



# PUMPS AND WATER SYSTEMS

[pentair.com/aurora](http://pentair.com/aurora)

# 3800 SERIES SINGLE STAGE END SUCTION PUMPS

Capacities to 4200 gpm (954 m<sup>3</sup>/hr)  
Heads to 520 feet (158 meters)  
Temperatures to 300°F (149°C)

## Setting New Standards of Efficiency

Pentair Aurora is delivering over a century of innovation for constant peace of mind. Our years of experience in the design, sales and manufacturing of centrifugal pumps has led to the new Pentair Aurora® 3800 Series. Liquid handling requirements have evolved over the years and have increased along with temperatures and pressures. Today's installations demand sturdy but quiet, smooth running pumps with longer life cycles. These modern pumps with a clean, straightforward and updated design were developed with upgraded materials of construction and a simplified offering without limiting ranges and keeping maximum interchangeability in mind. These pumps not only exceed U.S. Department of Energy (U.S. DOE) pump efficiency standards, but also feature shared hydraulics and premium materials as standard offering. The new Pentair Aurora 3800 series offer industry-leading durability and reliability to support your liquid handling needs.



### STANDARD FEATURES

- ◆ Offered in two configurations:
  - 3801 Close coupled
  - 3804 Flexible coupled-frame mounted
- ◆ Ductile Iron ASTM A536 Casings provide higher strength and durability
- ◆ Flange dimensions match the largest installed base for maximum interchangeability
- ◆ 316 Stainless Steel impellers and shaft sleeves provide less corrosion, additional chemical resistance and durability
- ◆ Shared Hydraulics with Pentair Aurora 382B Vertical In-line Pumps to streamline parts inventories
- ◆ Heavy duty power frames with bearing life of 100,000 hours (Pentair Aurora 3804 only)
- ◆ Double volute on some 4" and all 5" and larger discharge to reduce bearing loads and increase durability. Note: Not available on 4x5x11 and 4x5x13.5. Note: Single volute also available.
- ◆ Gauge taps on suction and discharge on flanged models
- ◆ 4 Power frame sizes
- ◆ Standard back pullout design reduces downtime
- ◆ Internal self-flushing mechanical seal for continuous lubrication and extended durability, eliminates the need for exterior lubricating and tubing
- ◆ Regreaseable bearings (Pentair Aurora 3804 only)
- ◆ Coupling guard (Pentair Aurora 3804 only)
- ◆ Working pressures up to 175 PSI
- ◆ Rigid baseplate design (Pentair Aurora 3804 only)
- ◆ NSF 372 listing standard

### OPTIONAL FEATURES

- ◆ 316 Stainless Steel shaft
- ◆ Unique drip rim base that is easier to grout than fabricated bases (Pentair Aurora 3804 only)
- ◆ Drip pan (Pentair Aurora 3804 only)
- ◆ Braided hose of Stainless Steel construction
- ◆ Epoxy coating for NSF50
- ◆ Several mechanical seal options for maximum temperatures up to 275°F
- ◆ Oil lube bearings (Pentair Aurora 3804 only)
- ◆ 416 Stainless Steel case wear ring
- ◆ Certified performance testing

### APPLICATIONS

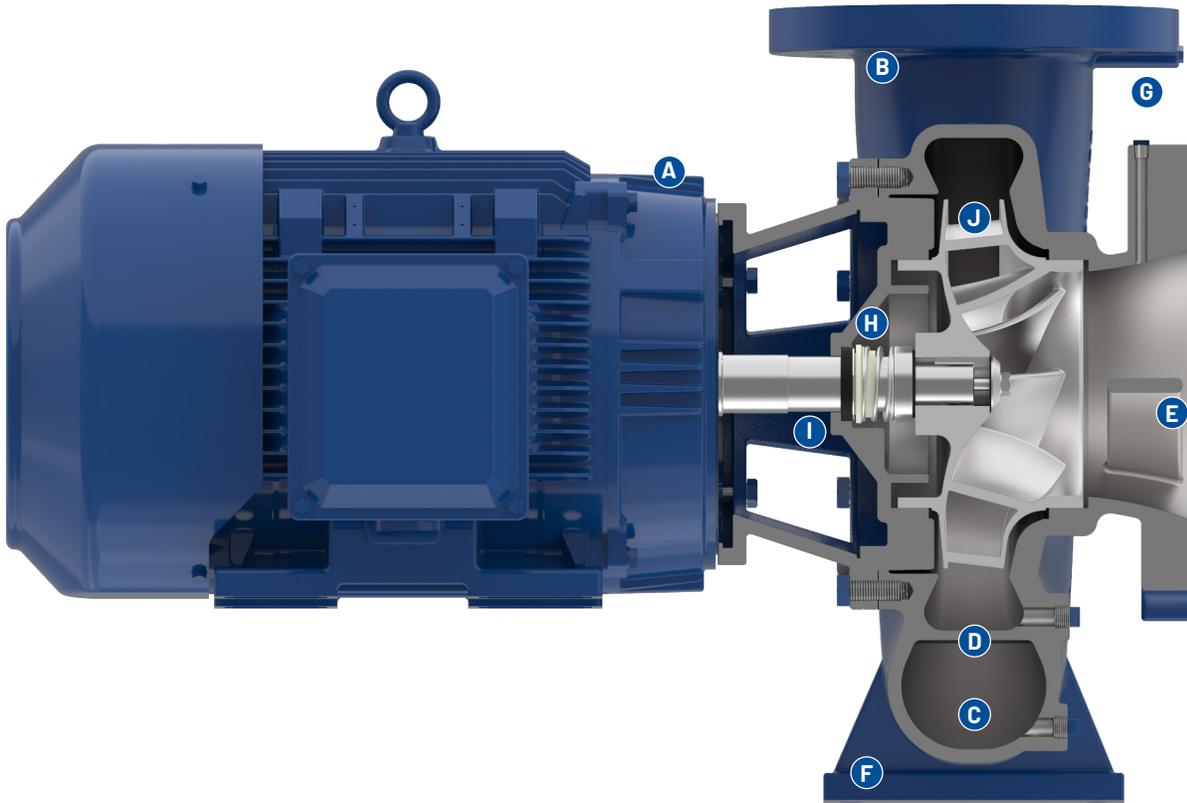
- ◆ HVAC Systems
- ◆ Boosting
- ◆ Chilled and Hot Water
- ◆ Commercial Pools
- ◆ Industrial Uses
- ◆ Municipal

# PUMP SIZE OFFERING

Pump Sizes
1.5x2x11
2x3x11
3x4x11
4x5x11A
5x6x11
6x8x11A
1.25x1.5x7
1.5x2x7
2x2.5x7A
2.5x3x7
3x4x7A*
4x5x7A*
5x6x7*
1.25x1.5x9.5
1.5x2x9.5
2x2.5x9.5
2.5x3x9.5
3x4x9.5
4x5x9.5
5x6x9.5A
6x8x9.5*
2x3x13.5
2.5x3x13.5
3x4x13.5
4x5x13.5
5x6x13.5
6x8x13.5
8x10x13.5
1.5x2x12

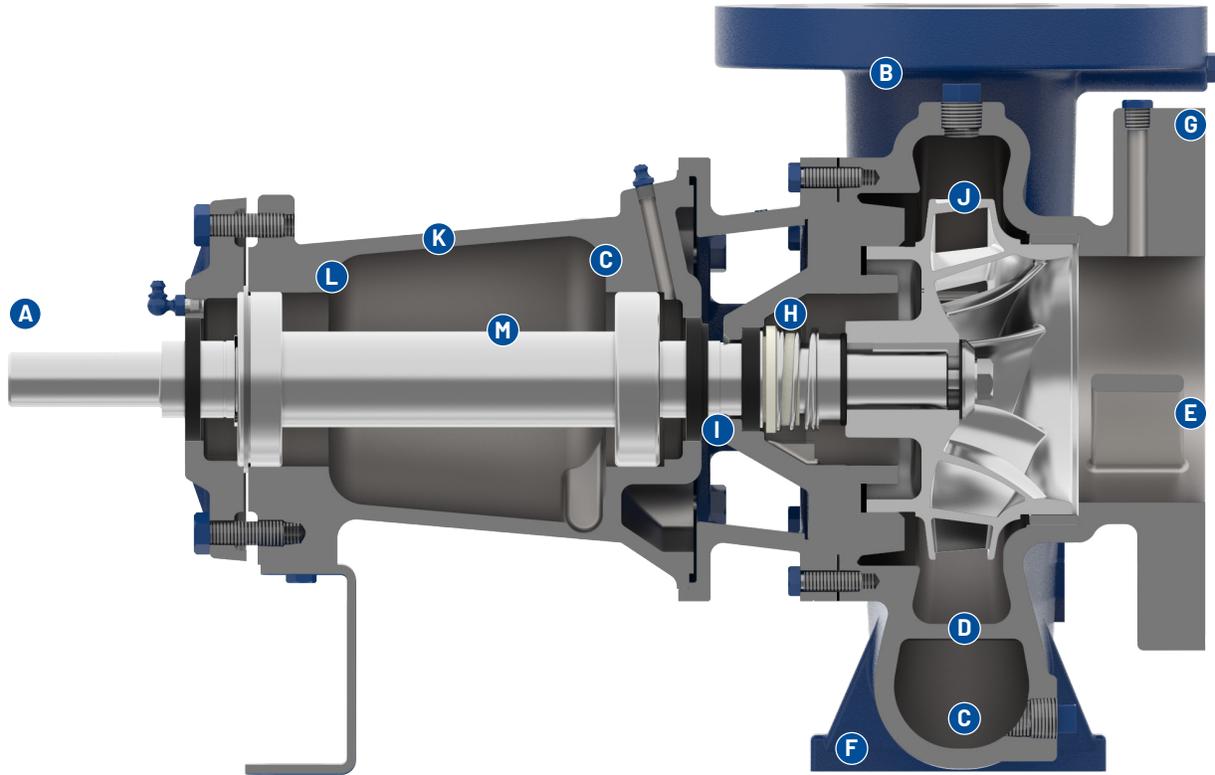
\*Temporarily unavailable until further notice.

# PENTAIR AURORA® 3801 CLOSE COUPLED



- A.** Standard JM and JP motors provide low noise level pump operation.
- B.** Ductile Iron casing long life with higher working pressures.
- C.** Factory Hydro test guarantees casing and seal integrity.
- D.** Double volute discharge on some 4" and all 5" and larger discharge to reduce bearing loads (exceptions: 4x5x11 and 4x5x13.5).  
Note: Single Volute also available
- E.** Suction splitter on some 4" and all 5" and larger suction to eliminate pre-rotation.
- F.** Casing feet for easy back pull out  
allows servicing of pump without disturbing suction and discharge pipelines.
- G.** Gauge taps on suction and discharge flanges
- H.** Mechanical seal has carbon against ceramic face for optimum hot water performance. Long life is assured with 303 SST metal parts and Buna-N flexible elastomers.
- I.** Shaft sleeve to protect the motor shaft.
- J.** Stainless Steel impeller keyed to shaft extension and secured by a capscrew and washer. Gaskets are used to prevent leakage to shaft end.
- K.** Optional casing wear rings
- L.** Optional seal materials flange to flange matching largest installed base.

# PENTAIR AURORA® 3804 FLEXIBLE COUPLED



**A.** Standard T and TS base type motors

provide low noise level pump operation.

**B.** Ductile Iron casing

long life with higher working pressures.

**C.** Factory Hydro test

guarantees casing and seal integrity.

**D.** Double volute discharge

on some 4" and all 5" and larger discharge to reduce bearing loads.

Note: Single Volute also available

**E.** Suction splitter

on some 4" and all 5" and larger suction to eliminate pre-rotation.

**F.** Casing feet for easy back pull out

allows servicing of pump without disturbing suction and discharge pipelines.

**G.** Gauge taps on suction and discharge flanges

**H.** Mechanical seal

has carbon against ceramic face for optimum hot water performance. Long life is assured with 303 SST metal parts and Buna-N flexible elastomers.

**I.** Shaft sleeve

to protect the pump shaft.

**J.** Stainless Steel impeller

keyed to shaft extension and secured by a capscrew and washer. Gaskets are used to prevent leakage to shaft end.

**K.** Optional casing wear rings

**L.** Re-greaseable bearings

**M.** Stainless Steel shaft

Designed for minimum deflection.

