



KALAY-E-PUMP Company...

... established in 1972 and as one of the pioneers of the pump industry started manufacturing industrial pumps in Iran and more than 3000 sets of Kalay-e-Pump products are being operated in Oil, Gas, Petrochemical and Power Plant industries up to now.

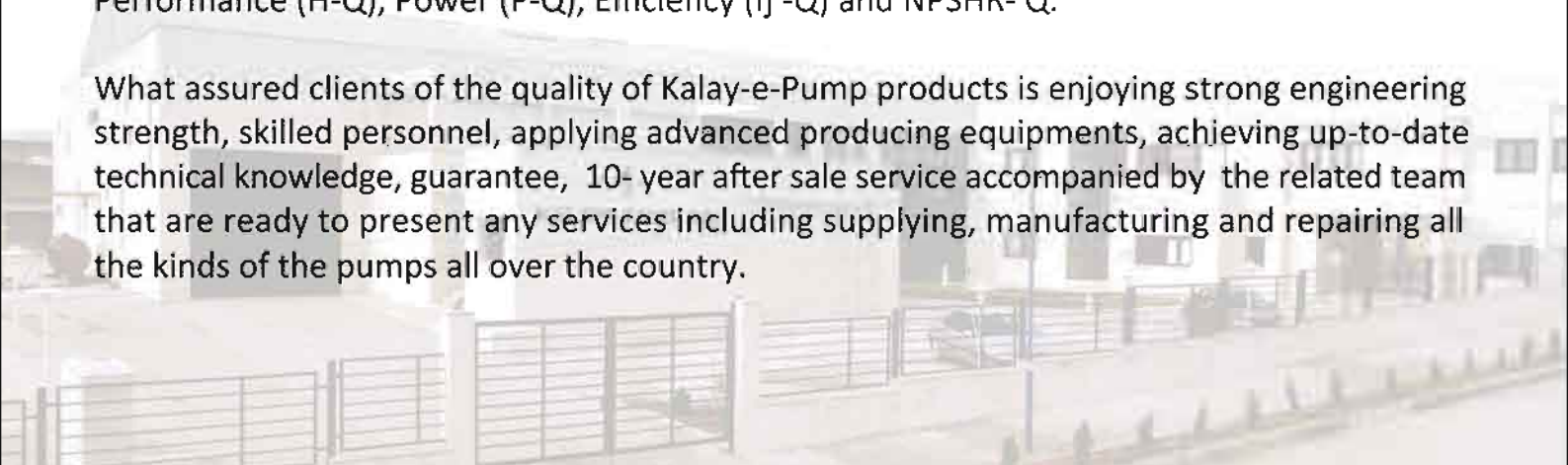
In 1999 this company as the first Iranian pump manufacturer obtained Standard ISO 9002:1994 from SGS of Switzerland, succeeded in promoting and positioning the quality management system according to Standard ISO 9001: 2000 of TUV SAARLAND of Germany in 2003 and finally received the related certificates of Standard ISO 9001: 2008 from AENOR of Spain in 2011 and Standard ISO/ TS 29001: 2010 from AGR of Sweden.

In 2002 it proceeded to transfer the relevant technology and fabricate screw pumps in accordance with Standard API 676 and the joint – venture and Co- manufacturing contract with Albany of United Kingdom for the first time in Iran that 400 sets of the screw pumps kinds have been used in oil, gas, petrochemical and power plant industries. In 2004 it was awarded the title of “The Superior Manufacturer of Oil Equipments” by the Oil Ministry of Iran.

At present this company has the capability of supplying and manufacturing Positive Displacement Gear and Screw pumps under the license of Albany company of UK according to Standard API676, Centrifugal Horizontal Volute Casing pumps (Type OH1 & OH2), Centrifugal Vertical In-line pumps (Type OH3, OH4, OH5) , Centrifugal Vertical Turbine & Sump pumps (Type VS1, VS4 & VS5), Centrifugal Axially & Radially Split One, Two and Multistage Double Suction pumps (Type BB1, BB2 &BB3) according to the latest edition of Standard API 610 and also fire- fighting packages in accordance with NFPA20.

