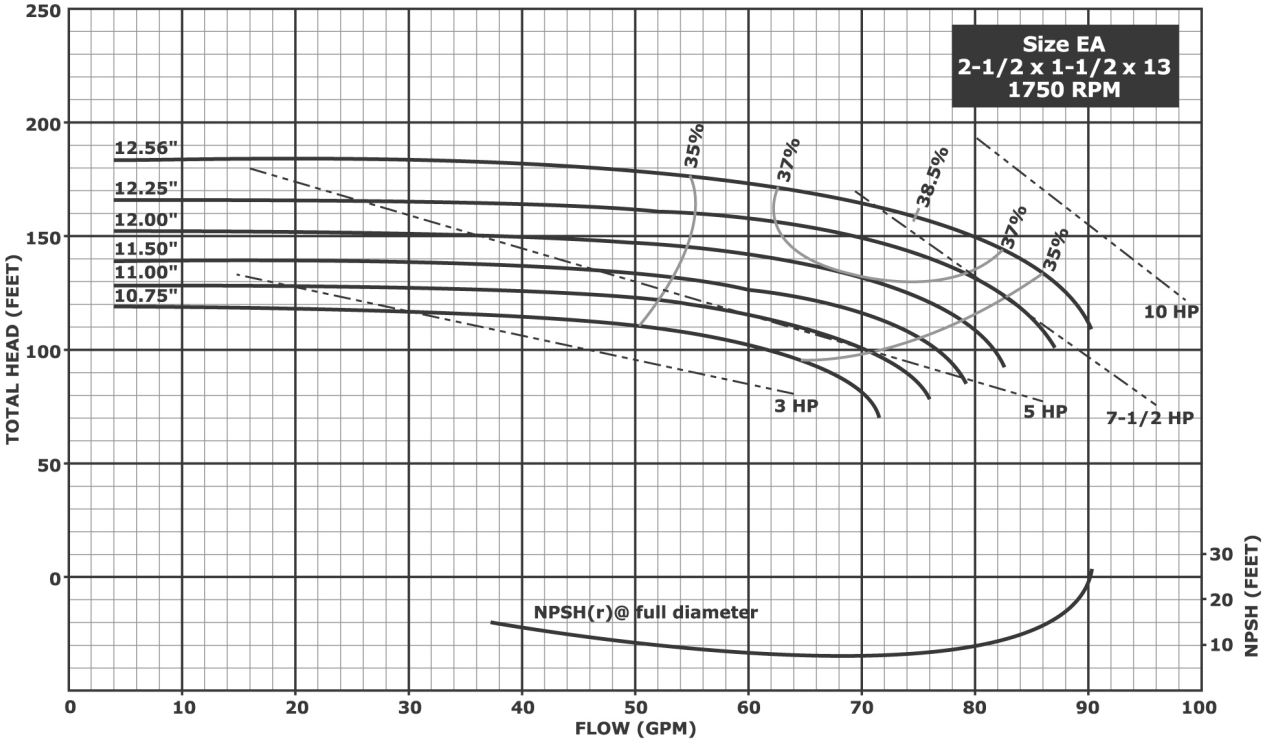


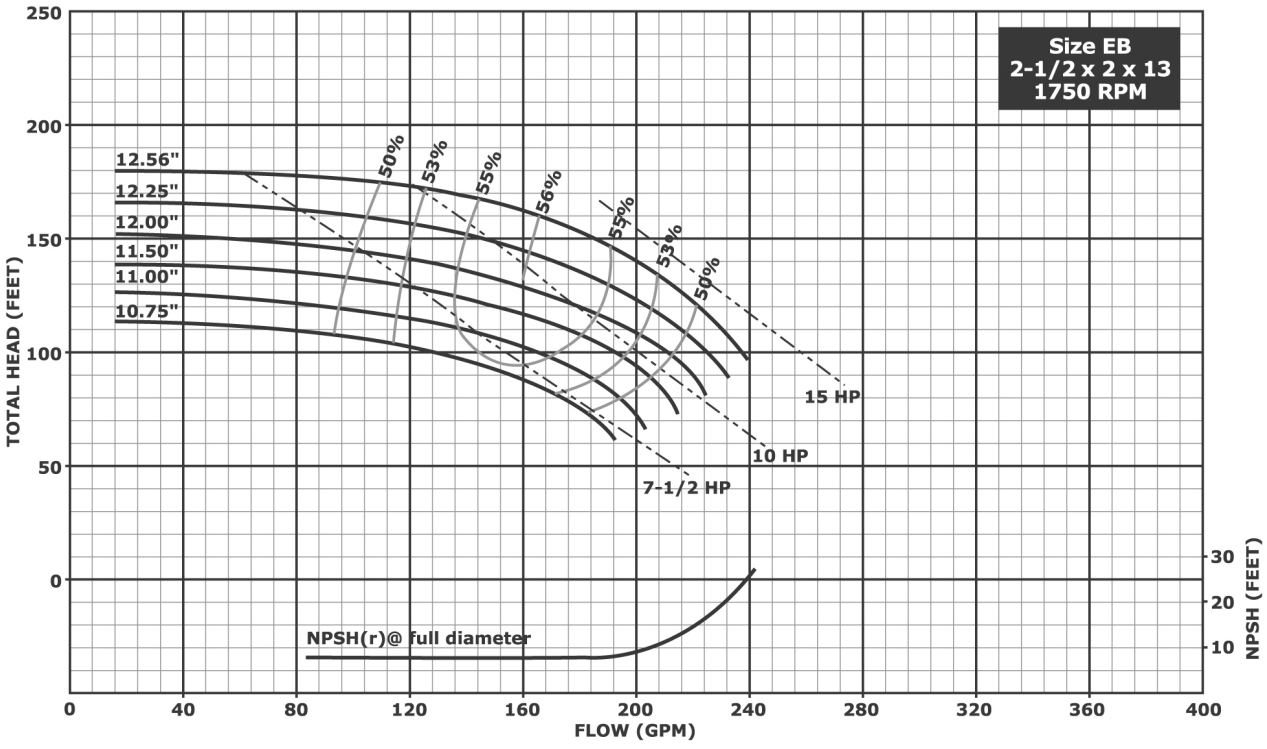


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 13 Inch Impellers @ 1750 RPM