**N.** Heavy duty power frame

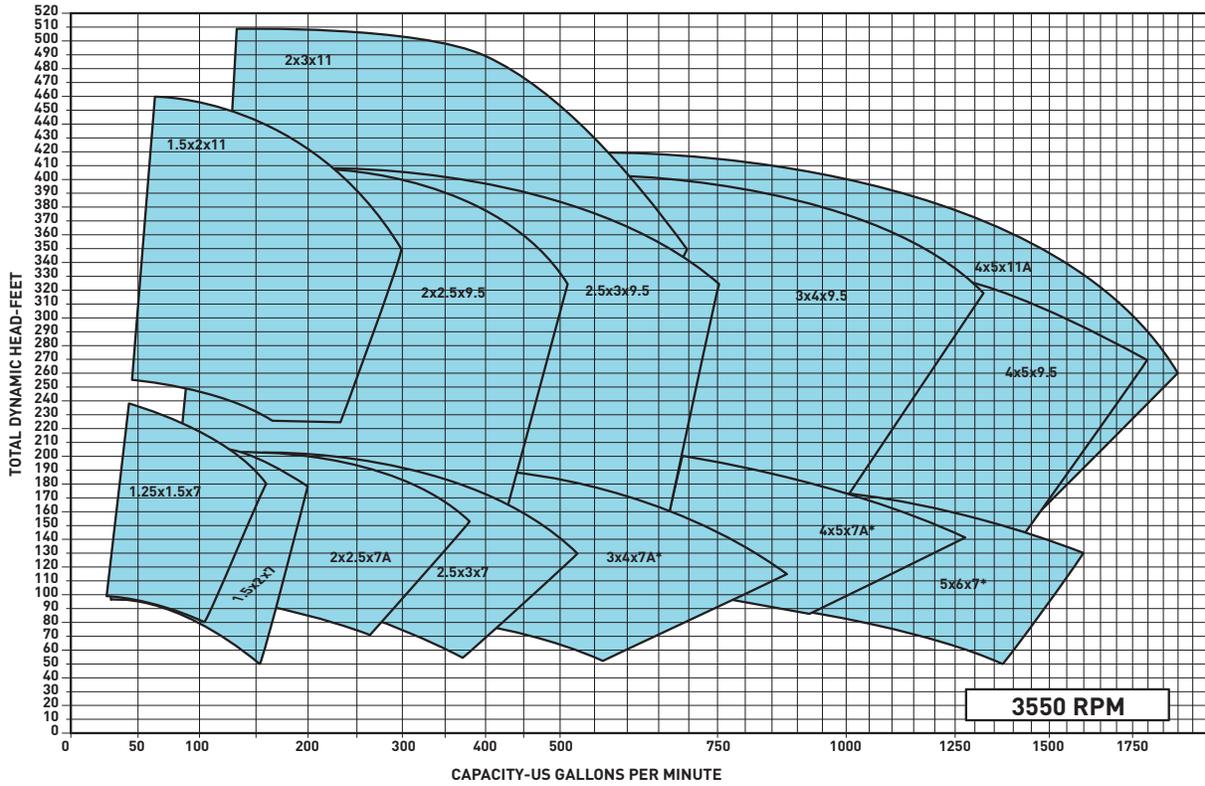
with re-greaseable bearing for 100,000 hours.

**O.** Optional seal materials

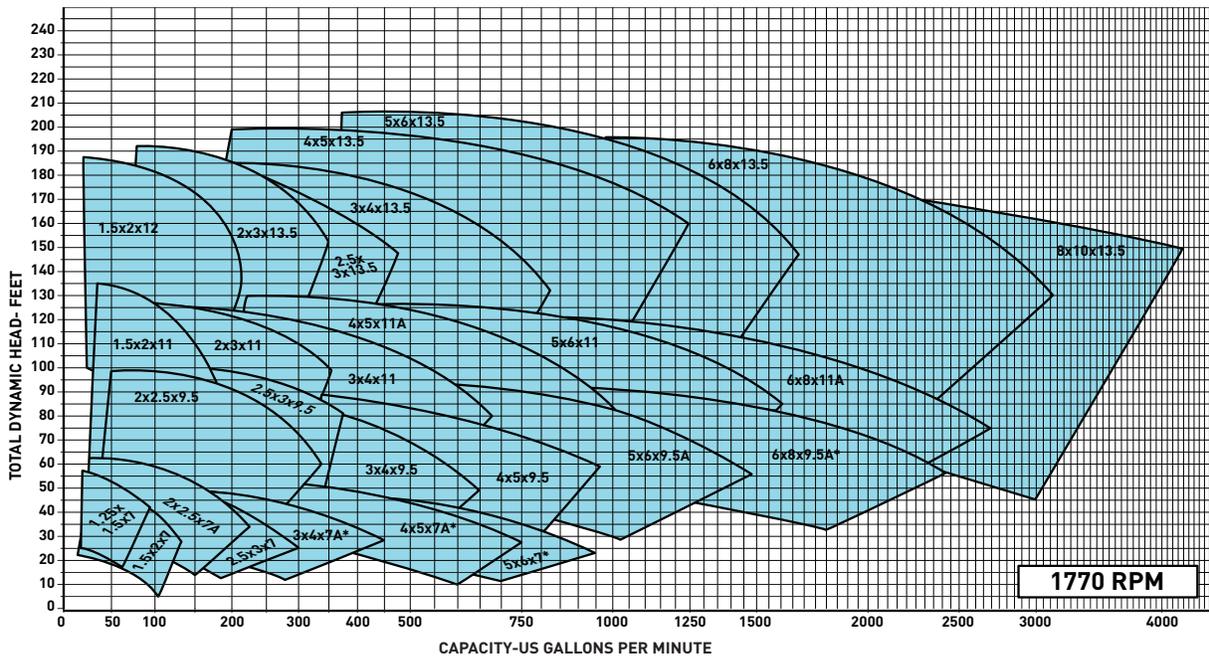
flange to flange matching largest installed base.

# PUMP PERFORMANCE

## 3550 RPM, 60 Hz RANGE CHART



## 1770 RPM, 60 Hz RANGE CHART

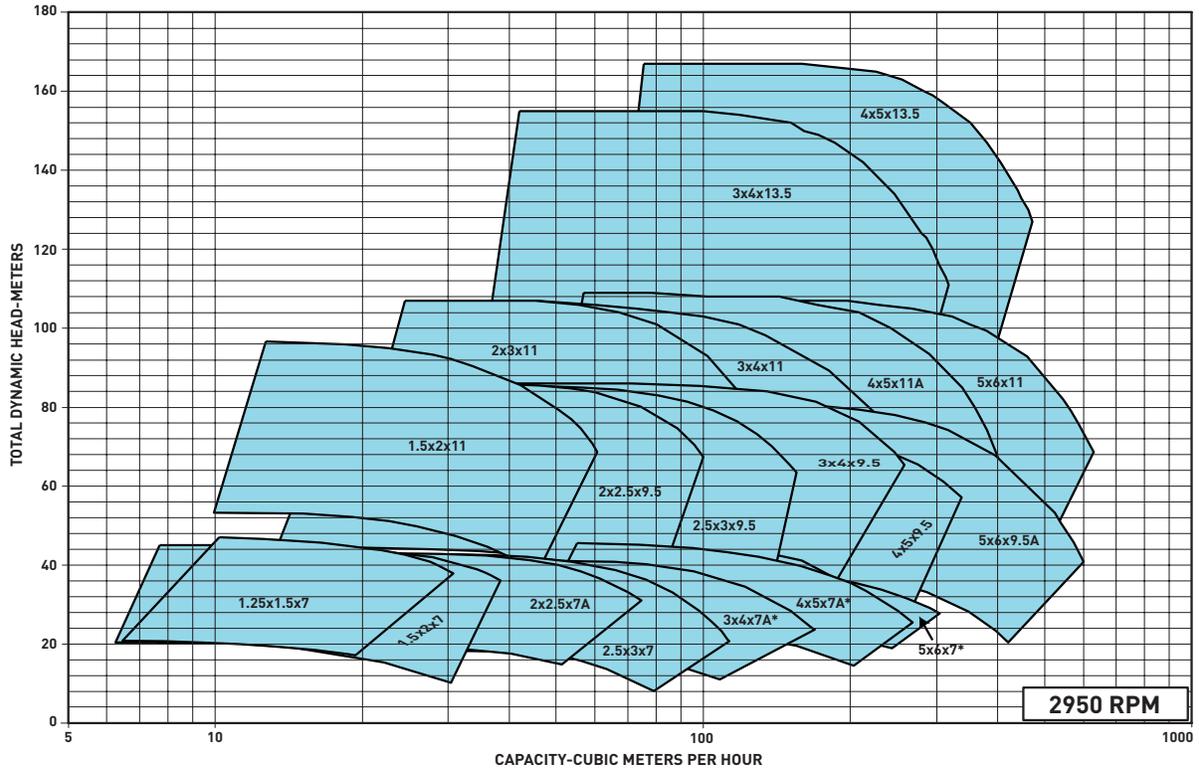


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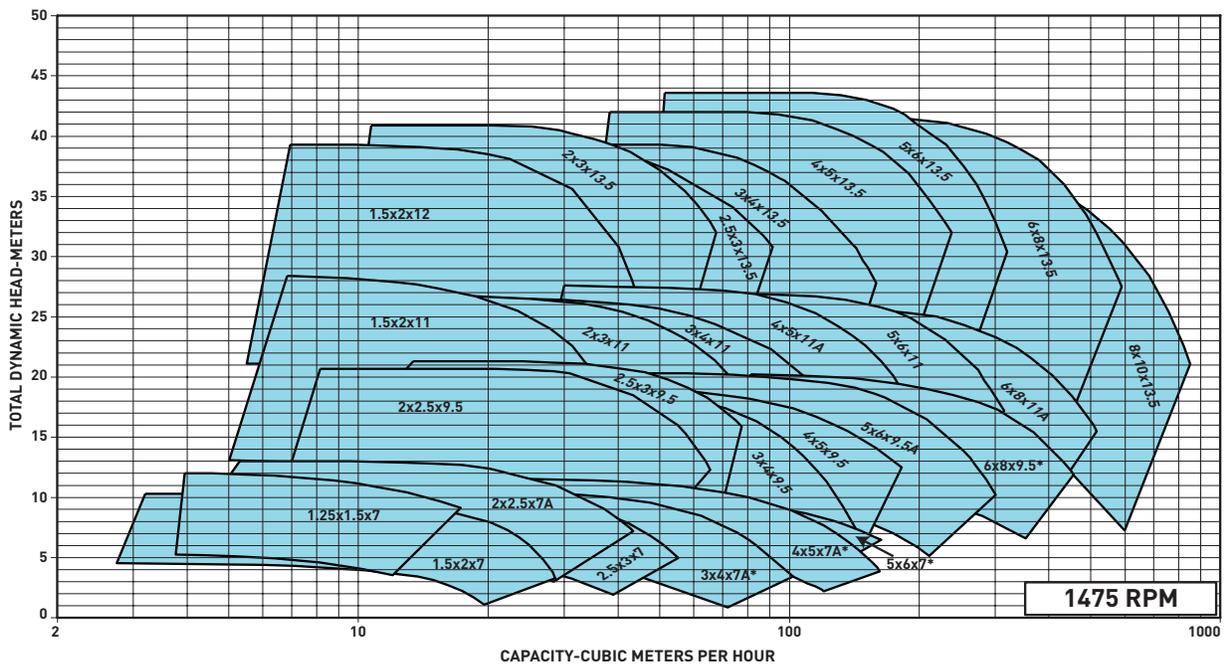
Reference only: For the most current information, refer to the Encompass Pump Selection Tool.

# PUMP PERFORMANCE

## 2950 RPM, 50 Hz RANGE CHART



## 1475 RPM, 50 Hz RANGE CHART



\* Temporarily unavailable until further notice.

Reference only: For the most current information, refer to the Encompass Pump Selection Tool.