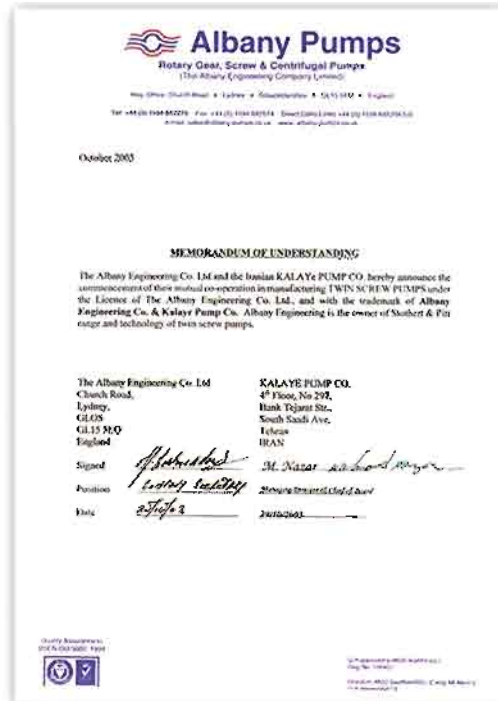
The test line of KalayPump factory located in Hashtgerd industrial zone doubly assures clients of the related specifications of the delivered pumps by having the ability of testing Vertical and Horizontal Centrifugal pumps, Screw and Gear pumps up to the capacity of 4000 m³/hr as well as measuring and extracting the hydraulic test and drawing the relevant curves of Performance (H-Q), Power (P-Q), Efficiency (η -Q) and NPSHR- Q.

What assured clients of the quality of Kalay-e-Pump products is enjoying strong engineering strength, skilled personnel, applying advanced producing equipments, achieving up-to-date technical knowledge, guarantee, 10- year after sale service accompanied by the related team that are ready to present any services including supplying, manufacturing and repairing all the kinds of the pumps all over the country.





... Awarded The Best Pump Manufacturer of 2004 by the Oil Ministry





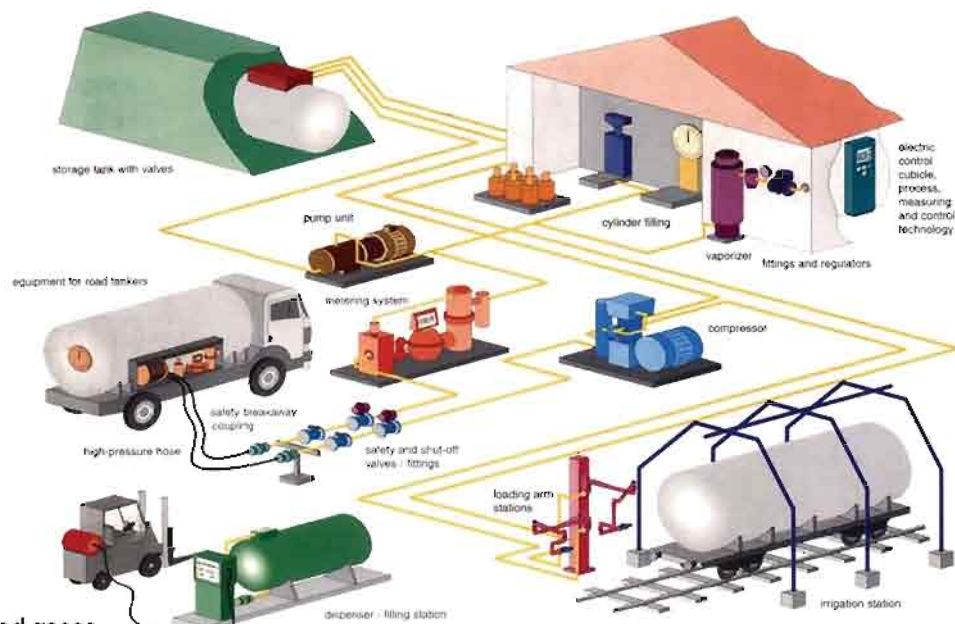
Centrifugal Side-Channel Pumps

Models: KP 31/36/41/51/6100

NON-API Standard



► Application



Liquids

- Thin Liquids & Liquefied gases
- LPG
- Refrigerants & solvents
- Liquefied hydrocarbons
- Water

Industrial Usage

- Cylinder filling/evacuation LPG plants
- Loading/unloading LPG storage plants
- Automotive filling gas stations
- Oil refineries & petrochemical plants
- Pressure relay stations
- Boiler feed water
- Condensation & distillation
- Direct Burner/Vaporizer feed