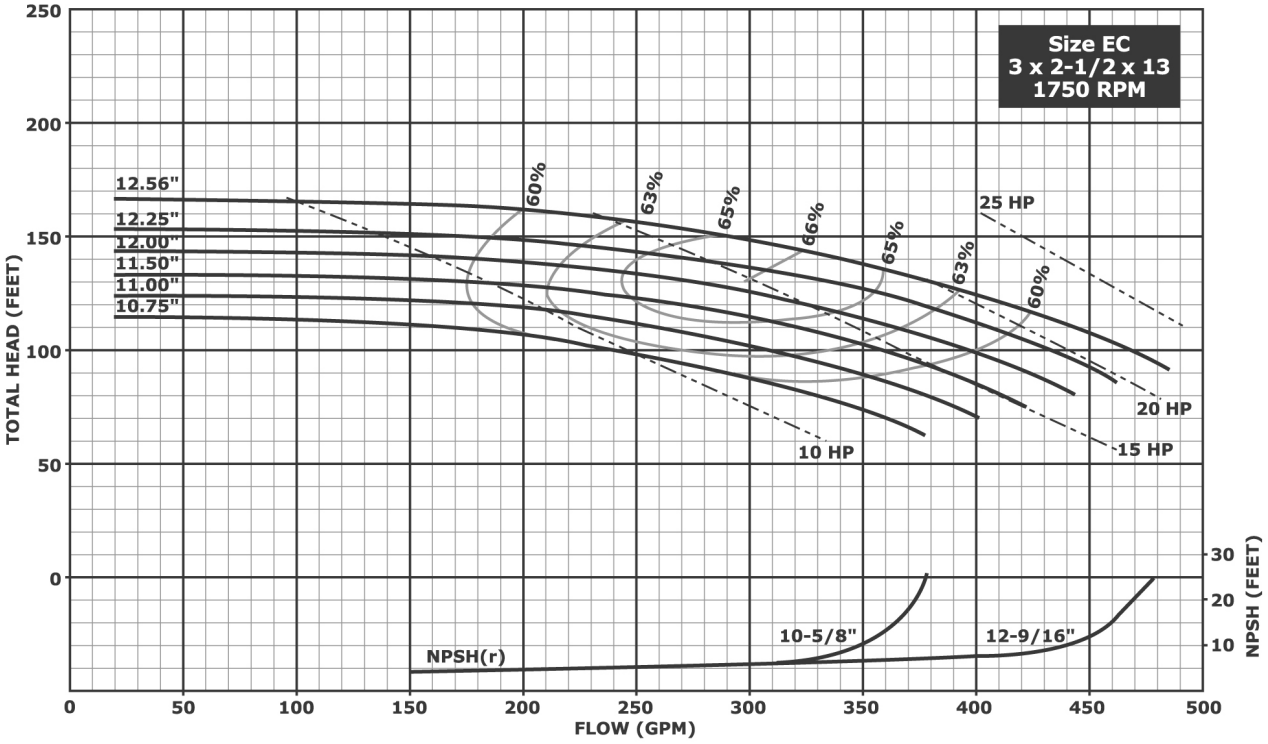


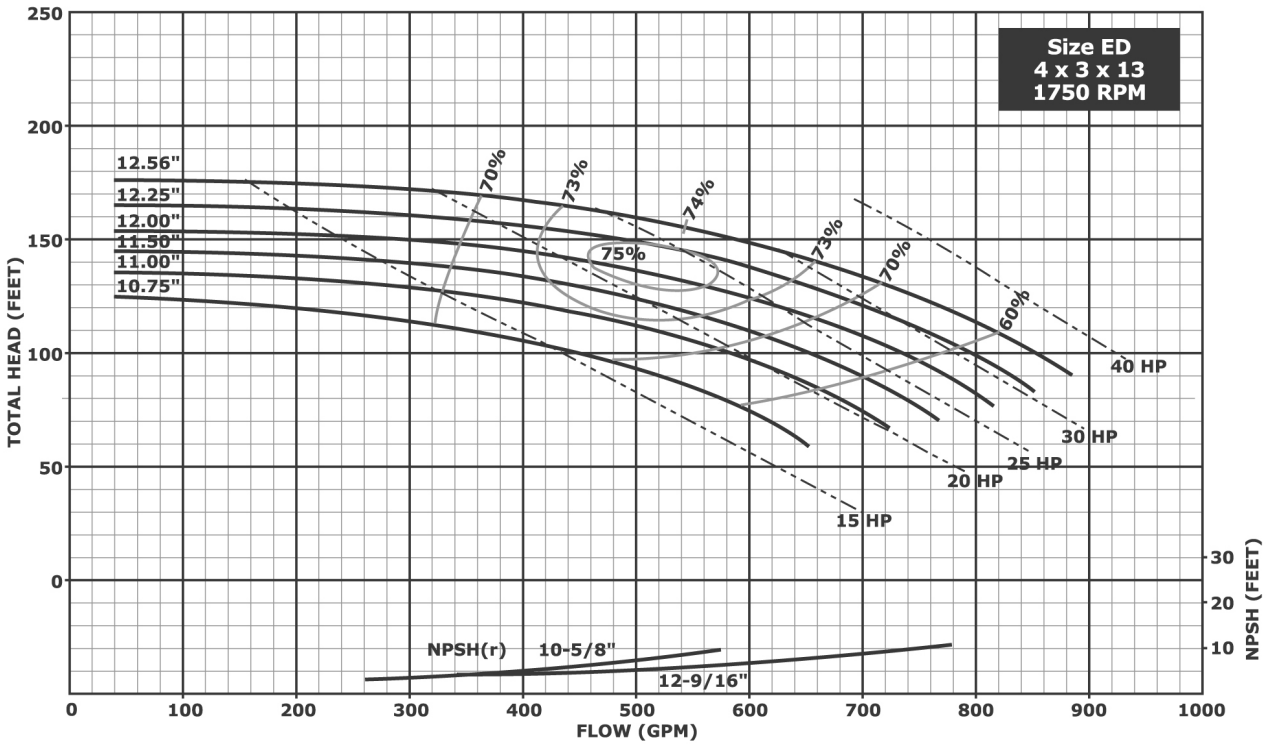


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 13 Inch Impellers

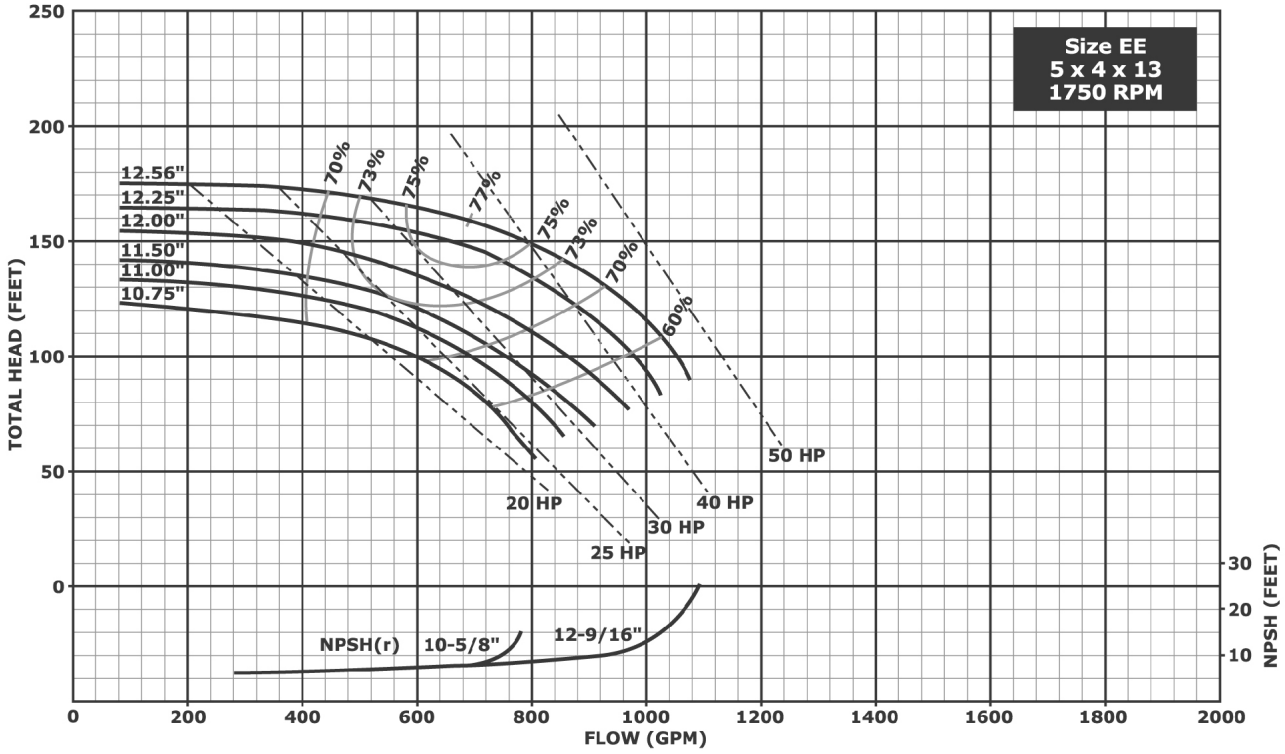


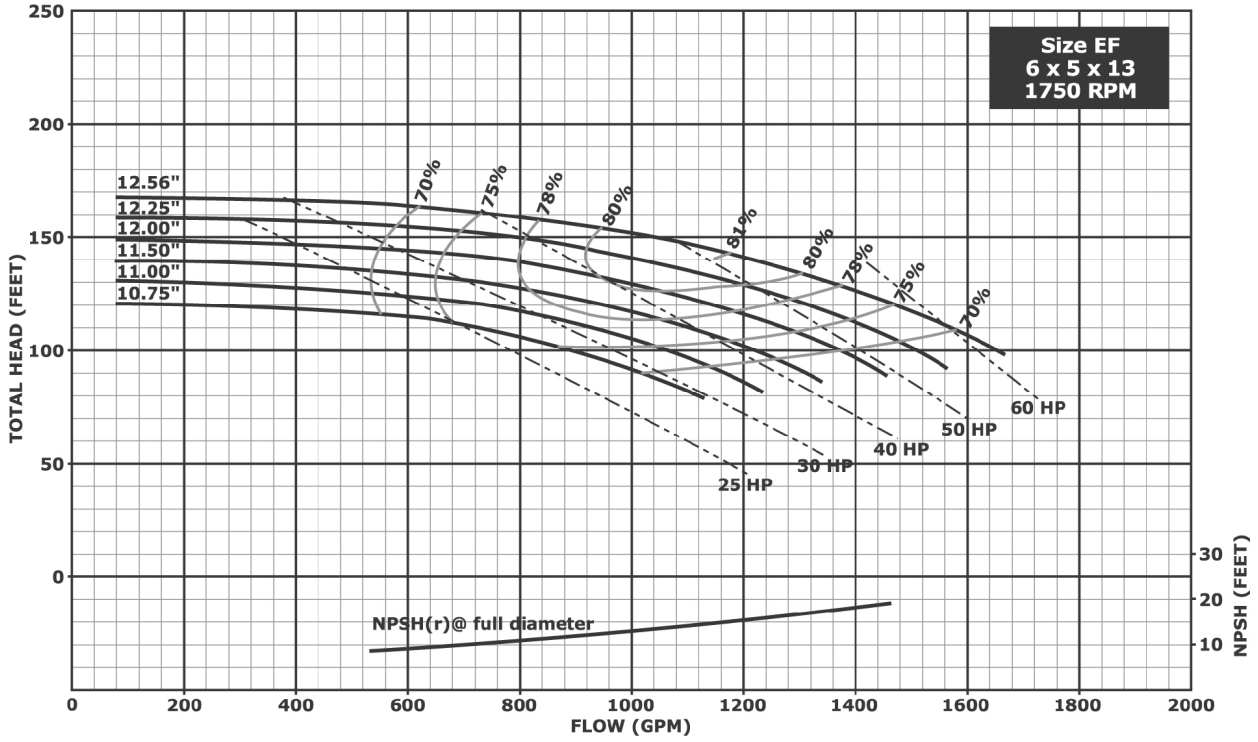


Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 13 Inch Impellers

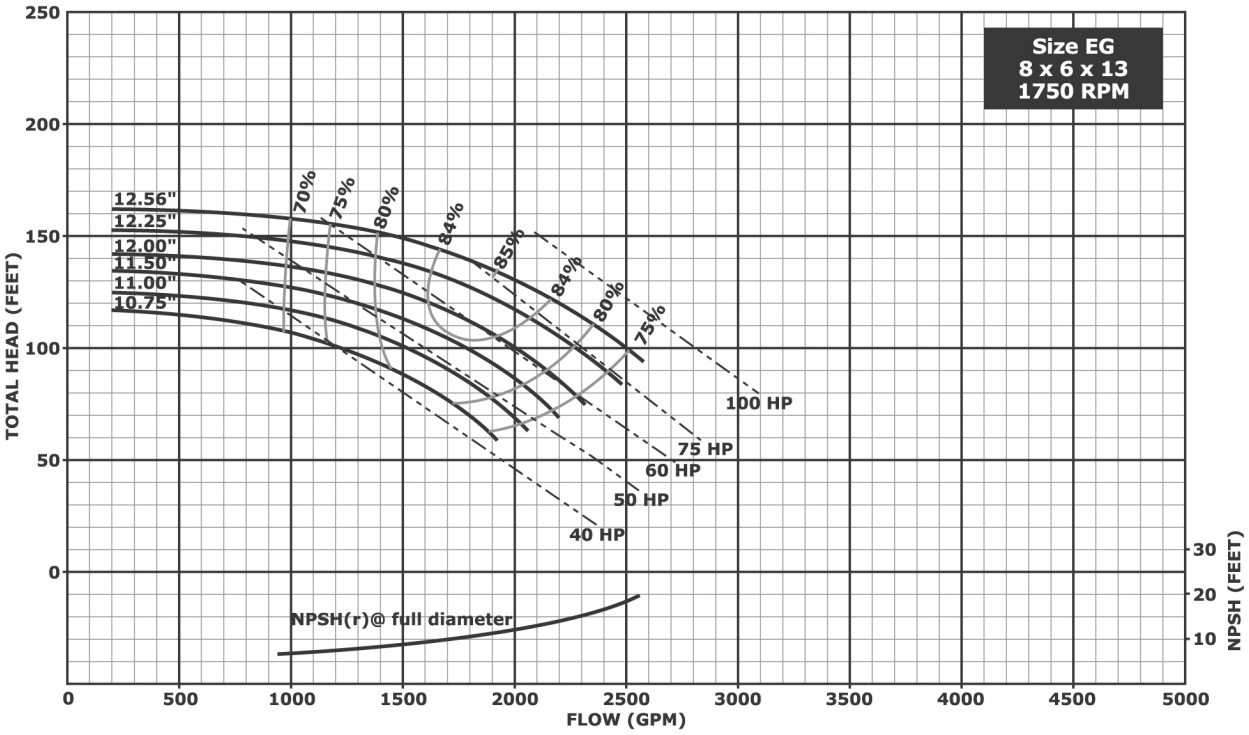




Notes:

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.
3. For special GVS power requirements at start up refer to Table 1.13, page 23.