# PUMP FEATURES

## MAXIMUM LIMITATION BASED ON STANDARD MATERIALS AND PUMPING CLEAR WATER

Speed (RPM)		3600 RPM
Horsepower (HP)	1200 RPM	60 HP
	1800 RPM	200 HP
	3600 RPM	250 HP
Temperature (°F/°C)		Standard 225 °F (107 °C) / Optional 275 °F (135 °C)
Case Working Pressure (PSI)		175 <sup>1</sup> PSI

<sup>1</sup>Refer to factory for pump size 1.5x2x11, 2x3x11, 3x4x11 & 4x5x11A

## MATERIALS OF CONSTRUCTION

Pump Part	Stainless Steel Impeller Fitted
Casing	Ductile Iron ASTM A536
Impeller	Stainless Steel ASTM A743 Type 316
Seal plate/motor bracket	Cast Iron ASTM A48
Shaft (Pentair Aurora 3804 only)	Stainless Steel AISI C1045
Sleeve	Stainless Steel ASTM A743 Type 316
Power frame (Pentair Aurora 3804 only) (PF1, PF2, PF3 or PF21A)	Cast Iron ASTM A48
Mechanical seal	
Washer	Carbon
Seat	Ceramic
Elastomer	Buna-N
Metal Parts	303 SST
Spring	303 SST



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# AURORA® 380 SERIES

## Single Stage Vertical Inline Pump

Capacities to 4500 G.P.M. (1,020 m<sup>3</sup>/hr)

Heads to 370 Feet (78 m)

Temperatures to 250°F (120°C)

### 380 Series Pumps.

Vertical Inline Close Coupled Pumps are specifically designed for mounting directly in a pipe line. The suction and discharge nozzles are located on the same centerline 180° apart. Vertical pumps significantly reduce the space required; two pumps fit in the space of one. They are easy to maintain; simply remove the capscrews and the motor and bracket assembly is easily removed from the casing without disturbing the piping.

The impeller is direct coupled to the motor shaft for easy maintenance to minimize impeller runout and reduce noise. Most pump parts, except for the casing, are 100% interchangeable with Aurora Pump's high quality, high production 340 and 360 Series pumps for speedy spare parts service. The inline casing has provisions for mounting an optional support base should the pump sit on the floor. Mechanical seals are provided as standard to prevent leakage around the shaft. A relief line is provided from the seal faces to the pump discharge for flushing and venting purposes.

Suction Branch Design on Model 382A pumps prerotates suction liquid in the direction of pump impeller rotation. This concept minimizes pumping noise that is otherwise associated with more common short radius suction inlet designs. Each pump has been engineered and assurance tested to arrive at the proper velocities and entrance angles to ensure quiet operation. Aurora 380 Series pumps are available in 31 sizes, offering a size and model precisely fitted to a wide range of head and capacity requirements. Look through this bulletin for additional details and specifications.



### Standard Features

- Bronze Fitted Construction
- Bronze Shaft Sleeve
- Carbon Steel Shaft
- Dynamically Balanced Cast Impeller
- Casing Wearing Rings
- 303 Stainless Mechanical Seal with Buna-N, Ceramic and Carbon Parts
- Factory Hydro Test

### Optional Features

- All Iron Construction
- 316 Stainless Steel Shaft Sleeve
- Impeller Wearing Ring(s)
- Suction and Discharge Companion Flanges
- Pump Base
- Certified Performance Test Data Consisting of Head Capacity and Power Readings Taken over the Full Operating Range of the Pump
- Split Mechanical Seal

# 382A-SC Series Pumps

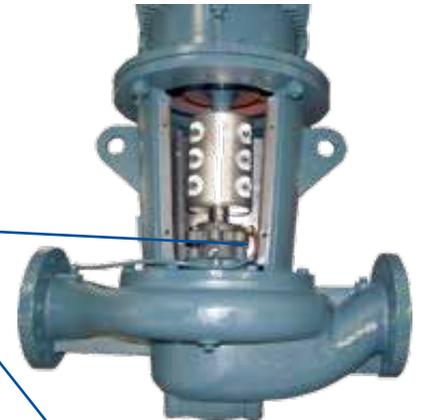
## 382-A Split Coupled Inline Pump.

Aurora® 382A-SC Vertical Inline Split Coupled Pumps are specifically designed for mounting directly in a pipe line. The High Strength Aluminum Split Coupling allows for the mechanical seal to be replaced without removing the motor. The patented Integral Jacking Gland eases the changing of the mechanical seal making this repair chore faster and easier for the maintenance specialist. A carbon throttle bushing controls the flow of mechanical seal flushing while providing additional support for the stainless steel pump shaft. The Aurora 382A-SC Inline Pump comes in 31 sizes, offering a size and model precisely fitted for a wide range of head and capacity requirements.



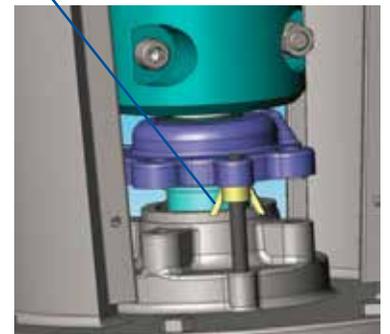
## Standard Features

- Bronze Fitted Construction
- Stainless Steel Shaft
- High Strength Aluminum Coupling
- Dynamically Balanced Cast Impeller
- Casing Wear Rings
- 303 Stainless Steel Mechanical Seal with Buna-N, Ceramic and Carbon Parts
- Factory Hydro Test
- Patented Integral Jacking Gland
  - Easier & faster serviceability of the seal & re-coupling the shaft versus the competition
  - Simple 1 step by hand operation (no tools required)
  - Accessible without removing VFD
  - 4-20mA transducer installed and wired to VFD
  - Aegis grounding ring



## Optional Features

- All Iron Construction
- Impeller Wear Rings
- Pump Base
- High Temperature Mechanical Seal
- Certified Performance Testing over the Full Operating Range of the Pump



# The Aurora Variable Frequency Drive controlled 382 Vertical In-line pumps

Globally, buildings consume 40% of the total world's energy and emit 21% of the total greenhouse gases. Many facilities across the U.S. and the globe are dealing with rising energy costs, electricity as a top five expense item and heating, ventilation and air conditioning (HVAC) accounting for 40-60% of total energy use. Businesses could save thousands of dollars every year (collectively, billions), simply by using less electricity. This strategy would have far reaching effects on profits, the overall economy as well as the environment.

## According to the U.S. Department of Energy:

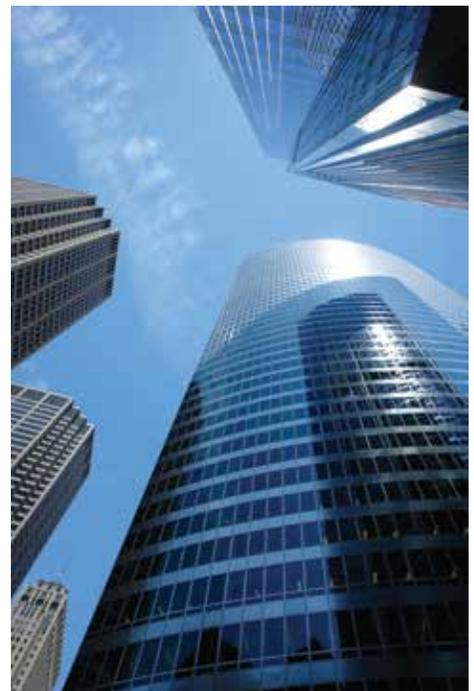
The U.S. spends \$400 billion annually powering its homes and commercial buildings.

- Buildings consume 70% of all U.S. electricity, accounting for 40% of all energy use.
- Nearly 40% of carbon dioxide emissions come from energy use in buildings.
- Cutting energy use in U.S. buildings by even 20% can save \$80 billion a year.
- Electricity is a top 5 expense item.
- Energy costs are not projected to go down.

A growing number of system designers, specifying engineers, maintenance professionals and end users are turning to variable speed motor control systems that can save up to 60 percent in energy costs as well as significantly reduce maintenance and equipment costs, improve process control and enhance system reliability.

Rather than constantly run the motor at full speed, variable frequency drive (VFD) systems-also referred to as adjustable frequency drives, variable speed drives, AC drives or simply "drives"-monitor system characteristics like pressure and control the motor speed to match the system requirements only as needed, often at lower speeds. By modulating the power delivered to the motor (pulse width modulation or PWM), VFDs provide continuous control, smoothly adjusting motor speed to directly control pressure, flow and fluid levels. The Aegis grounding ring prevents bearing failures due to transient voltage.

VFDs also improve electrical power factor and significantly reduce motor starting current typically by a factor of 4:1 to further reduce power demand from the local power utility. Aurora's 382 Vertical In-Line, Variable Frequency Drive, pumps adjust in response to changes in actual [not assumed] demand and in combination with a NEMA premium motor in turn leads to astonishing energy savings meeting ASHRAE 90.1.



# The Science behind the Savings

When a VFD starts a motor, it initially applies a low voltage at a low frequency to the motor. Starting at a low frequency and voltage avoids the high inrush current (typically 600 percent of its rated current) that occurs when a motor is started by turning on a switch or contactor to apply across-the-line voltage. The VFD then increases the applied frequency and voltage at a controlled rate to accelerate the load without drawing excessive current. This starting method typically allows a motor to develop rated torque while drawing rated current. For smoothest starting, The Aurora 382VFD incorporates S-ramp acceleration and deceleration functions that provide the least amount of mechanical shock loading on the pump, motor and system.

The key to maximizing energy savings is continuous control of the motor voltage and frequency commonly referred to as the Volts-to-Hertz ratio. VFDs provide selectable V/Hz control modes to provide the highest level of savings for single motor and multiple motor applications. For single motor control, dynamic V/Hz control uses the least amount of energy and a square law characteristic mode is best for multi-motor variable torque loads.

## Variable frequency drives application and use

In the early days of variable frequency drive (VFD) technology, the typical application was in process control for manufacturing synthetic fiber, steel bars, and aluminum foil. Because VFDs improved process performance and reduced maintenance costs, they replaced motor generator sets and DC drives. When the energy crisis occurred in the early 1970s, saving energy became a critical goal, and the use of VFDs quickly spread into large pump applications and eventually into HVAC fan systems.

## Variable frequency drives compared to throttling devices

In many flow applications, a mechanical throttling device is used to limit flow. Although this is an effective means of control, it wastes mechanical and electrical energy. **Figure 1** represents a pumping system using a mechanical throttling valve and the same system using a VFD.

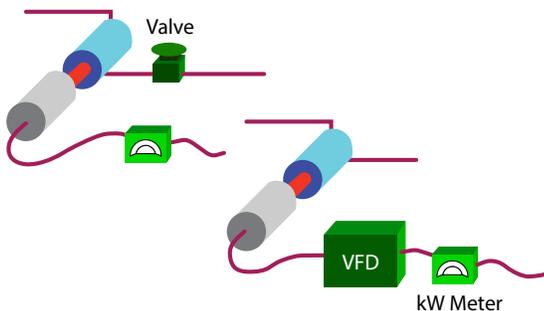


Figure 1. A mechanical throttling device versus a VFD

If a throttling device is employed to control flow, energy usage is shown as the curve in **Figure 2**, while the lower curve demonstrates energy usage when using a VFD. Because a VFD alters the frequency of an AC motor, speed, flow, and energy consumption are reduced in the system. The energy saved is represented by the green shaded area.

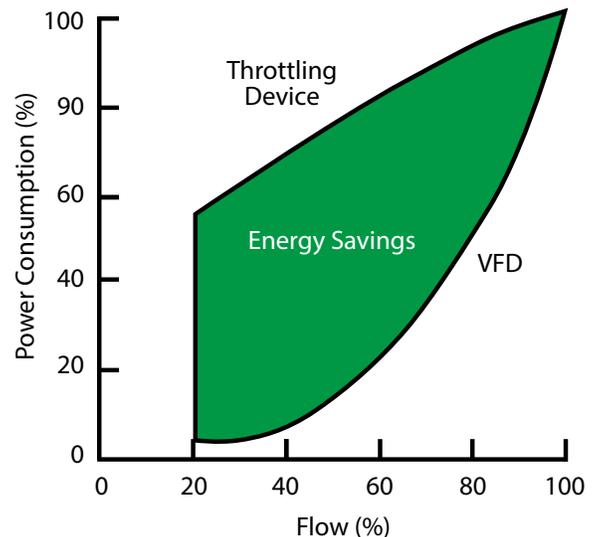


Figure 2. The amount of energy saved by using a variable frequency drive (versus a valve) to control flow

# Capital Cost Savings

When designing and installing a new pumping system, the capital cost of a VFD can often be offset by eliminating control valves, bypass lines, and conventional starters, as explained below.