Design & Special Features

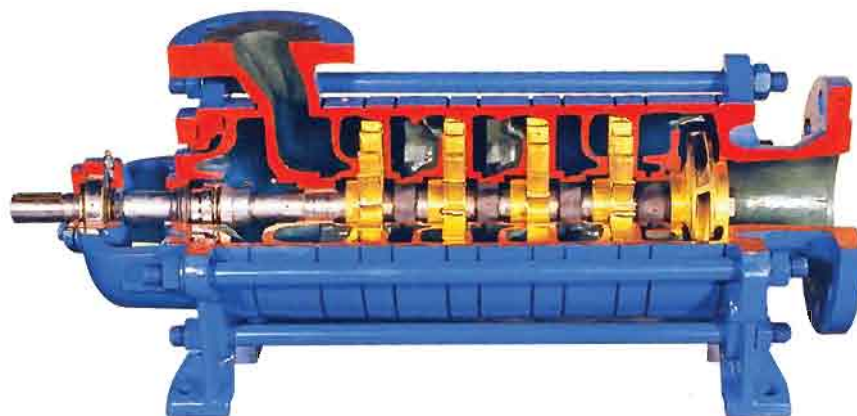
- Horizontal centrifugal side channel
- Self-priming
- DIN standard design
- Low Noise and vibration
- Low NPSH
- Boiling point liquid pump capability
- Segmental type construction with open vane wheel impellers
- Statically/dynamically balanced impellers
- 1-8 stage incremental pressure models
- Simple, low cost installation
- Long life pumping system



Technical Specifications

(KP31/36/41/51/6100 Type)

Type	Flow rate $Q, m^3/hr$	Total head H, m	Inlet diameter mm	Outlet diameter mm
KP 3100	1.0 - 4.5	10 - 320	65	32
KP 3600	3.5 - 7.5	10 - 230	65	32
KP 4100	6.0 - 12	10 - 250	80	40
KP 5100	11 - 20	20 - 310	100	50
KP 6100	16 - 35	10 - 350	100	65
Max. speed	1450 rpm			
Max. temperature	180° C			
Max. casing pressure	40 bar from - 40° C to 120° C pressure stages for higher temperatures as per DIN 2401 standard			
Max. hydrostatic test pressure	60 bar			
Sealing	Standard balanced mechanical seal			
Flange Standard	DIN 2535 PN 40			
Flange Design Standard	DIN 2512			
Flange with groove and drilled	ANSI 150 - BS: Table F			
Flange connection standard	DIN 2501 PN 40			
Ball bearing standard	DIN 625			
Direction of rotation	Anti-clock wise, as seen from the drive on the pump			
Drive Mechanism	Direct with flexible (elastomeric) coupling			
Driver	Explosion proof Electromotor			
Material	Cast - iron, brass/bronze alloy, carbon steel, stainless steel			





Centrifugal Volute Casing Pumps

Models: KP N & C Types

OH1&OH2, API 610 Standard



► Application

Liquids

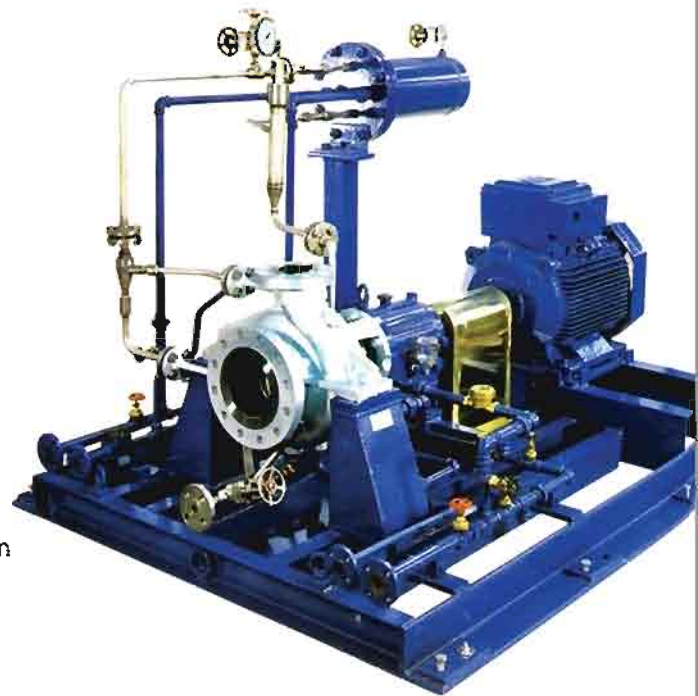
- Petroleum Liquids
- All type of hydrocarbons
- Non-aggressive liquids
- Corrosive Liquids
- Acids
- Brine and alkalis
- Water & sea water