Hydraulic Performance - 13 Inch Impellers



Notes:

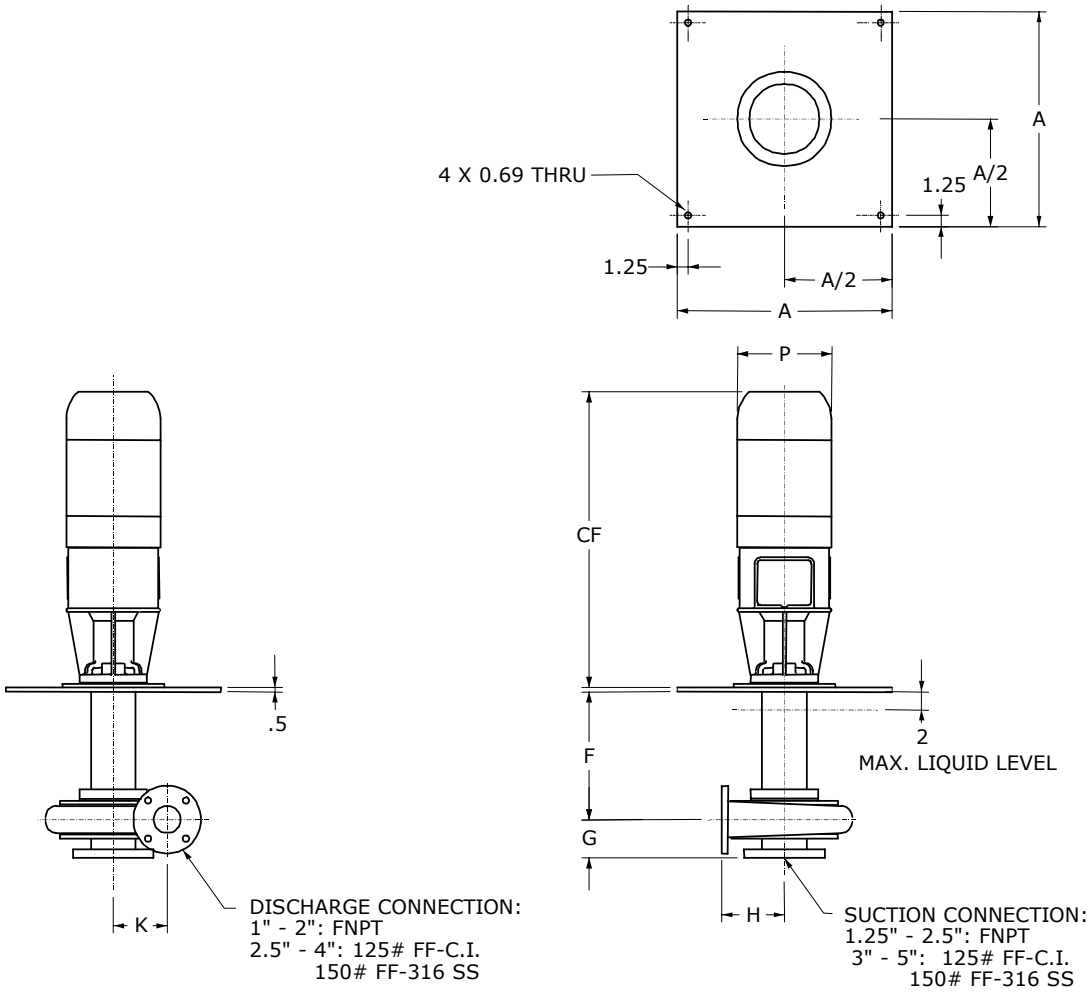
1. Above data is based on 1.0 sp. gr. water at ambient temperature and pressure in accordance with Hydraulic Institute guidelines.
2. Impeller diameters between minimum and maximum shown are available in 1/8 inch increment trims.
3. For special GVS power requirements refer to Table 1.13 below.

1.13 Special Power Considerations for the GVS

To allow for lineshaft bearing friction losses sometimes encountered in start up (i.e., potentially dry run) situations, we recommend the following power requirements be added to those shown on the Hydraulic Performance curves.

GVS Dry Lineshaft Bearing Friction Losses	
Column Depth	Added Dry Start Up Losses
4 to 10 ft.	0.50 BHP
10 to 16 ft.	0.75 BHP
16 to 20 ft.	1.00 BHP
over 20 ft.	1.25 BHP

GVC - 7" and 10" Impeller Sizes (Without Discharge Piping)



Pump Size	Pump Dimensions						
	A	F		G	H	K	Bearing Frame
		Standard	Extended				
1¼ x 1 x 7	18.0	14.8	26.8	2.7	4.3	3.8	1520
1½ x 1¼ x 7	18.0	14.4	26.4	2.8	4.5	4.0	
2½ x 2 x 7	18.0	14.3	26.3	3.7	5.0	4.1	
3 x 2½ x 7	24.0	14.3	26.3	4.0	5.8	4.3	
4 x 3 x 7	24.0	14.5	26.5	4.8	6.0	4.5	
5 x 4 x 7	24.0	14.4	26.4	5.0	7.5	4.8	
1½ x 1¼ x 10	18.0	14.2	26.2	3.3	6.0	5.3	1520
2 x 1½ x 10	18.0	14.3	26.3	3.5	6.0	5.4	
2½ x 2 x 10	18.0	14.4	26.4	4.3	6.3	5.5	
3 x 2½ x 10	24.0	14.4	26.4	4.7	7.0	5.8	
4 x 3 x 10	24.0	14.4	26.3	4.6	7.0	6.0	
5 x 4 x 10	24.0	14.4	26.4	4.7	8.5	6.5	
6 x 5 x 10	30.0	15.9	27.9	5.8	8.4	7.6	1530

Motor Dimensions		
NEMA Motor Frame	CF	P
143 TC	27.0	7.4
145 TC	28.0	7.4
182 TC	28.5	9.5
184 TC	29.5	9.5
213 TC	31.0	11.0
215 TC	32.0	11.0
254 TC	34.0	13.0
256 TC	35.0	13.0
284 TC	41.0	15.0
286 TC	43.0	15.0

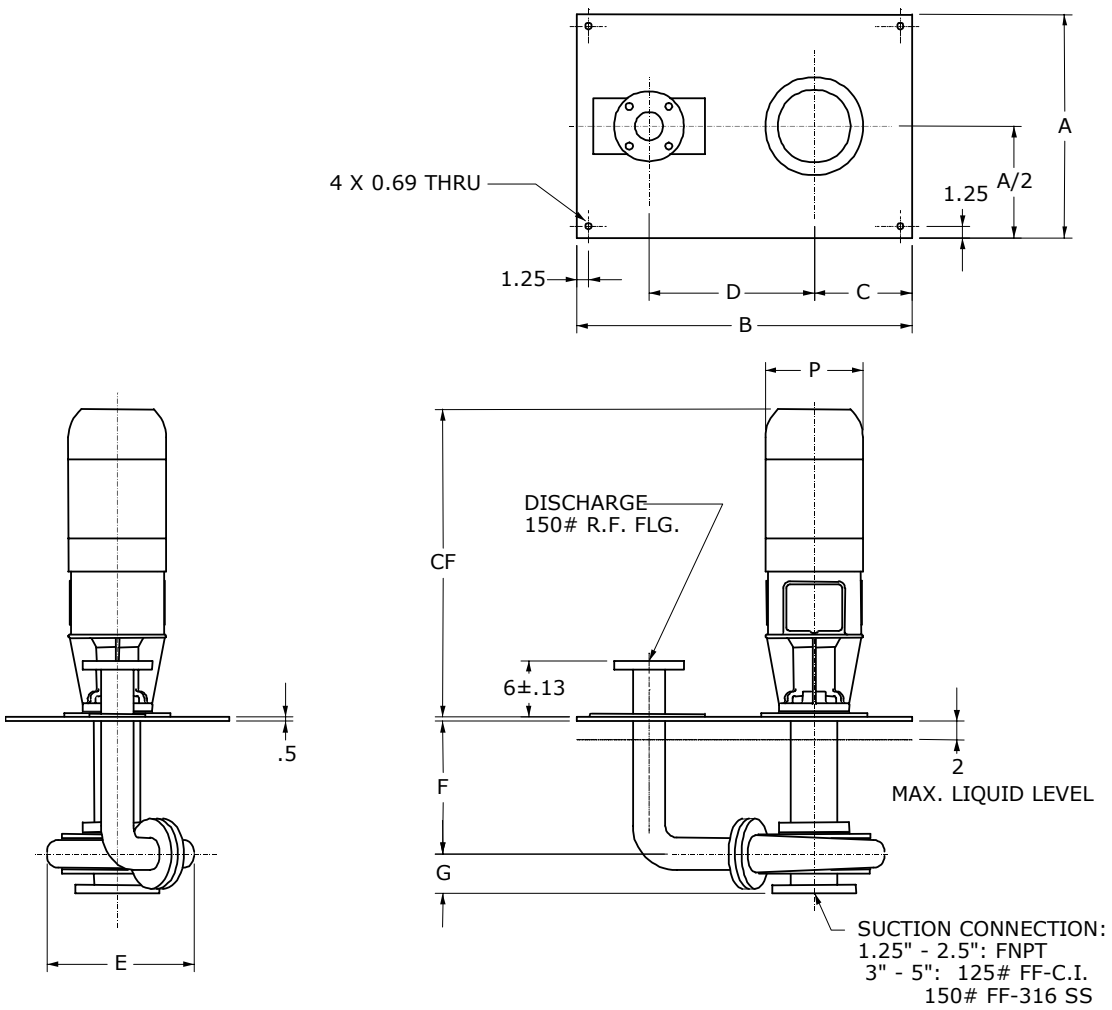
Note: NEMA frames 284 / 286 TC available with size 1530 bearing frame only