## Elimination of Control Valves

Control valves are used to adjust pump output to suit varying system requirements. Usually a constant-speed pump is pumping against a control valve, which is partially closed for most of the time. Even at maximum flow conditions, a control valve is normally designed to be 10% shut, for control purposes. Hence, a considerable frictional resistance is applied. Energy is therefore wasted overcoming the added frictional loss through the valve. Using a VFD to control flow can eliminate the control valve.

## Elimination of Bypass Lines

All fixed-speed pumps have a minimum flow requirement. If the pump is operated at flow rates below the minimum for extended periods, various mechanical problems can occur. If the flow requirements in a system can drop below this minimum flow capacity, it is necessary to install a constant or switched bypass to protect the pump. The use of a VFD greatly reduces the volume to be bypassed.

## Maintenance Cost Reductions

Programmable soft starting and stopping reduces shock loads. S-ramp functions provide great reduction, resulting in less stress on system components such as valves and pipe joints. Variable speed control operates the pump at its BEP to greatly reduce vibration when compared to other process control methods. This reduction in vibration significantly extends the life of the pump seals and the time between costly and, in many cases, unscheduled maintenance events. Skip frequencies avoid natural system resonances that may cause high levels of vibration, an enemy of every pumping application.

### Variable frequency drives application in a pump system

Applying a VFD to the pump allows control of the pump's speed electrically while using only the energy needed to produce a given flow. This is similar to applying a new pump with a smaller impeller. **Figure 3** demonstrates the new pump curve and the energy consumed by this method. Also, the pressure is reduced, which helps reduce the mechanical stresses generated by throttling devices.

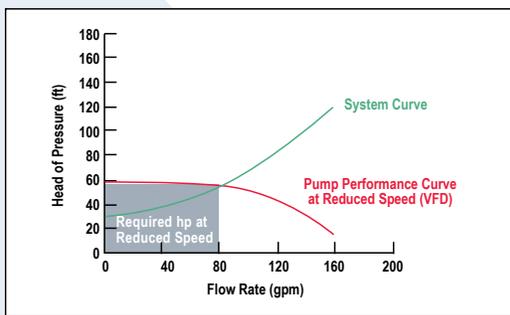


Figure 3. System characteristics using a variable frequency drive

Overlaying the two previous graphs, the difference is obvious in **Figure 4**. The blue shaded area is the energy saved by using a VFD instead of a throttling device.

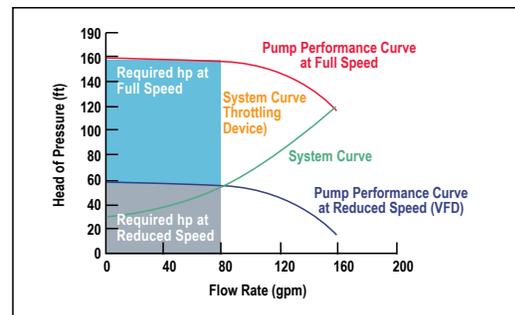


Figure 4. The difference in energy consumption using a throttling device versus a variable frequency drive

# VFD Available on the following pump models

Pentair's line of Aurora Variable Frequency Drive pumping systems are available on our Closed-Coupled and Split-Coupled 382 Vertical In-line pump models.

- 382 Vertical In-line C.C sizes from 1.5x1.5x9B to 8x8x12
- 382 Vertical In-line S.C sizes from 1.5x1.5x9B to 10x10x15
- 200/208/230, 460/480, and 575 VAC
- ODP or TEFC motors up to 60HP
- Supported with Aurora's E.2 pump sizing software

## Standard Product Feature Sets:

- NEMA 1/IP21
- Built-in fusible disconnect – 100K AIC @ 600V
- Basic Cascade control (single drive in multi-pump applications) for across-the-line starting
- Up to two VFD's without separate controller
- Built-in DC link reactors with EMC filters to minimize RFI interface to reduce harmonic noise
- Dry pump & end of curve detection
- 2-Step S-ramps (initial ramp)
- BMS compatible- analogue / digital I/O and RS485 port with Modbus RTU, BACnet, N2 Metasys
- Native BACnet standard
- Fire Mode
- 2 analog inputs, 1 analog outputs
- 4 digital inputs, 2 digital outputs
- 2 programmable relays
- Graphical user interface
- Built-in Disconnects For Each VFD

## Optional Adder Features:

- VFD Bypass (fused or circuit breaker)
- NEMA12IP, NEMA 4X/IP66 enclosure rating available
- Touch screen controller for up to 4 pumps
- Liquid Filled Pressure Gauges (Suction & Discharge)

## Environmental Ratings:

- Temperature: 0-50 degree C
- Maximum Relative Humidity: 93% +2%, -3%

# Pump Features

## 380 Series Specifications

The contractor shall furnish (and install as shown on the plans) Aurora® Models 382A/382A-SC vertical close coupled inline back pull-out centrifugal pumps size \_\_\_ x \_\_\_ x \_\_\_ of (bronze fitted)(all bronze)(all iron) construction.

The suction and discharge flanges shall be located on a common CL 180° apart for mounting inline. Each pump shall have a capacity of \_\_\_GPM at \_\_\_ft. total head, with a temperature of \_\_\_°F, \_\_\_specific gravity.

Each pump is to be furnished with a mechanical seal with all metal parts to be 303 stainless steel with Buna-N elastomers, Ceramic seat and carbon washer. A bypass line must be provided between the seal faces and the discharge flange to assure adequate venting of the seal chamber and to provide lubrication. Impellers are to be dynamically balanced

and keyed to the shaft. Model 382A/382A-SC pumps to include a volute type casing suction branch to minimize pumping noise.

The unit must be equipped with (bronze) (stainless steel) shaft sleeve, keyed, that extends the length of the seal box. Pump shaft extension shall be O-ring sealed from the pumped liquid. Pump casing shall have a case wearing ring (impeller wearing rings). Each pump is to be close coupled to a standard NEMA-JM \_\_\_HP \_\_\_phase \_\_\_Hertz \_\_\_volt \_\_\_ RPM (drip-proof) (total enclosure) (hazardous location) motor up to 60 HP and special TCZ frame motor for HP above 60.

## Limitations

Maximum Limitation Based on Standard Materials and Pumping Clear Water	
Speed	3500 RPM
Horsepower	1150 RPM - 30 1750 RPM - 50 3500 RPM - 60 TCZ FRAME MOTORS - RTF
Temperature °F	Standard 225/Optional 250
Hydrostatic Test Pressure PSI	265
Case Working Pressure PSI (All or Any Part Can Be Suction Free)	175

## Materials of Construction

Description	Material of Construction
Pump Part	Bronze Fitted
Casing	Cast Iron ASTM A48
Impeller	Bronze ASTM B584
Shaft (382A)	Carbon Steel Per Motor Mfg.
Shaft (382A-SC)	Stainless Steel ASTM A582 Type 416
Case Wearing Rings	Bronze ASTM B62
Bushing (382A-SC Only)	Carbon Graphite Matrix
Sleeve (382A Only)	Bronze ASTM B62
Bracket	Cast Iron ASTM A48
Mechanical Seal (STD) Washer Seat Elastomer Metal Parts Spring	Carbon Ceramic Buna-N 303 SS 303 SS

# For applications that require more than two pumps

For the larger ever-increasing needs and complexity of today's water systems that require more than two pumps, Pentair Aurora offers a PLC touch screen control panel with a PID Loop to stage up to four pumps.

This system offers a state of the art combination of the Pentair Variable Frequency Drive for each pump, and a Programmable Logic Controller (PLC) with a Proportional Integral Derivative (PID) Loop to stage up to four pumps based on pressure and flow needs of the building. Pumps are the Pentair PVM multistage and end suction pumps.

Each system is fully assembled, wired and tested for ease of installation providing reliable service and meeting all specification requirements out of the box.

## Touch Screen Color Display - 5.7"

- Audible/Visible Panel Alarm (Configured to Relay Output 1)
- Single Information and Status Screen - Default
- Two to Four Pump Operation
- Constant Pressure Control - PSI
- Constant Flow Control\* - GPM (Requires external Flow x-ducer)
- System Modification while in Operation through Touch Screen
- VFD Remote Hand Control through PLC
- VFD Hand Control Screen includes Complete Control of VFD and Monitoring
- Auto-Detect System Parameters for Pump Operation - Default
- Sequence of Operation: Timed Rotation/Same Lead Pump/1st On-1st Off
- Four Relay Outputs Configurable through Touch Screen with 27 Options for each Relay - System Operation, Alarms, Faults, Digital Inputs, Maintenance
- Maintenance Screen Setup - On Screen Alarm and/or Relay Output
- Faults and Alarm History
- Password Protection for Basic and Advanced Setup (Enable/Disable)
- Password(s) Disable/Enable Bypass
- Screen Saver Option and Settings
- Four Screen Basic Setup for Operation
- Summary Screen Review of Basic Settings  
Maximum and Minimum Speeds Allowed for Controller and VFD
- Discharge: Transducer Settings, Setpoint, Alarms and Faults
- Suction: Transducer Settings, Alarms and Faults
- Flow: Transducer Settings, Setpoint, Alarms and Faults
- Real Time Operation and Control
- Built-in Disconnects For Each VFD



# Complete Control with IntelliManager™

## Customize, Monitor, Maintain

The IntelliBoost™ Variable Speed Constant Pressure Booster System is controlled using our latest technology, IntelliManager. Configure the system settings to your exact needs and tolerances.

Monitor your system from anywhere in the world when it is connected using the built in Ethernet connection. Use your computer, or mobile device to access the built in web page, giving you the statistics and information needed to properly monitor a booster system.

IntelliManager will continually monitor performance and sound an alarm if any of your pre-determined tolerances are reached. System faults protect your investment by automatically shutting down the system when tolerances are exceeded.

	Actual	Setpoint		Additional Hardware
Discharge PSI	999.9	999.9	Maintenance Alarm Active	Ethernet SD Card
Suction PSI	999		Flow Switch	
Flow GPM	999	999	Off	
Pump #	1	2	3	4
Status	ON	ON	ON	ON
Speed (Hz)	99.9	99.9	99.9	99.9
VFD Mode	Auto	Auto	Local	Local
Comm Status	OK	OK	OK	OK
Sequence	Lead	Lag 1	Lag 2	Lag 3

**PENTAIR** Alarm Active 99/99/99 hh:mm AM Fault Active Menu

Realtime system operation, status, settings and hardware. Alarms, faults and maintenance indicators are active when set by operator.

Some examples of actual screens you will find in the IntelliBoost Variable Speed Constant Pressure Booster System, IntelliManager.

### Basic Setup 2

Select Number of Pumps for System Operation.  
4 Pumps in the System  
may be operated as 2, 3 or 4 Pump Operating System.  
3 Pumps in the System  
may be operated as 2 or 3 Pump Operating System.

Number of Pumps in System to Operate: < 4 >

Pump Control Response to System Changes:  
Low (slower pump reaction, smooth demand transition)  
High (fast reaction to higher demands)

Back < Low > Next

Easily configure the number of pumps in operation.