Industrial Usage

- Oil refineries & petrochemical plants
- All processing plants
- Power stations
- Refrigeration Plants
- Condensate

Design & Special Features

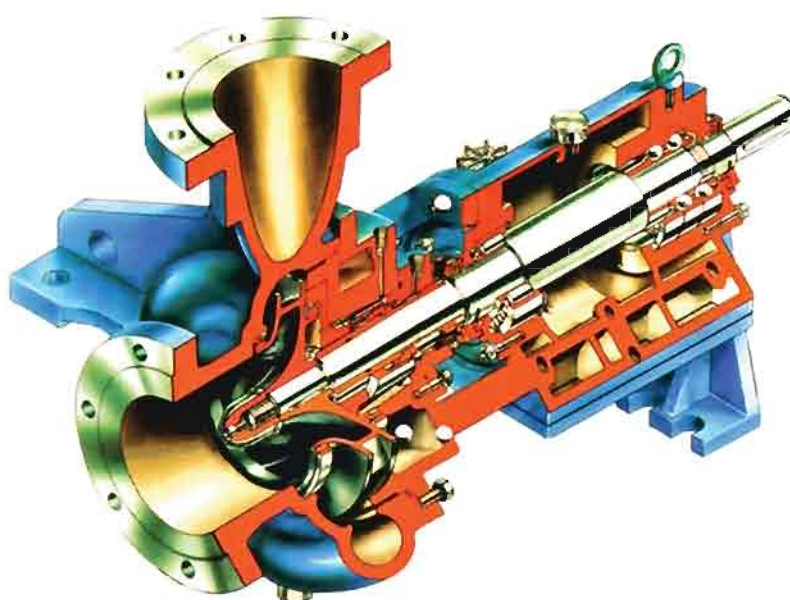
- Horizontal centrifugal single-stage volute casing-End suction
- Design in accordance with API 610 standard
- "Foot" or "Center line" arrangement
- High hydraulic efficiency
- Low NPSH required
- Easy dismantling of the complete bearing unit towards the drive and without the need to disconnect the pump casing from the piping
- No necessity to disconnect the motor if a spacer coupling is used
- Statically/dynamically balanced closed impeller
- Simple, low cost installation
- Long life pumping system





Technical Specifications

(KP N&C Type)	
Nozzle Size	up to 12"
Capacity	up to 1500 m ³ /hr
Pressure	up to 15 bar
Max. speed	2950 rpm
Max. temperature	250° C
Max. casing pressure	40 bar
Max. hydrostatic test pressure	60 bar
Sealing	Packing or mechanical seal (acc. to API 682)
Design Standard	API 610, Latest edition
Flange standard	ANSI (other standards also available)
Direction of rotation	Clockwise looking from end motor
Drive Mechanism	Direct with flexible/ Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor/Diesel Engine
Material	According to API 610 Material Code including 316 L, Duplex & Super Duplex





Centrifugal Vertical In - Line Pumps

Models: KP CI Types

OH3, OH4 & OH5, API 610 Standard



► Application

Liquids

- Gas Oil
- Gasoline
- Kerosene
- Aviation fuels (ATK,JP4)
- Refrigerants
- Fuels

Industrial Usage

- Oil refineries & petrochemical plants
- Loading/unloading storage fuel tanks

Design & Special Features

- Vertical centrifugal in - line mounting
- Design in accordance with API 610 standard
- open or shrouded impellers
- Statically/dynamically balanced impeller
- Optional wear rings
- Balance line for cooling mechanical seal

Simple, Low Cost Installation

- Fits like a pipeline valve
- Low space requirements
- No concrete foundation or grouting
- Standardized dimensions speed up client design work
- Permanent alignment; no site alignment necessary

Maintenance Savings

- Pull-out design allows that the entire rotating assembly to be removed without breaking case/pipeline joints
- On Site or workshop maintenance