Carver

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

Dwg: SP-GV-1, Rev: 0

GVC - 7" and 10" Impeller Sizes (With Discharge Piping)



Note: Minimum discharge pipe size is 2"

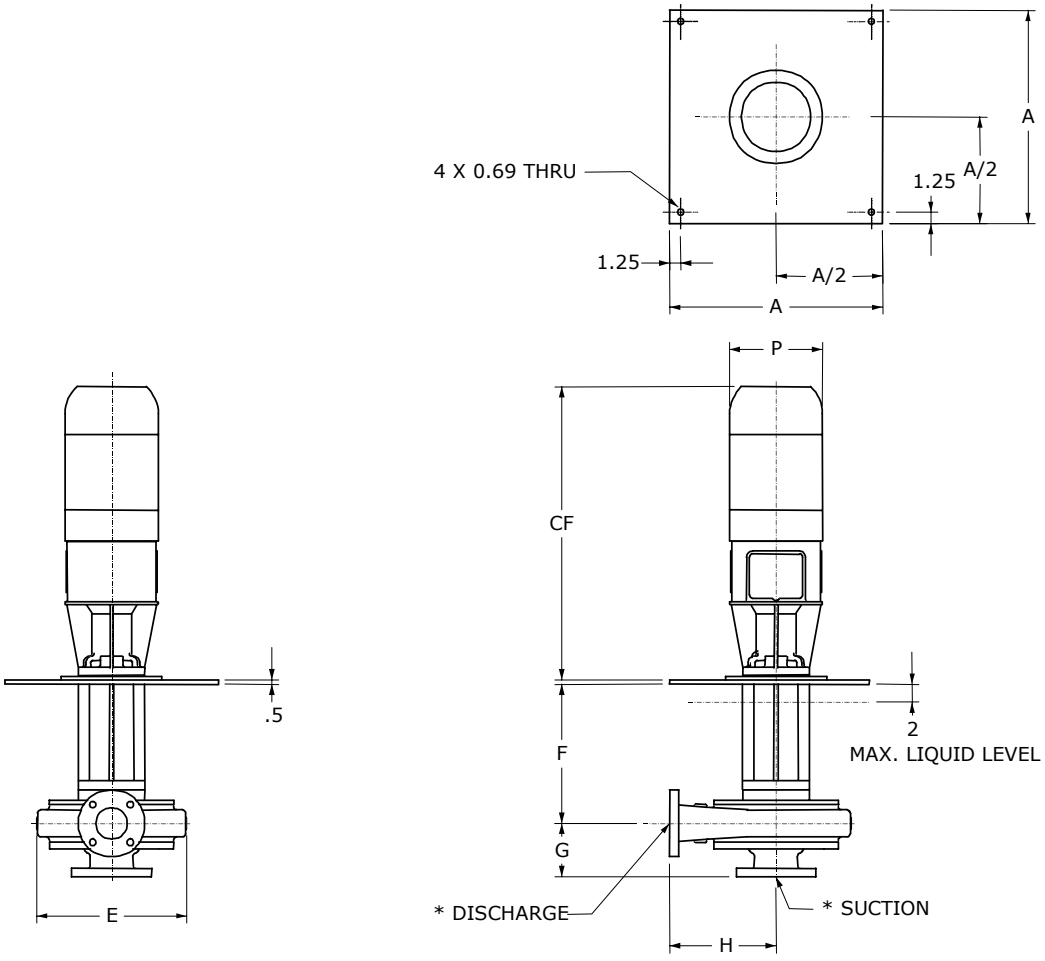
Pump Size	Pump Dimensions													
	Discharge Pipe			A	B	C	D			E	F		G	Bearing Frame
	Standard	Oversized	Dbl. O'size				Standard	Oversized	Dbl. O'size		Standard	Extended		
1 x 1 x 7	2	2	2	18.0	24.0	8.5	11.4	12.0	12.2	8.8	14.8	26.8	2.7	1520
1½ x 1¼ x 7	2	2	2	18.0	24.0	8.5	11.8	12.1	12.4	8.9	14.4	26.4	2.8	
2½ x 2 x 7	2	2½	3	18.0	24.0	8.5	10.8	11.4	11.0	10.3	14.3	26.3	3.7	
3 x 2½ x 7	2½	3	4	24.0	36.0	10.5	17.3	17.3	17.3	10.6	14.3	26.3	4.0	
4 x 3 x 7	3	4	5	24.0	36.0	10.5	17.3	17.3	17.3	11.0	14.5	26.5	4.8	
5 x 4 x 7	4	5	6	24.0	36.0	10.5	17.3	17.3	17.3	11.8	14.4	26.4	5.0	
1½ x 1¼ x 10	2	2	2	18.0	24.0	8.5	11.8	12.3	12.5	13.3	14.2	26.2	3.3	1520
2 x 1½ x 10	2	2	2½	18.0	24.0	8.5	12.1	12.1	12.0	12.6	14.3	26.3	3.5	
2½ x 2 x 10	2	2½	3	18.0	24.0	8.5	12.5	12.6	12.5	12.8	14.4	26.4	4.0	
3 x 2½ x 10	2½	3	4	24.0	36.0	10.5	17.3	17.3	17.3	13.3	14.4	26.4	4.7	
4 x 3 x 10	3	4	5	24.0	36.0	10.5	17.3	17.3	17.3	14.5	14.3	26.3	4.6	
5 x 4 x 10	4	5	6	24.0	36.0	10.5	19.0	19.0	19.0	16.0	14.4	26.4	4.7	
6 x 5 x 10	5	6	8	30.0	45.0	13.0	22.0	22.0	22.0	20.5	15.9	27.9	5.8	1530

Carver

1. All dimensions in inches, all tolerances +/- 0.125 inch.
2. For motor dimensions CF and P see prior page.
3. Not valid for construction unless certified.