### Basic Setup 4

Transducer Failure Settings:  
Fault will stop all Drives when in Auto Mode  
Alarm will Allow Drives to Run when in Auto Mode at Speed Setting

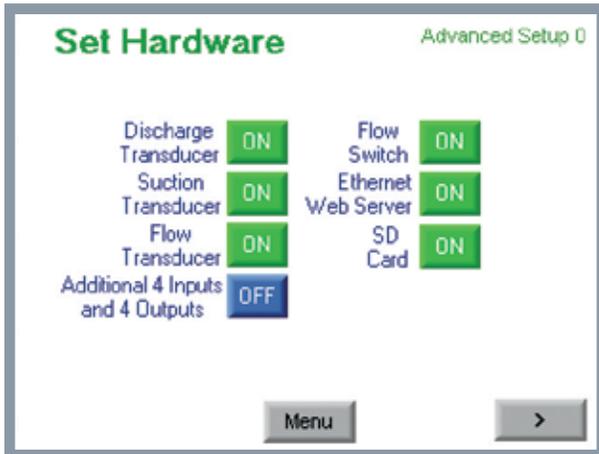
Alarm Alarm Speed Setting: 99.9 Hz

Password Setup: Enter Password/Pin(4) Numbers  
Disabled 9999

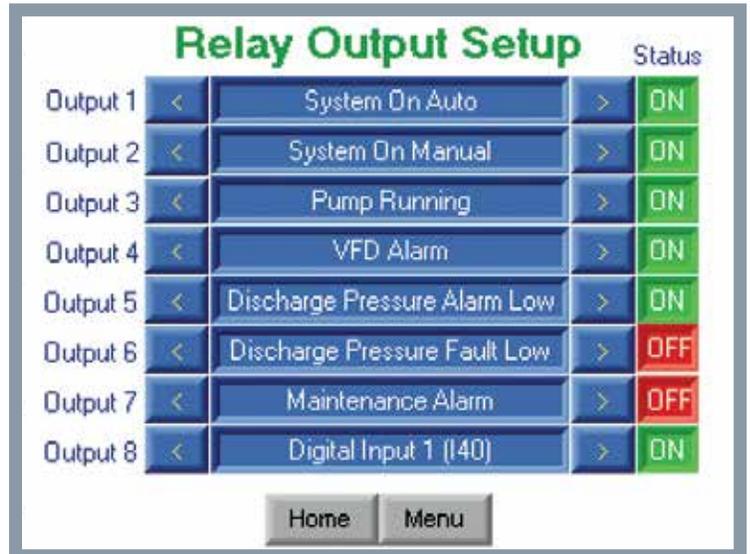
Screen Saver Setting:  
OFF 9999 Min.

Back < > Next

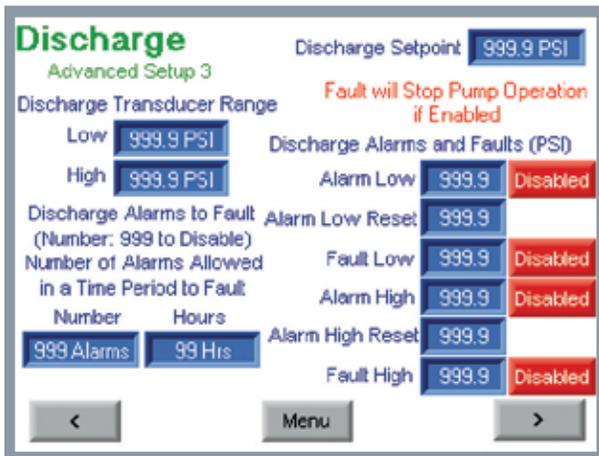
Customizable settings can be entered throughout the software to configure the system to your exact needs.



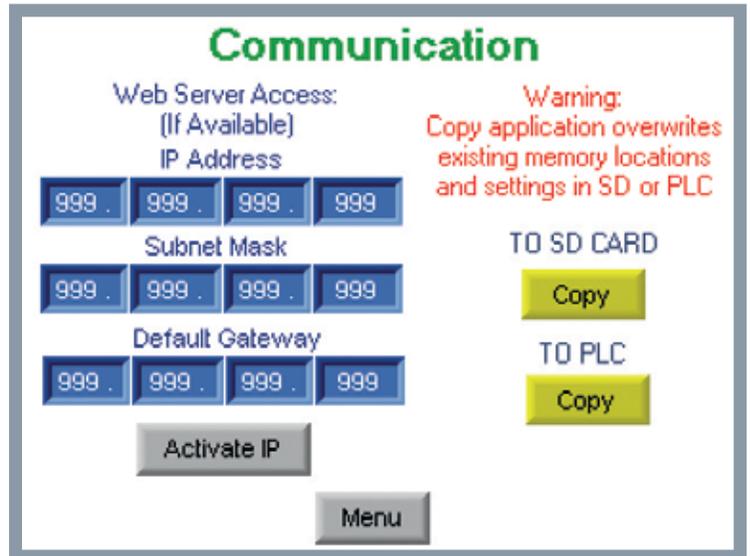
Hardware settings are factory set to match the exact hardware in your system.



Monitor the system through the use of four standard relays. An additional four relays may be added to the system as an option.



Determine your Alarm and Fault tolerances. Alarms will reset once operating conditions return to normal. Faults will cause the system to stop operating, resulting in operator assistance.



Use the available SD card to transfer information, or connect the system to your network using the built-in Ethernet port. When connected using Ethernet, you are able to view the system performance and operation from any computer or mobile device with web access.



Alarm Setting	Pump 1	Pump 2	Pump 3	Pump 4
Starts	999999	999999	999999	999999
Default	999999	999999	999999	999999
# of Starts	999999	999999	999999	999999
Pump Hours	999999	999999	999999	999999
Default	999999	999999	999999	999999
Total Hours	999999	999999	999999	999999
Motor Hours	999999	999999	999999	999999
Default	999999	999999	999999	999999
Total Hours	999999	999999	999999	999999
VFD Hours	999999	999999	999999	999999
Default	999999	999999	999999	999999
Total Hours	999999	999999	999999	999999

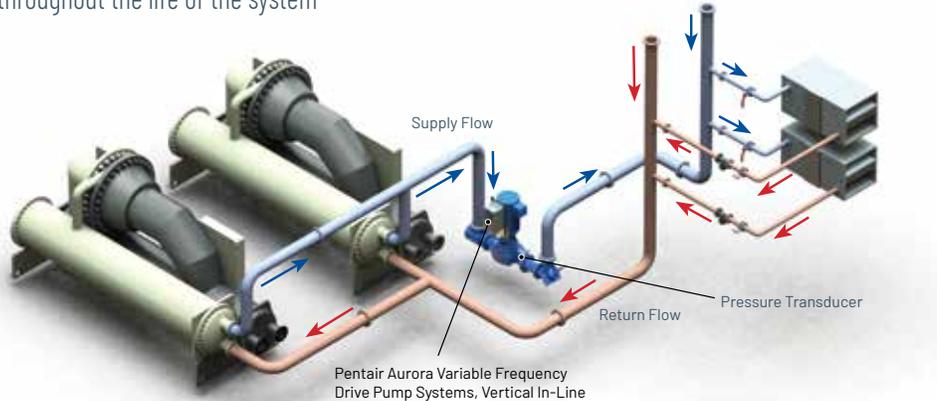
Set Default to -1 to Disable Alarm

Maintenance alarm screen provides the operator with complete statistics, helping determine what maintenance is needed.

# Single Loop Chiller Flow

## Heating and Chiller water systems with Aurora Vertical In-Line pump integrated with Variable Frequency Drives

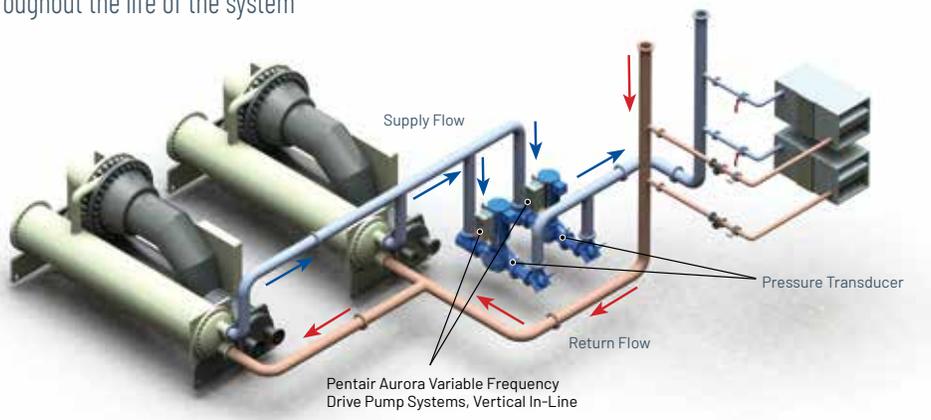
- Aurora 382 Vertical In-Line with Integrated VFD
- Pre-programmed from factory to match VFD to motor parameters
- Standard integrated communication specific to the HVAC market
- Aurora provides precise (no guessing) feedback signal to provide required pressure throughout the life of the system
- VFD's capable to withstand today's jobsite environment without the need for additional enclosure or derate for ambient temperature. Options available for NEMA 4 X / IP66 protection and standard 50 degree C rated
- Standard built-in fusible disconnect with 100K short circuit rating



# Double Loop Chiller Flow

## Heating and Chiller water systems with Aurora Vertical In-Line pumps integrated with Variable Frequency Drives

- Aurora 382 Vertical In-Line with Integrated VFD
- Pre-programmed from factory to match VFD to motor parameters
- Standard integrated communication specific to the HVAC market
- Aurora provides precise (no guessing) feedback signal to provide required pressure throughout the life of the system
- VFD's capable to withstand today's jobsite environment without the need for additional enclosure or derate for ambient temperature. Options available for NEMA 4 X / IP66 protection and standard 50 degree C rated
- Standard built-in fusible disconnect with 100K short circuit rating



800 Airport Road | North Aurora, Illinois 60542 | [www.AuroraPump.com](http://www.AuroraPump.com)

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# PENTAIR® AURORA® 410 SERIES SINGLE STAGE SPLIT CASE PUMPS

**Capacities to 15000 GPM (3407 m<sup>3</sup>/hr)**

**Heads to 663 Ft. (202 m)**

**Temperatures to 275°F (135°C)**

## **TRUSTED TECHNOLOGY. MODERN DESIGN.**

Horizontal split case pumps are a tried-and-true technology that have been trusted for generations to reliably pump water and other low-viscosity fluids in a variety of applications. Their simple design and rugged construction make them ideal for industrial, agricultural, and commercial settings.

Aurora 410 Series Pumps offer a modern contribution to that trusted design. The result is a pump that is best-suited to your specifications, while offering the performance and dependability you expect.

### **MODEL 411**

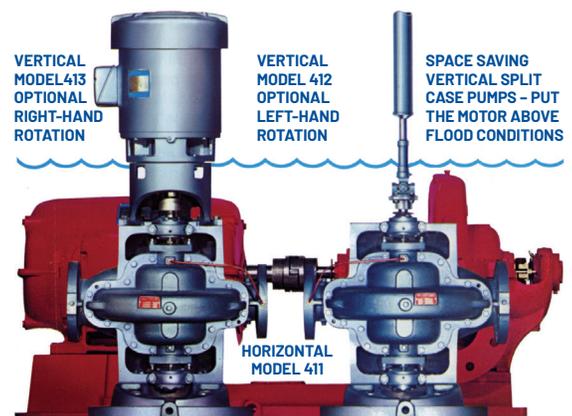
Horizontally baseplate mounted with a driver flexibly coupled to the pump. Recommended for installations with ample floorspace and no possibility of flooding.

### **MODEL 412**

Vertically mounted and uses flexible shafting between the driver and pump. Recommended for installations where flooding is possible.

### **MODEL 413**

Vertically mounted with an elevated driver coupled directly to the pump through a flexible coupling. Recommended for installations with limited floorspace and marginal possibilities of flooding.