Technical Specifications

(KP CI Type)	
Nozzle Size	up to 12"
Capacity	up to 800 m ³ /hr
Pressure	up to 10 bar
Max. speed	2950 rpm
Max. temperature	200° C
Max. casing pressure	40 bar
Max. hydrostatic test pressure	60 bar
Sealing	Packing or mechanical seal (acc. to API 682)
Design Standard	API 610, Latest edition
Flange standard	ANSI (other standards also available)
Direction of rotation	Clockwise from top view
Drive Mechanism	Direct with flexible/Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor/Diesel Engine
Material	According to API 610 Material Code including 316 L, Duplex & Super Duplex

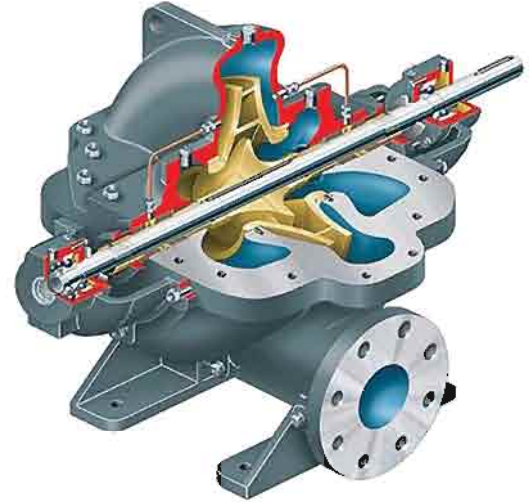




Centrifugal One & Two Stage Split Casing Pumps

Models: KPSP Types

BB1 & BB2, API 610 Standard



► Application

Liquids

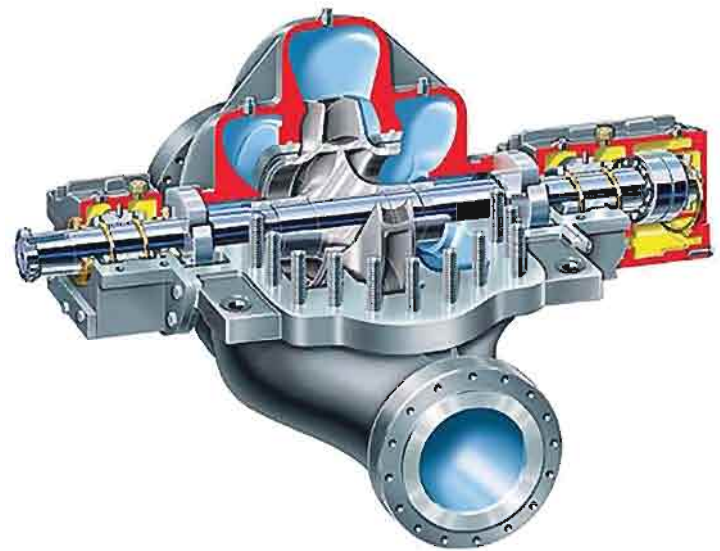
- Petroleum Liquids
- Non-aggressive & Corrosive Liquids
- All Type of hydrocarbons & Fuels
- Water & Seawater

Industrial Usage

- Refineries, Chemical & Petrochemical plants
- Power Plants
- Pipe Lines
- Cooling Water System

Design & Special Features

- Horizontal Centrifugal Axially & Radially Split Casing
- BB1 & BB2, API 610 design
- One & Two Stage, Double Suction
- Dynamically balanced double shrouded Impeller
- "Foot" or "Centerline" mounted arrangement
- Oil, ring oil & grease Lubrication methods
- API 682 Mechanical seal & Cooling plants is applicable as an option
- Simplifies piping design (Side-Side nozzle arrangement for BB1 Type)
- High efficiency, Safety-operating condition
- Easy maintenance, Low operation cost





Technical Specifications

(KPSP Type)	
Nozzle Size	up to 20"
Capacity	up to 4000 m ³ /hr
Pressure	up to 30 bar
Max. speed	2950 rpm
Max. temperature	300° C
Max. casing pressure	40 bar
Max. hydrostatic test pressure	60 bar
Sealing	Packing or mechanical seal (acc. to API 682)
Design Standard	API 610, Latest edition
Flange standard	ANSI (other standards also available)
Direction of rotation	Clockwise looking from end motor
Drive Mechanism	Direct with flexible/Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor/Diesel Engine
Material	According to API 610 Material Code including 316 L, Duplex & Super Duplex