Dwg: SP-GV-2, Rev: 0

GVC - 11" and 13" Impeller Sizes (Without Discharge Piping)



*125# F.F. FLG. - CAST IRON
150# F.F. FLG. - 316 SS

Pump Size	Pump Dimensions						
	A	E	F		G	H	Bearing Frame
			Standard	Extended			
2 x 1 x 11	24.0	14.5	14.9	26.9	3.9	11.0	1520
4 x 2 x 11	24.0	15.5	14.9	26.9	6.0	11.0	
4 x 3 x 11	24.0	17.0	14.9	26.9	6.0	12.0	
5 x 4 x 11	24.0	16.5	15.7	27.7	6.0	10.8	1530
8 x 6 x 11	30.0	22.0	15.3	27.3	6.5	16.0	
2½ x 1½ x 13	26.0	15.5	14.4	26.4	4.9	9.8	1520
2½ x 2 x 13	26.0	16.0	14.4	26.4	4.9	11.0	
3 x 2½ x 13	26.0	17.0	14.4	26.4	4.9	11.0	1530
4 x 3 x 13	26.0	17.0	14.4	26.4	4.9	12.4	
5 x 4 x 13	26.0	18.0	14.4	26.4	5.5	12.4	
6 x 5 x 13	30.0	20.5	14.8	26.8	5.5	14.0	
8 x 6 x 13	30.0	23.0	14.8	26.8	6.3	15.8	1540

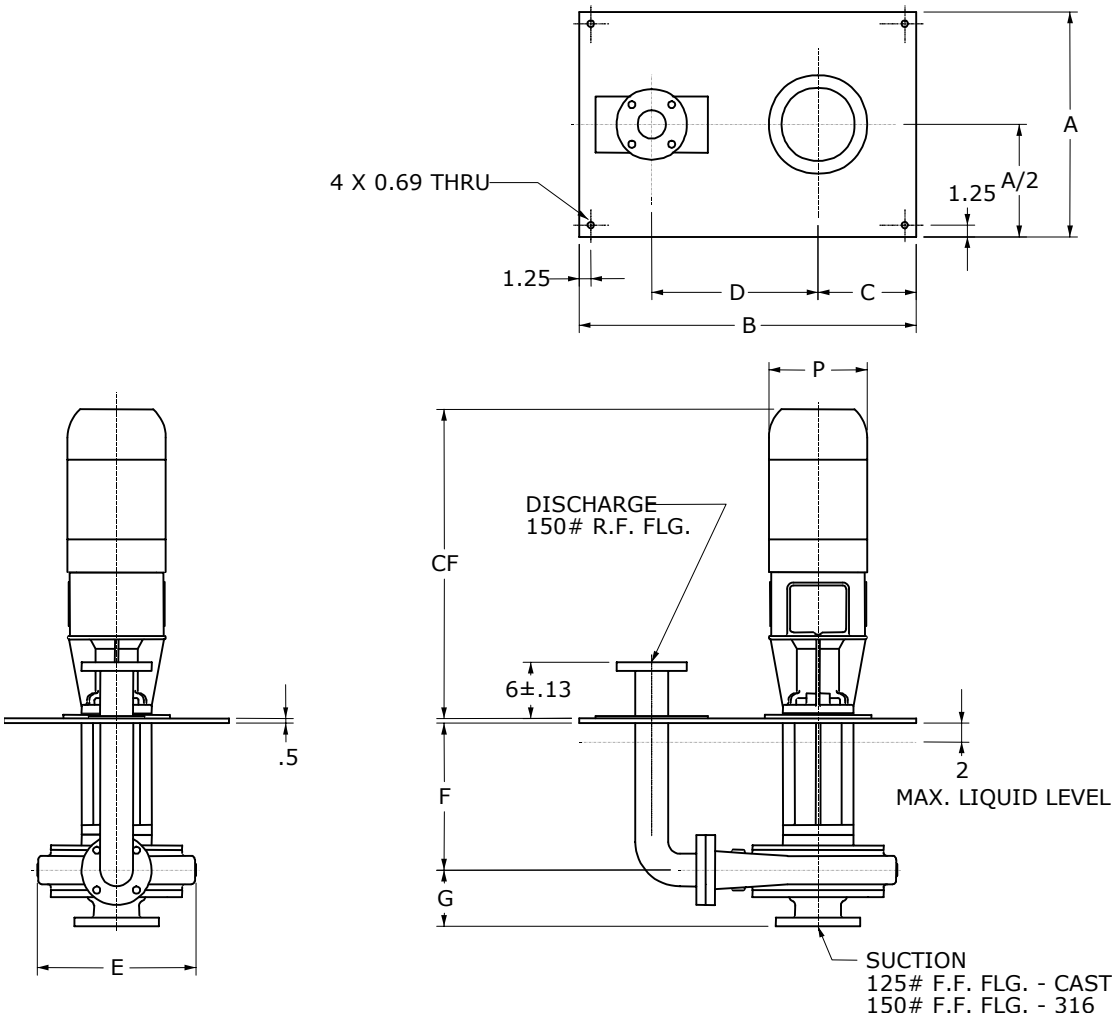
Motor Dimensions		
NEMA Motor Frame	CF	P
143 / 145 TC	27.0 / 28.0	7.4
182 / 184 TC	28.5 / 28.5	9.5
213 / 215 TC	31.0 / 32.0	11.0
254 / 256 TC	34.0 / 35.0	13.0
284 / 286 TC	31.0 / 32.0	15.0
324 / 326 TC	45.0 / 46.0	17.0
364 / 365 TC	47.0 / 48.0	20.0
404 / 405 TSC	52.0 / 54.0	22.0

Carver

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

Dwg: SP-GV-3, Rev: 0

GVC - 11" and 13" Impeller Sizes (With Discharge Piping)



Note: Minimum discharge pipe size is 2"