# PUMP FEATURES

## STANDARD FEATURES

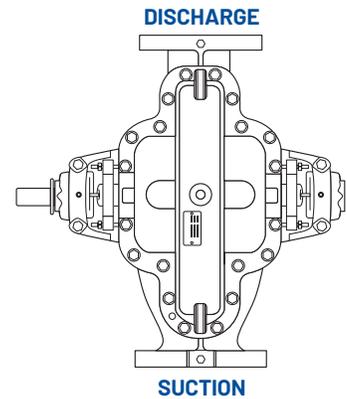
- ◆ Bronze fitted pump construction
- ◆ Bronze shaft sleeves
- ◆ Dynamically balanced impellers
- ◆ Bronze case wearing rings
- ◆ Twin volute on 10" and larger pumps
- ◆ Stainless steel impeller key
- ◆ Regreasable ball bearings
- ◆ Single row ball bearing (inboard)
- ◆ Double row ball bearing (outboard)
- ◆ Mechanical seals, single unbalanced (Models 412 and 413)
- ◆ Graphite and TFE lubricated acrylic packing

- ◆ Internal bypass between casing and stuffing box
- ◆ 125# ASA flanges
- ◆ 250 psi case working pressure
- ◆ Carbon steel shaft
- ◆ Stuffing box bushings
- ◆ Lifting lugs
- ◆ Hydrostatic test
- ◆ Cast integral bearing arms
- ◆ Water slingers and grease seals
- ◆ External bypass between casing and stuffing box (Models 412 and 413)
- ◆ Coupling guard (Model 411)

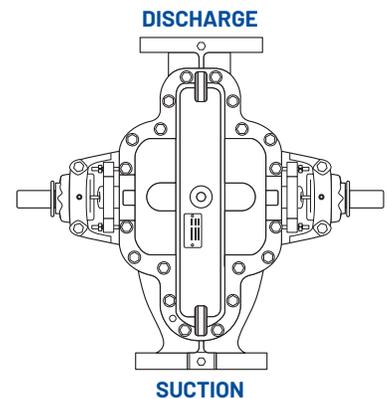
## OPTIONAL FEATURES

- ◆ All iron or specialty alloy pump construction
- ◆ Hardened 440C stainless steel shaft sleeves (packing only)
- ◆ 316 stainless steel shaft sleeves (mechanical seal)
- ◆ Impeller wearing rings
- ◆ Oil lubricated ball bearings (Model 411 horizontal pump)
- ◆ Mechanical seals
  - ◆ Single unbalanced (Model 411)
  - ◆ Single balanced (all models)

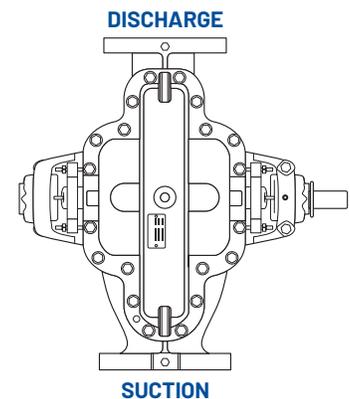
- ◆ Stainless steel or Monel® shaft
- ◆ External bypass between casing and stuffing box (Model 411)
- ◆ Steel drip rim, formed steel or fabricated steel bases
- ◆ Double extended shaft (Model 411)
- ◆ Right- or left-hand rotation
- ◆ Certified performance test
- ◆ Packing with lantern ring (Model 411)
- ◆ 250# ASA suction and discharge flanges
- ◆ Water cooled cartridge caps



**STANDARD  
RIGHT HAND ROTATION**

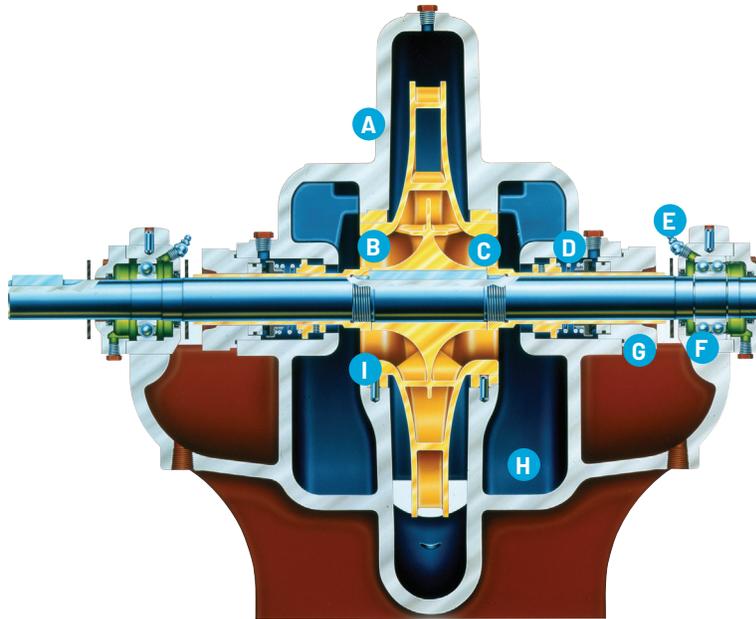


**OPTIONAL DUAL DRIVE  
RIGHT HAND ROTATION**



**OPTIONAL  
LEFTHAND ROTATION**

# HORIZONTAL PUMP FEATURES



## A. SPLIT CASE DESIGN

- ◆ Design makes service or inspection simple by removal of upper casing without disturbing suction and discharge piping and alignment
- ◆ Computer-machined major components with 360-degree registered fits assure concentricity of all parts
- ◆ Twin volute design balances radial hydraulic thrust loads on larger split case pumps (see range charts)

## B. DYNAMICALLY BALANCED IMPELLER

- ◆ Keyed to shaft and secured by adjustable shaft sleeves
- ◆ Double suction design balances hydraulic thrust loads
- ◆ Vacuum cast process and proven design provides superior efficiency and performance

## C. BRONZE SHAFT SLEEVE

- ◆ Slip fit over the shaft, keylocked and extends the entire length of each stuffing box to prevent shaft wear
- ◆ Shaft sleeves and impeller are O-ring sealed to help reduce likelihood of shaft corrosion, which helps avoid the need for high-cost, special stainless or Monel® shafts.

## D. INTERCHANGEABLE STUFFING BOX

- ◆ Allows use of mechanical seals or packing
- ◆ Optional lantern rings with internal water seal passages between the casing and stuffing box to help prevent damage
- ◆ Mechanical seals have carbon against ceramic face
- ◆ 303 stainless steel parts and Buna-N® elastomers help ensure long life
- ◆ Several mechanical seal options available

## E. GREASE LUBRICATION

- ◆ Purges old grease from bearing
- ◆ Oil lubrication optional on horizontal pumps
- ◆ Fittings conveniently located provide quick access and positive bearing lubrication
- ◆ Oil seals and nonsparking neoprene rotating slingers protect bearings during operation and washdowns

## F. BEARINGS

- ◆ Provide 50,000-hour minimum life at maximum load
- ◆ Double row thrust ball bearing standard on all models
- ◆ Short bearing span holds shaft deflection to .002" at face of stuffing box at maximum load
- ◆ Integral bearing arms help eliminate bearing misalignment and simplify service

## G. LEFT-HAND ROTATION

- ◆ Available with standard parts – tandem drive pumps only require a different shaft

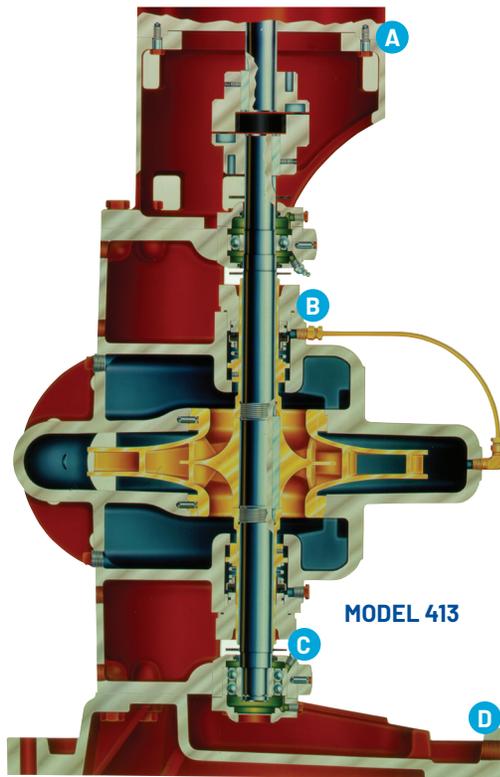
## H. CERTIFIED PERFORMANCE

- ◆ Certification with positive suction pressure or with a suction lift is available on each pump for customer approval – pumps are all hydrostatically tested

## I. CASE WEARING RINGS AND THROTTLE BUSHINGS

- ◆ Prevent wear on the pump casing
- ◆ Easy and cost-effective to replace

# VERTICAL PUMP FEATURES



## KEY FEATURES

### A. COUPLING ALIGNMENT

- ◆ Mounting bracket is rabbet fitted to the motor to help enable long life and proper performance

### B. MECHANICAL SEALS

- ◆ Standard construction includes carbon against ceramic face for optimum hot water performance
- ◆ 303 stainless steel parts and Buna-N® elastomers help provide long life

### C. BEARING PROTECTION

- ◆ Grease seals and water slingers protect the bearings from contamination (also standard on horizontal pumps)

### D. CAST IRON DRIP RIM BASE

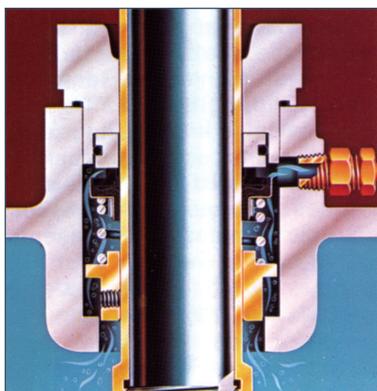
- ◆ Mounting base helps assure accurate positioning of the pump
- ◆ Integral drip rim controls condensation and leakage

## BENEFITS

Vertical pumps allow you to place two pumps where only one horizontal would fit. Pentair Aurora Space-Saving Vertical Split Case Pumps are known for their reliability, and the Model 413 builds on that reputation.

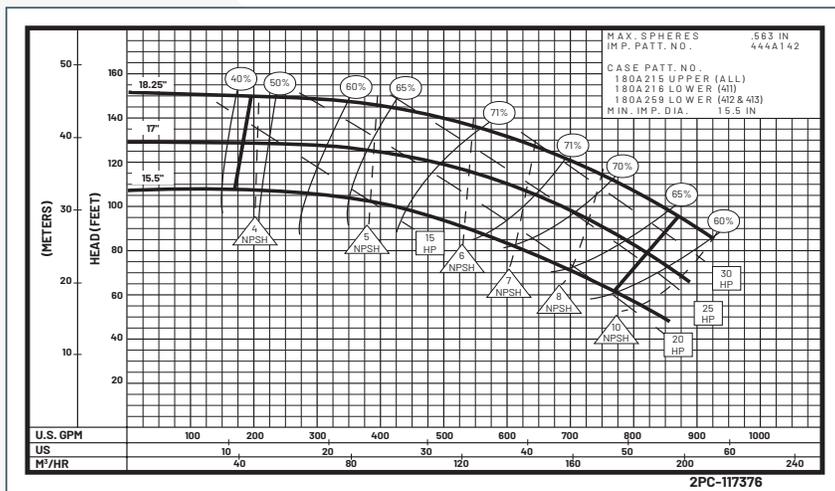
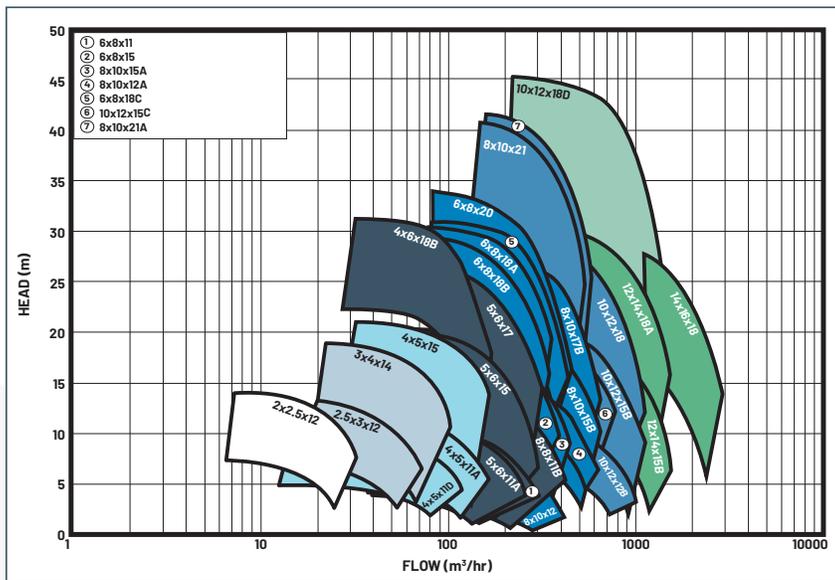
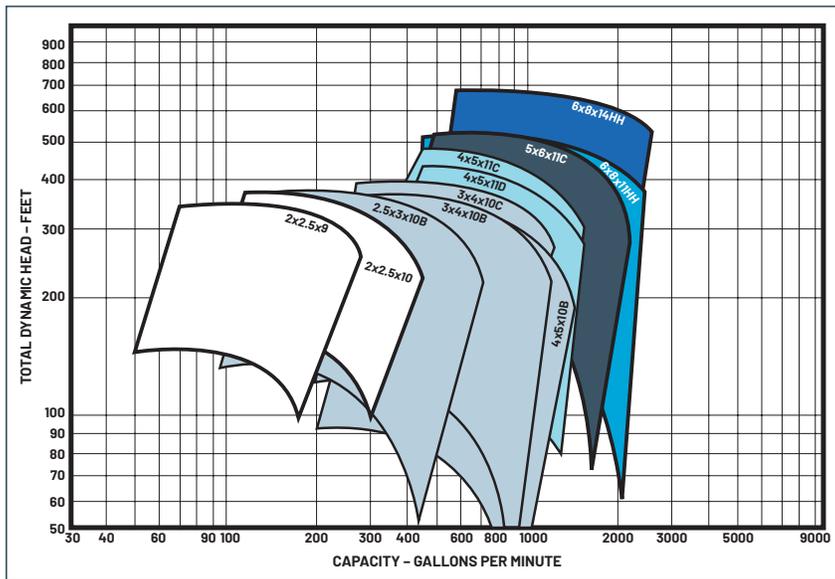
Vertical pumps offer distinct advantages over horizontal pump construction.