Centrifugal Multistage Split Casing Pumps

Models: KP SPM Types

BB3, API 610 Standard



► Application

Liquids

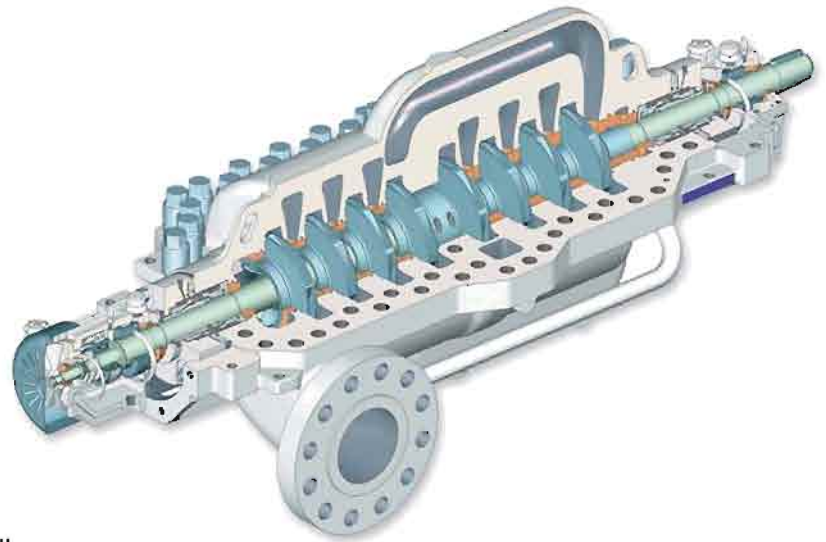
- Petroleum Liquids
- Non-aggressive & Corrosive Liquids
- All Type of hydrocarbons & Fuels
- Water & Seawater

Industrial Usage

- Refineries, Chemical & Petrochemical plants
- Power Plants
- Pipe Lines
- Water and Waste Water

Design & Special Features

- Horizontal Centrifugal Axially Split Casing
- BB3, API 610 design
- Multistage, Double Suction
- Dynamically balanced double shrouded Impeller
- "Foot" or "Centerline" mounted arrangement
- Oil, ring oil & grease Lubrication methods
- API 682 Mechanical seal & Cooling plants is applicable as an option
- Simplifies piping design (Side-Side nozzle arrangement)
- High efficiency, Safety-operating condition
- Easy maintenance, Low operation cost





Technical Specifications

(KP SPM Type)	
Nozzle Size	up to 16"
Capacity	up to 1500 m ³ /hr
Pressure	up to 100 bar
Max. speed	2950 rpm
Max. temperature	300° C
Max. casing pressure	100 bar
Max. hydrostatic test pressure	150 bar
Sealing	Packing or mechanical seal (acc. to API 682)
Design Standard	API 610, Latest edition
Flange standard	ANSI (other standards also available)
Direction of rotation	Clockwise looking from end motor
Drive Mechanism	Direct with flexible/Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor/Diesel Engine & Steam turbine
Material	According to API 610 Material Code including 316 L, Duplex & Super Duplex





Centrifugal Vertical Turbine Pumps

Models: KPVT Types

VS1, API 610 Standard

► Application

Liquids

- Petroleum Liquids
- All Type of hydrocarbons
- Non-aggressive Liquids
- Corrosive liquids
- Brine and alkalis
- Waste water & Sea water

Industrial Usage

- Oil refineries & Petrochemical plants
- Utility Circulating water
- Power stations
- Cooling water
- Condensate and general Industrial Service
- Process Transfer
- Fire-fighting system

Design & Special Features

- Vertical Centrifugal Diffuser
- Design in accordance with API 610 Latest edition
- Dynamically balanced closed impeller
- High efficiency, safety-operating condition
- Long life pumping system
- Completely standardization for wide application