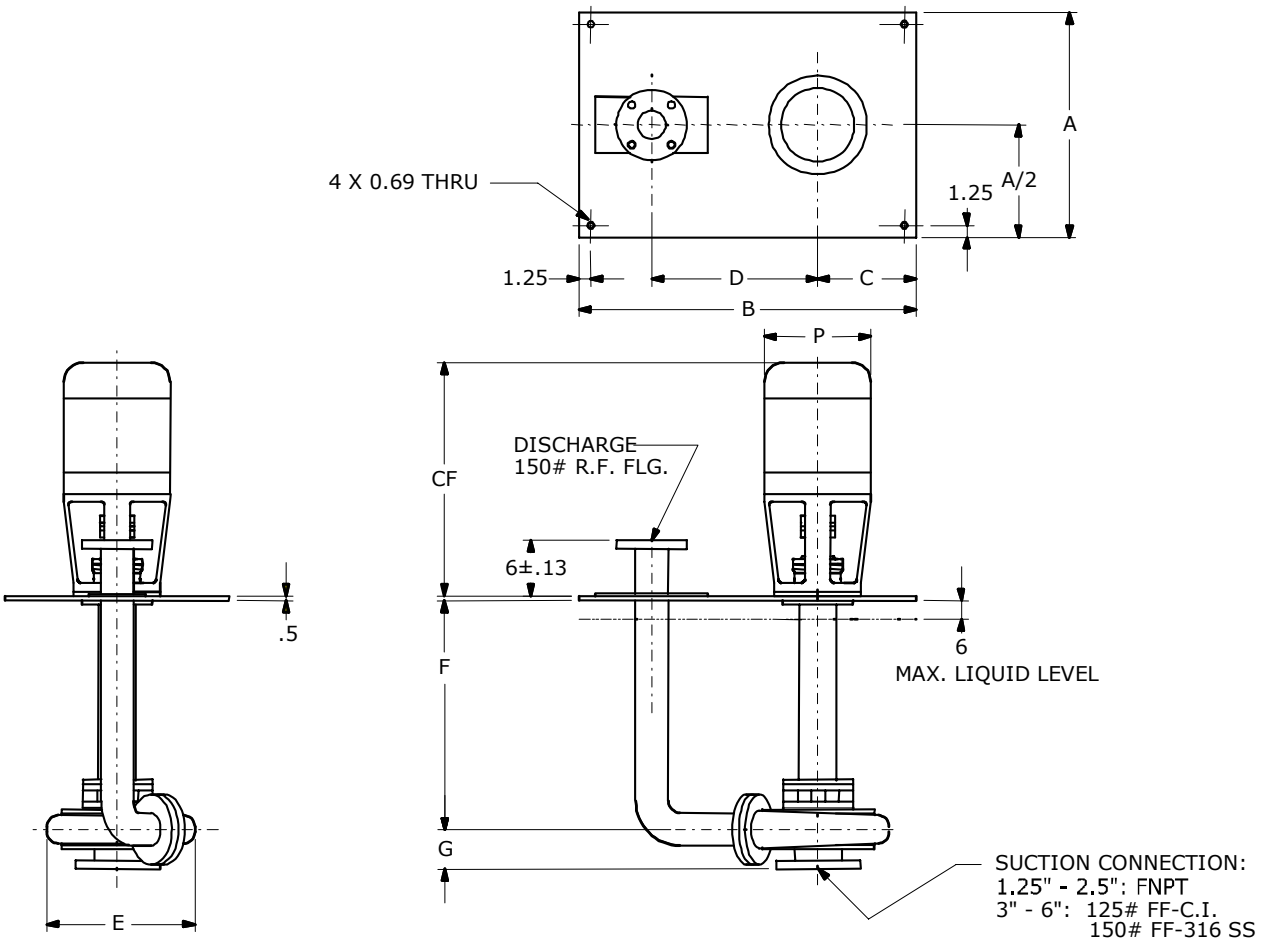
Pump Size	Pump Dimensions													
	Discharge Pipe			A	B	C	D			E	F		G	Bearing Frame
	Standard	Oversized	Dbl. O'size				Standard	Oversized	Dbl. O'size		Standard	Extended		
2 x 1 x 11	2	2	2	24.0	36.0	12.0	18.0	18.0	18.0	14.5	14.9	26.9	3.9	1520
4 x 2 x 11	2	2½	3	24.0	36.0	12.0	18.0	18.0	18.0	15.5	14.9	26.9	6.0	
4 x 3 x 11	3	4	5	24.0	36.0	12.0	18.0	18.0	18.0	17.0	14.9	26.9	6.0	
5 x 4 x 11	4	5	6	24.0	36.0	12.0	18.0	18.0	18.0	16.5	15.7	27.7	6.0	1530
8 x 6 x 11	6	8	10	30.0	45.0	13.0	25.0	24.0	23.0	22.0	15.3	27.3	6.5	
2½ x 1½ x 13	2	2	2½	26.0	40.0	13.0	20.0	20.0	20.0	15.5	14.4	26.4	4.9	1520
2½ x 2 x 13	2	2½	3	26.0	40.0	13.0	20.0	20.0	20.0	16.0	14.4	26.4	4.9	
3 x 2½ x 13	2½	3	4	26.0	40.0	13.0	20.0	20.0	20.0	17.0	14.4	26.4	4.9	1530
4 x 3 x 13	3	4	5	26.0	40.0	13.0	20.0	20.0	20.0	17.0	14.4	26.4	4.9	
5 x 4 x 13	4	5	6	26.0	40.0	13.0	20.0	20.0	20.0	18.0	14.4	26.4	5.5	
6 x 5 x 13	5	6	8	30.0	45.0	13.0	22.0	22.0	22.0	20.5	14.8	26.8	5.5	
8 x 6 x 13	6	8	10	30.0	45.0	13.0	25.0	24.0	23.0	22.0	14.8	26.8	6.3	1540

Carver

1. All dimensions in inches, all tolerances +/- 0.125 inch.
2. For motor dimensions CF and P see prior page.
3. Not valid for construction unless certified.

Dwg: SP-GV-4, Rev: 0

GVS - 7" and 10" Impeller Sizes



Pump Size	Pump Dimensions							
	Discharge Size	A	B	C	D	E	F (see Note 2 below)	G
1¼ x 1 x 7	2	18	24	8.5	12.5	8.8	6.3 + column depth	2.7
1½ x 1¼ x 7	2	18	24	8.5	12.4	8.9	5.9 + column depth	3.4
2½ x 2 x 7	2	18	24	8.5	10.8	10.2	5.9 + column depth	3.7
3 x 2½ x 7	2½	24	36	10.5	17.2	10.6	5.9 + column depth	4.0
4 x 3 x 7	3	24	36	10.5	17.2	11.0	6.1 + column depth	4.8
5 x 4 x 7	4	24	36	10.5	17.2	11.7	6.0 + column depth	5.0
1½ x 1¼ x 10	2	18	24	8.5	12.5	13.3	5.7 + column depth	3.3
2 x 1½ x 10	2	18	24	8.5	12.6	12.6	5.9 + column depth	4.4
2½ x 2 x 10	2	18	24	8.5	12.5	12.8	5.9 + column depth	4.3
3 x 2½ x 10	2½	24	36	10.5	13.2	13.2	5.9 + column depth	4.5
4 x 3 x 10	3	24	36	10.5	14.5	14.5	5.9 + column depth	4.6
5 x 4 x 10	4	24	36	10.5	16.0	16.0	5.9 + column depth	5.0
6 x 5 x 10	5	30	45	13.0	20.5	20.5	8.4 + column depth	5.8