- ◆ They require less floor space
- ◆ In-line piping arrangement allows piping in any direction
- ◆ Elevated motor helps protect against potential flooding

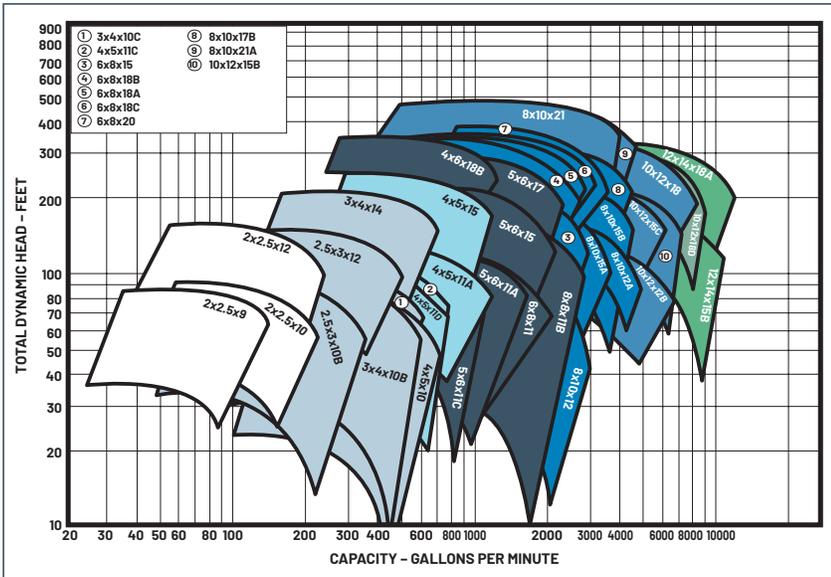
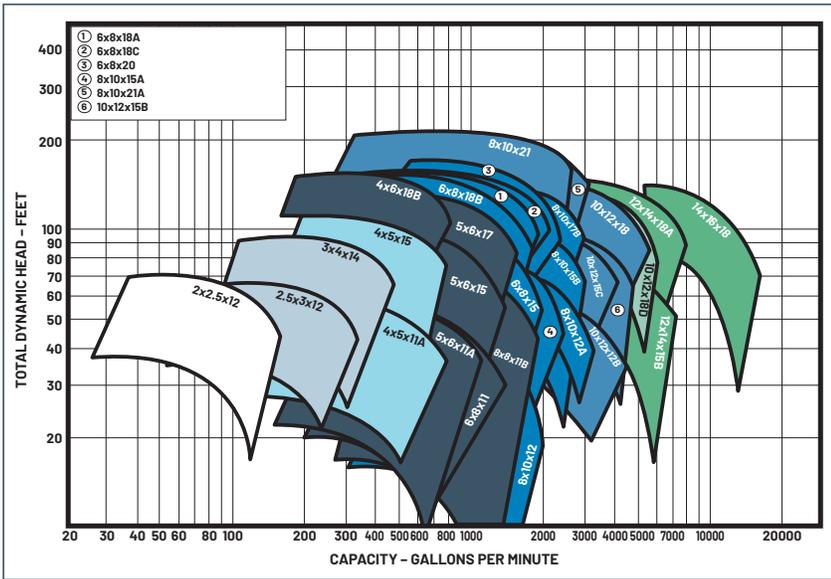


EXTERNAL UPPER SEAL FLUSH

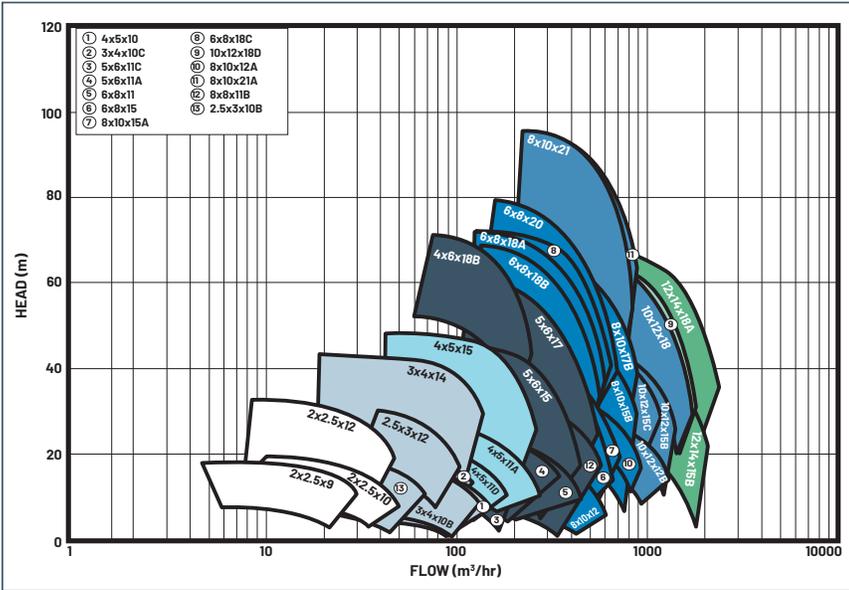
# RANGE CHARTS



# RANGE CHARTS



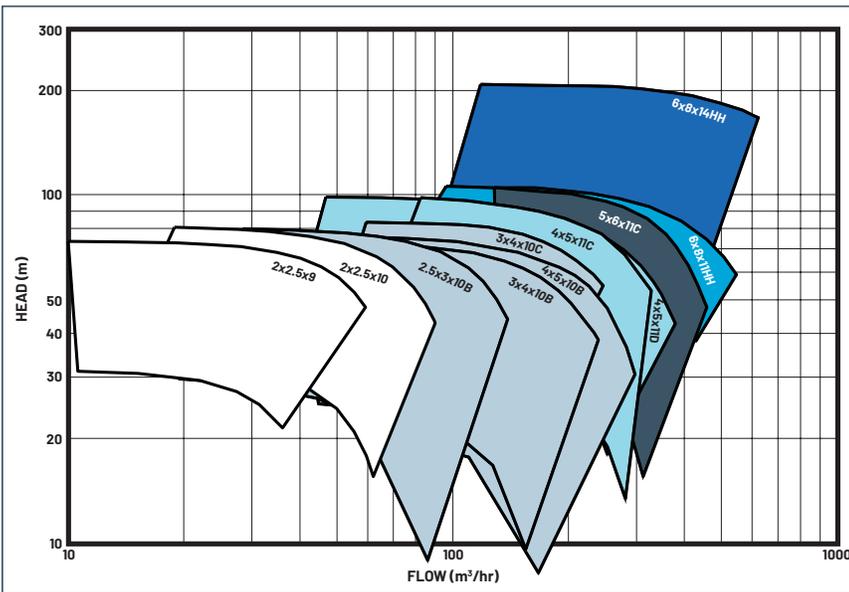
# RANGE CHARTS



## 1500 RPM

Individual performance curves should be checked for final selection.

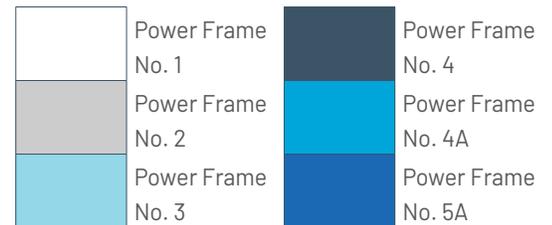
For selections not shown on this chart, please refer to the factory.



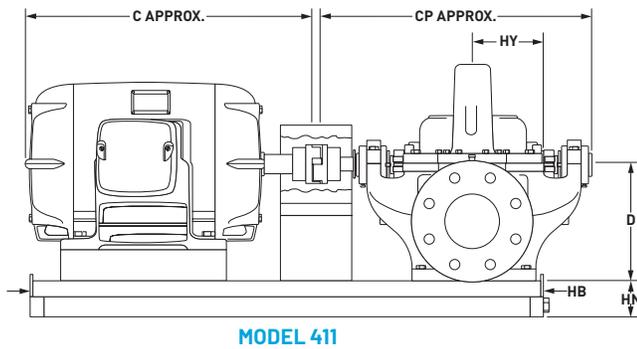
## 3000 RPM

Individual performance curves should be checked for final selection.

For selections not shown on this chart, please refer to the factory.



# PUMP DIMENSIONS



## NOTES – APPLIES TO ALL MODELS:

May not be used for all pump sizes in this power series. Consult individual dimension pages for final selection.

- † For motor and baseplate dimensions over 200 HP, refer to the factory.
- 1. Dimensions and weights are approximate.
- 2. See dimensional data sheets available on Pentair.com for complete dimension information.
- 3. Frame sizes shown are for open drip-proof motors only.
- 4. Add pump, base and motor weight for unit total weight.
- 5. Conduit box is shown in approximate position. Dimensions are not specified as they vary with each motor manufacturer.
- 6. Pentair Aurora reserves the right to make revisions to its products and their specifications and to this brochure and related information without notice.
- 7. 10x12x18 and 12x14x15 pump sizes are also available as bottom suction horizontal Model 411B pumps. See individual dimension pages for complete dimensions.

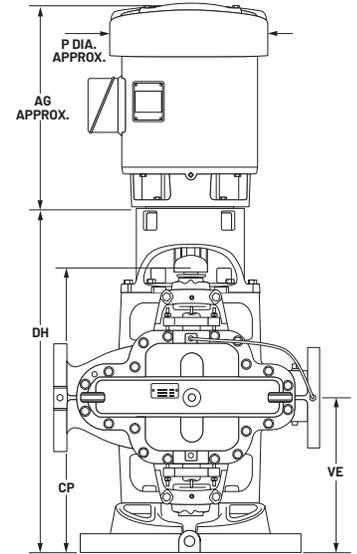
MOTOR FRAME	MODEL 413	143 HP	145 HP	182 HP	184 HP	213 HP	215 HP	254 HP	256 HP	284 HPH	286 HPH	324 HP	326 HP	364 HP	365 HP	404 HP	405 HP	444 HP	445 HP										
	MODEL 411	143 T	145 T	182 T	184 T	213 T	215 T	254 T	256 T	284 TS	286 TS	324 TS	326 TS	364 TS	365 TS	404 TS	405 TS	444 TS	445 TS										
HP	3500 RPM	1-1/2	2-3	5	7-1/2	10	15	20	25	30	-	40	-	50	-	60	-	75	-	100	-	125	-	150	-	200†	-	-	-
	1750 RPM	1	1-1/2-2	3	5	7-1/2	10	15	20	-	25	-	30	-	40	-	50	60	-	75	-	100	-	125	-	150	-	200†	-
	1150 RPM	-	1	1-1/2	2	3	5	4-1/2	10	-	15	-	20	-	25	-	30	-	40	-	50	-	60	-	75	-	100	-	125
MOTOR WGT.	MODEL 411	40	45	72	80	130	145	220	240	330	330	370	370	475	475	525	525	630	630	690	690	830	830	915	915	1095	1095	1270	1270
	MODEL 413	43	48	84	102	132	156	300	300	420	420	420	420	570	570	570	570	950	950	950	950	1230	1230	1230	1230	1680	1680	1680	1680
C		12	13	13	14	16	18	21	23	22	24	24	25	25	26	26	28	27	29	28	30	30	33	31	34	34	38	36	40
D (SEE NOTE***)		3-1/2	3-1/2	4-1/2	4-1/2	5-1/4	5-1/4	6-1/4	6-1/4	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11
P APPROX.		8	8	10	10	11	11	13	13	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	26	26	26	26
AG APPROX.		11	12	14	15	16	17	20	21	22	23	23	23	25	25	26	26	25	25	25	25	28	28	28	28	32	32	32	32