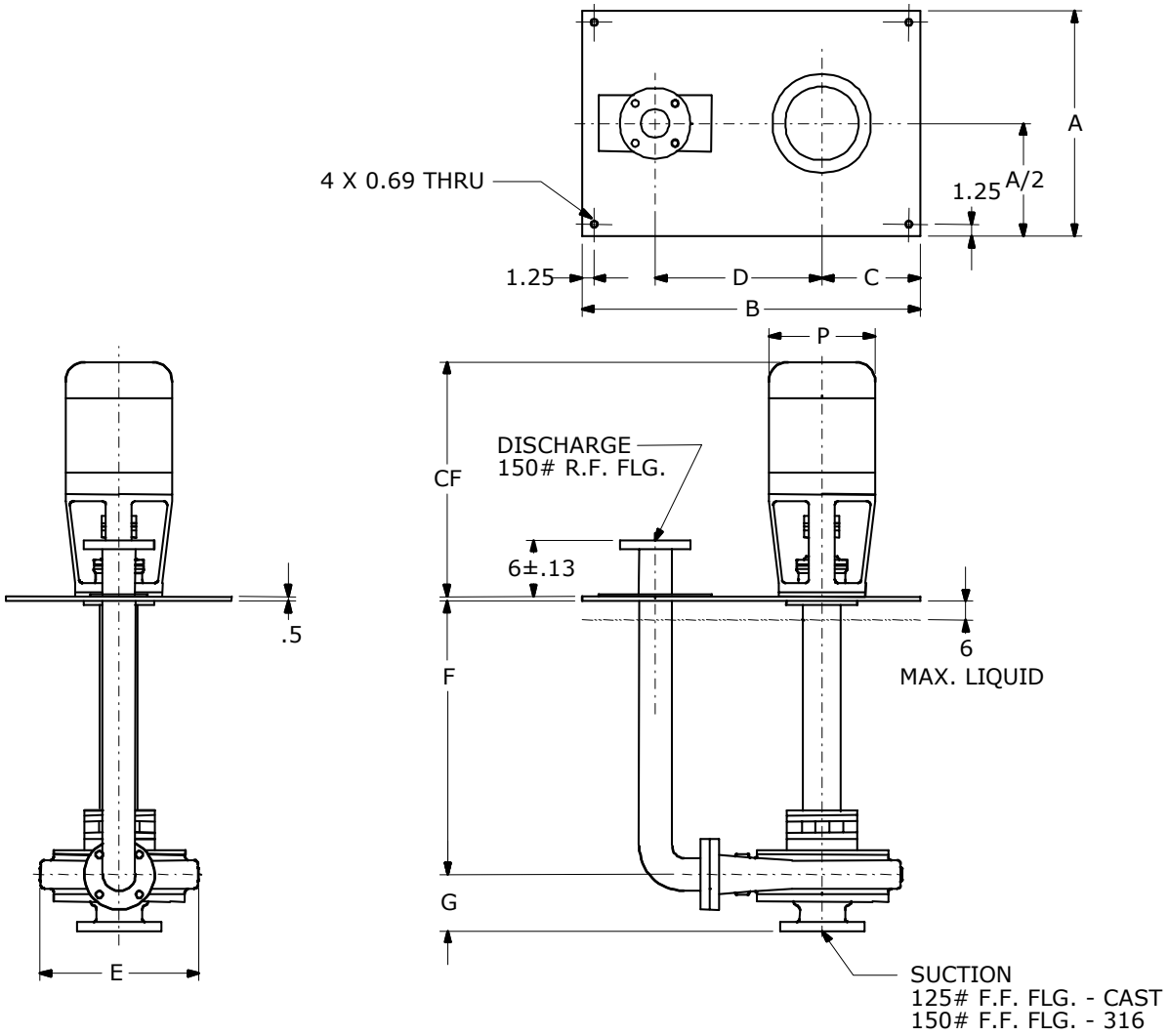
Motor Dimensions (Approx.)		
NEMA Motor Frame	CF	P
143 TC	21	7.4
145 TC	22	7.4
182 TC	25	9.5
184 TC	26	9.5
213 TC	28	11.0
215 TC	29	11.0
254 TC	31	13.0
256 TC	32	13.0
284 TC	34	15.0
286 TC	35	15.0

Carver

1. All dimensions in inches, all tolerances +/- 0.125 inch.
2. Dimension "F" equal to values shown plus nominal column depth in increments of 12 inches (3.0 foot min, 20.0 foot max).
3. Not valid for construction unless certified.

Dwg: SP-GV-5, Rev: 0

GVS - 11" and 13" Impeller Sizes



Note: Minimum discharge pipe size is 2"

Pump Size	Pump Dimensions							
	Discharge Size	A	B	C	D	E	F (see Note 2 below)	G
2 x 1 x 11	2	24	36	12.0	18.0	14.50	6.5 + column depth	3.9
4 x 2 x 11	2	24	36	12.0	18.0	15.50	6.5 + column depth	6.0
4 x 3 x 11	3	24	36	12.0	18.0	17.00	6.5 + column depth	6.0
5 x 4 x 11	4	24	36	12.0	18.0	16.50	8.2 + column depth	6.0
8 x 6 x 11	5	30	45	13.0	25.0	22.00	7.8 + column depth	6.5
2½ x 1½ x 13	2	26	40	13.0	20.0	15.50	5.9 + column depth	4.9
2½ x 2 x 13	2	26	40	13.0	20.0	16.00	5.9 + column depth	4.9
3 x 2½ x 13	2½	26	40	13.0	20.0	17.00	6.9 + column depth	4.9
4 x 3 x 13	3	26	40	13.0	20.0	17.00	6.9 + column depth	4.9
5 x 4 x 13	4	26	40	13.0	20.0	18.00	6.9 + column depth	5.5
6 x 5 x 13	5	30	45	13.0	22.0	20.50	7.3 + column depth	5.5

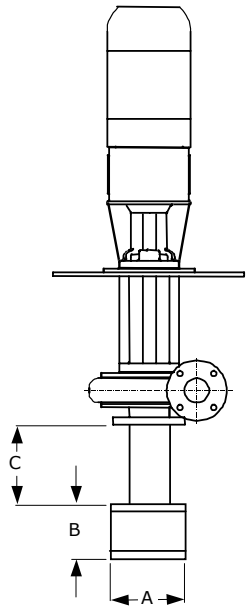
Motor Dimensions (Approx.)		
NEMA Motor Frame	CF	P
143 / 145 TC	21 / 22	7.4
182 / 184 TC	25 / 26	9.5
213 / 215 TC	28 / 29	11.0
254 / 256 TC	31 / 32	13.0
284 / 286 TC	34 / 35	15.0
324 / 326 TC	37 / 38	17.0
364 / 365 TC	39 / 40	20.0
404 / 405 TSC	43 / 45	22.0

Carver

1. All dimensions in inches, all tolerances +/- 0.125 inch.
2. Dimension "F" equal to values shown plus nominal column depth in increments of 12 inches (3.0 foot min, 20.0 foot max)
3. Not valid for construction unless certified.

Dwg: SP-GV-6, Rev: 0

Suction Strainer and Inlet Tailpipe Dimensions

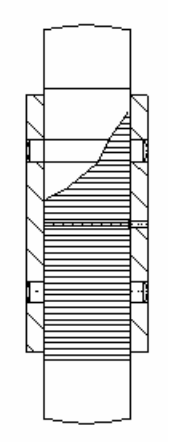


Inlet Size	Suction Strainer and Tailpipe Dimensions				
	Inlet Pipe Connection	Mesh Opening	A	B	C
1¼	NPT	0.375	5.00	3.50	5.25 (+/- 0.25)
1½		0.375	5.00	4.00	
2		0.375	6.00	4.00	
2½		0.375	6.00	4.00	
3	ANSI Flange	0.375	7.00	5.00	6.25 (+/- 0.25)
4		0.375	7.00	5.00	
5		0.375	9.00	9.00	
6		0.375	9.00	9.00	
8		1.000	11.0	11.0	

Notes:

1. Tailpipe (dimension "C") is with a standard 6" pipe nipple, with effective length varying by the degree of thread (NPT) or socket weld (ANSI flange) engagement.
2. Actual strainer distance above tank bottom is generally recommended to be 0.3 to 0.8 times actual pump inlet nominal diameter – see Section 1.10, page 6.
3. Dimensions in above table apply to all GV Series (i.e., GVC, GVT and GVS) pumps.

GVS Extended Shaft Length Details



All GVS pumps incorporate renewable intermediate lineshaft bearings for positive shaft support and to avoid deflection at critical shaft speeds. Lineshaft bearings are placed at approximately every 4.0 foot of column length.

For shaft lengths in excess of 10 feet, a two-piece shaft design with rigid coupling is also used – see diagram at left. The basic arrangement consists of an upper and lower shaft, shaft coupling, upper and lower coupling-to-shaft pins, and a gasket situated between the two shaft ends.

All pumps are also provided with a Buna N (steel shaft) or Alloy 20 (316 SS shaft) slinger located on the shaft close to the impeller. The slinger deflects pumped fluid away from the shaft and prevents it from entering the column assembly and lineshaft bearing area




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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