		MODEL 411 BASE NUMBER																												
PWR. SERIES MODEL 411	1	3	3	3	3	3	3	8	8	8•	-	8•	-	11•																
	2	3	3•	3•	3•	5	5	8	8	9	9	9	9	11•	12	11•	12	12	-	12										
	3				5•	8	8	8	9	11	11	11	11	12	12	12	12	12	-	12	-	15•	-	15•						
	4					6•	6•	9	9•	-	11	-	11	11	11	12	12	12•	12•	12•	12	16•	-	16•	-	16•	-	16•	-	16•
	5							11	11	-	12	-	12	-	12•	-	12	12	12	12	13	16	16•	16•	16•	16•	16•	16•	16•	-
	6B												13	-	13•	-	13•	-	13•	13•	13	17	17•	17	17	17	17	17	17	18
	7																						17•	-	17•	17•	18	18	18•	

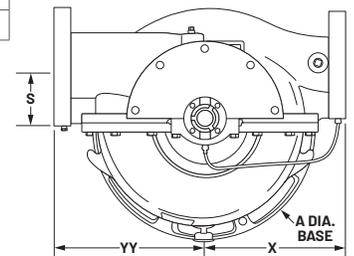
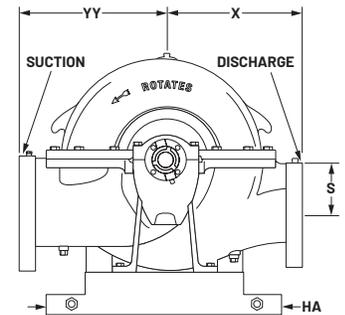
BASE	3	5	6	8	9	11	12	13	15	16	17	18	Flanges – ASA Std.	Furnished As:
BASE WGT.	49	59	68	96	109	164	192	235	291	344	399	441	250# with 125# drilling	Standard
HA	15	17-1/4	17-1/4	20-1/2	20-1/2	26-3/4	26-3/4	26-3/4	30-3/4	30-3/4	30-3/4	30-3/4		
HB	33-1/2	36-1/2	42-1/2	42-1/2	48-1/2	46-1/2	54-1/2	64-1/2	54-1/2	64-1/2	74-1/2	82-1/2	250# with 250# drilling	Optional
HN	3	3	3	3	3	4	4	4	4-1/2	4-1/2	4-1/2	4-1/2		

# PUMP DIMENSIONS

PUMP SIZE	DISCHARGE	SUCTION	BORE	PWR. SERIES	PUMP WGT. (LBS.)		A	D**	S	X	CP	HY	VE	YY	
					411	413									
2x2.5x9	2	2-1/2	9	1	145	215	18	7	3-1/2	8-1/2	21	4-1/2	11-1/8	9	
2x2.5x10	2	2-1/2	10		145	215	18	7	3-1/2	8-1/2	21	4-1/2	11-1/8	9	
2x2.5x12	2	2-1/2	12		175	260	18	8	4	10	21	4-1/2	11-1/8	10-3/4	
2.5x3x10	2-1/2	3	10	2	215	300	18	8	4	9-3/4	24	5-1/2	13	10	
2.5x3x12	2-1/2	3	12		255	360	18	9	4-1/2	11	24	5-1/2	13	11-1/2	
3x4x10	3	4	10		260	365	18	9	4-1/2	10	24	5-1/2	13	11	
3x4x14	3	4	14	3	310	435	18	10	5	12	24	5-1/2	13	13	
4x5x10	4	5	10		330	465	18	9	4-5/8	10	24	5-1/2	13	11-1/4	
4x5x11	4	5	11		390	435	22	10	5	11-1/4	26	6-1/2	14	12-3/4	
4x5x15	4	5	15	4	415	490	22	11	5-1/2	13	26	6-1/2	14	14	
4x6x18	4	6	18		560	780	22	12-1/2	6-1/4	14	29	6-1/2	15	16	
5x6x11	5	6	11		455	580	22	11	5-1/2	11-1/4	29	6-1/2	15	13-1/4	
5x6x15	5	6	15	5	530	735	22	12-1/2	6-1/4	13-1/4	29	6-1/2	15	15	
5x6x17	5	6	17		635	855	22	12-1/2	6-1/4	14	29	6-1/2	15	15	
6x8x11	6	8	11		520	650	22	12-1/2	6-1/4	11-3/4	29	6-1/2	15	14-1/2	
8x8x11	8	8	11	6B	605	835	22	12-1/2	6-1/4	12	29	6-1/2	15	14-1/2	
6x8x11HH	6	8	11HH		4A	990	1095	22	13-3/16	8-5/8	10	32-3/4	8-1/2	17-1/8	15
6x8x14HH	6	8	14HH		5A	1190	1410	30	13-3/16	7-1/2	15	36-3/4	8-1/2	19-7/16	17
6x8x15	6	8	15	7	585	735	30	13-1/2	6-3/4	14-1/4	32	7-1/2	17	16-3/4	
6x8x18	6	8	18		800	1020	30	14-3/4	8	16	32	7-1/2	17	18	
6x8x20	6	8	20		875	1095	30	14-3/4	8	15-3/4	32	7-1/2	17	18	
8x10x12	8	10	12	7A	740	925	30	14-3/4	8*	17	32	7-1/2	17	17-3/4	
8x10x15	8	10	15		835	1040	30	14-3/4	8*	17	32	7-1/2	17	17-3/4	
8x10x17	8	10	17		865	1085	30	14-3/4	8	17	32	7-1/2	17	17-3/4	
8x10x21	8	10	21	7	955	††	††	18-1/2	9-1/2	18	38	11-1/2	-	21	
10x12x12	10	12	12		1325	1575	40	23	12	16	38	11-1/2	-	19	
10x12x15	10	12	15		1390	††	††	25	13-1/2	17	38	11-1/2	-	20	
10x12x18	10	12	18	7	1725	††	††	25	13-1/2	18	38	11-1/2	-	22	
10x12x18D	10	12	18D		7A	1920	††	††	25	12-1/4	20	42-15/16	11-1/2	-	24
12x14x15	12	14	15		2000	††	††	24	15	17	44	11-1/2	-	22	
12x14x18	12	14	18	7	2100	††	††	24	15	18	44	-	-	23	
14x16x18	14	16	18		2850	††	††	29-1/4	16	22	44	-	-	27	



**MODELS 412 AND 413**



**MODEL 411**

**MODELS 412 AND 413**

PWR. SERIES		1	2	3	4	5
DH	Up to 256 hp	26	30	33	35	-
	284 hph and up	28	32	35	37	41
CP		23	27	29	31	35

**NOTES - APPLY TO ALL MODELS:**

- \* Add 1" for true discharge centerline.
- \*\* Always use largest of 2 "D" dimensions.
- †† These pump sizes are available in a vertical chair mount configuration in Models 412 and 413. See individual dimensions pages for complete dimensions and weights.

# ENGINEERING SPECIFICATIONS

## MODELS 411, 412 AND 413 SPLIT CASE BASE MOUNTED

Furnish and install as shown on the plans \_\_\_\_ Right-hand (Left-hand) Pentair Aurora Model (Horizontal - 411) (Vertical - 412 Open Shaft) (Vertical - 413 Flexible Coupled) type Split Case, Double Suction, Single Stage centrifugal pump, size \_\_\_\_x\_\_\_\_x\_\_\_\_ of bronze fitted (all bronze)(all iron)(stainless steel) construction. The pump shall be capable of delivering at design conditions a capacity of \_\_\_\_ GPM when operating against a Total Dynamic Head of \_\_\_\_ feet, with a temperature of \_\_\_\_ °F, specific gravity \_\_\_\_\_. Pump shall have minimum guaranteed efficiency at design capacity of \_\_\_\_%. Pump must also be capable of delivering a maximum of \_\_\_\_ GPM when operating against a head of \_\_\_\_ feet, and at this condition shall have a minimum efficiency of \_\_\_\_%. Minimum shut-off head acceptable will be \_\_\_\_ feet. Pump shall operate at a maximum synchronous speed of \_\_\_\_ RPM.

A unit operating at a lesser rotative speed will be considered, but in no event will a pump operating at more than the maximum speed specified be acceptable. The pump casing halves shall be of the inline piping design and will be constructed of Class 30 cast iron having a minimum tensile strength of 30,000 psi and shall be of sufficient thickness to withstand stresses and strains at full operating pressures.

Casings shall be subject to a hydrostatic pressure test at 150% of the specified duty point. Bearing housing supports, suction and discharge flanges shall be integrally cast with the lower half of the casing. Removal of the upper half of the casing must allow the rotating element to be removed without disconnecting the suction and discharge flanges. The upper casing is to be dowel aligned to the lower casing.

Pump sizes 10" and larger are to be of the twin volute design. Drain openings must be provided in the bearing arms for

removal of lubricating liquid. Impeller shall be of the enclosed double suction type and shall be vacuum cast bronze (\_\_\_\_). Impeller shall be dynamically balanced and securely fastened to the shaft by key and screw locked shaft sleeves. The vanes shall be designed to reduce noise. The pump shaft shall be made of high grade SAE 1045 steel or equal, accurately machined to give a true running rotating element. The minimum dia. acceptable will be \_\_\_\_". The shaft shall be protected from wear by bronze (\_\_\_\_) sleeves which are key locked and threaded so that the sleeves tighten with the rotation of the shaft. Buna® O-rings must be provided between the impeller hub and the shaft sleeves to prevent pumped liquid from corroding the shaft.

Pump shall be equipped with easily renewable bronze (\_\_\_\_) casing rings (impeller wearing rings) so designed that hydraulic pressure will seat them against a shoulder in the pump case around the full periphery of the wearing ring. The wear rings will be locked in place by the doweling to prevent rotation. The rotating element shall be mounted in heavy duty grease lubricated ball bearings and shall be equipped with water strainers on side next to pump glands.

Bearing housings shall be so designed to flush lubricant through and provide continuous cleaning of bearing surfaces and protection against overheating. The pump shall be supplied with a single row inboard bearing primarily for radial loads and double row outboard bearing primarily for thrust loads. Both bearings shall be regreaseable lubrication ball type, designed for 50,000 hours average life. Each bearing shall be mounted in a machined housing that is moisture- and dust-proof. The housing shall have registered fits to assure alignment, pinned to prevent rotation and bolted to the bearing arms. Each housing shall be supplied with a grease fitting and a plugged relief port.

# ENGINEERING SPECIFICATIONS

## MODEL 411

Stuffing boxes shall be placed on both sides of the pump centerline to seal the pump shaft. All packed pumps having a suction lift shall be provided with lantern rings connected to the pressure side of the pump by cored passages in the parting flange of the pump. The stuffing boxes shall be equipped with heavy, cast, split glands with extra length, for easy removal for packing inspection and maintenance. Pump and motor shall be mounted on a common heavy baseplate of (steel with drip rim)(formed steel)(structural steel). Pump and motor must be checked for alignment after the pump base has been installed and grouted in place, in accordance with the standards of the Hydraulic Institute. There shall be no strain transmitted to the pumps.

## MODELS 412 AND 413

Mechanical seal boxes shall be placed on both sides of the pump centerline to seal the pump shaft. Each pump is to be furnished with mechanical seals with all metal parts to be 303 stainless steel with Buna-N® elastomers, ceramic seat, and carbon washer. A bypass line must be provided for the upper seal between the seal faces and the discharge flange to assure adequate venting of the seal chamber and to provide lubrication. All pumps shall be provided with cored passages in the parting flange of the pump to provide additional circulation to both seals. The mechanical seal boxes shall be equipped with heavy, cast, one piece O-ring sealed glands. The pump shall be supported by a cast iron drip rim base.

## MODEL 412

Vertical open shaft pumps are to be driven through flexible shafting with dia. tubing and intermediate bearings. Shafting must be of sufficient size to transmit required HP and must be provided with a slip spline which will permit removal of the pump rotating assembly without removing any section of intermediate shafting, bearings, suction or discharge piping.

## MODEL 413

Vertical flexible coupled pumps shall be furnished with a cast iron motor bracket which is to be bolted to the vertical casing. The motor bracket must be machined with a register fit to ensure proper alignment of motor and pump shaft.

## MODELS 411 AND 413

The pumps shall be flexible coupled to a standard (horizontal) (vertical) NEMA®, \_\_\_ hp, \_\_\_ phase, \_\_\_ hertz, \_\_\_ volts, \_\_\_ RPM (drip-proof)(tot. encl.)(hazardous location) motor.



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