Technical Specifications

(KPVT Type)	
Nozzle Size	up to 24"
Capacity	up to 3000 m ³ /hr
Pressure	up to 20 bar
Max. speed	2950 rpm
Max. temperature	250° C
Max. casing pressure	20 bar
Max. hydrostatic test pressure	30 bar
Sealing	Packing or mechanical seal (acc. to API 682)
Design Standard	API 610, Latest edition
Flange standard	ANSI (other standards also available)
Direction of rotation	Clockwise looking from end motor
Drive Mechanism	Direct with flexible/Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor/Diesel Engine
Material	According to API 610 Material Code including 316 L, Duplex & Super Duplex





Centrifugal Vertical Sump Pumps

Models: KPVS Types

VS4 & VS5, API 610 Standard

▶ Application

Liquids

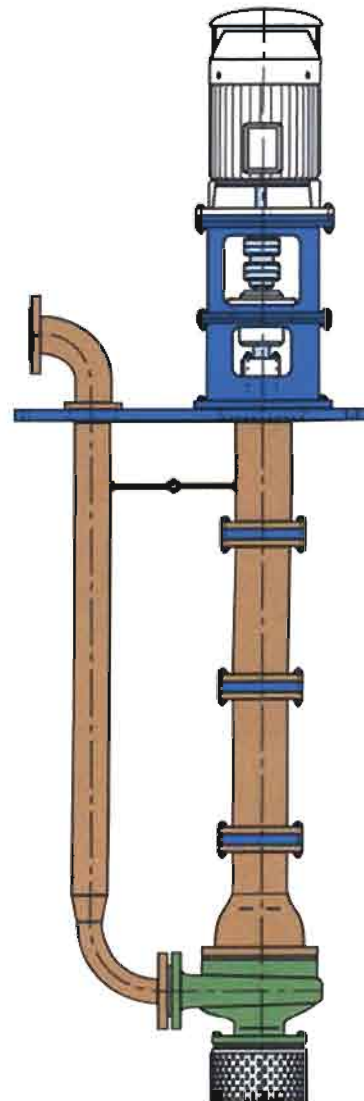
- Petroleum Liquids
- All Type of hydrocarbons
- Non-aggressive Liquids
- Corrosive liquids
- Brine and alkalis
- Waste water & Sea water

Industrial Usage

- Oil refineries & Petrochemical plants
- Slop & Drainage system
- Power stations
- Cooling water
- Condensate
- Process Transfer

Design & Special Features

- Vertical Centrifugal Sump
- Design in accordance with API 610 standard
- Statically/dynamically balanced closed impeller
- Simple, low cost installation
- Long life pumping system
- Small Installation area





Technical Specifications

(KPVS Type)	
Nozzle Size	up to 12"
Capacity	up to 1200 m ³ /hr
Pressure	up to 10 bar
Max. speed	2950 rpm
Max. temperature	250° C
Max. casing pressure	20 bar
Max. hydrostatic test pressure	30 bar
Sealing	Packing or mechanical seal (acc. to API 682)
Design Standard	API 610, Latest edition
Flange standard	ANSI (other standards also available)
Direction of rotation	Clockwise looking from end motor
Drive Mechanism	Direct with flexible/Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor/Diesel Engine
Material	According to API 610 Material Code including 316 L, Duplex & Super Duplex





Rotary Twin Screw Positive Displacement Pumps

API 676 Standard

Manufactures joint venturely by K.P.Co. & Albany Engineering Co. (England)

Horizontal Models

SH1, internal bearing for Lubricating fluids

SH2, external bearings for non-Lubricating & high viscosity fluids

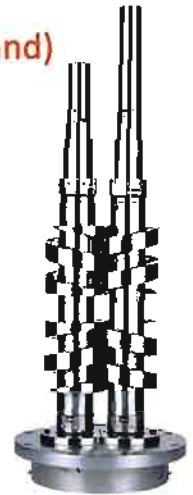
SH3, internal seal for clean fuels of low viscosity

Vertical Models

SV1, internal bearing for Lubricating fluids

SV2, external bearings for hot or dirty liquids

SV3, internal seal for clean fluids of low viscosities



► Application

Liquids

- Crude oil & oil products
- Lubricating oil
- Fresh water & oily water
- Sea water, bilge & ballast
- Aircraft refueling & aviation fuels
- Bitumen & asphalt
- Fire foam concentrate & boiler firing

Industrial Usage

- Industrial, oil exploration & petrochemical environments
- Viscous fuel for Storage plant
- Marine, offshore & dock areas

Design & Special Features

- Horizontal / Vertical twin screw types
- API 676 standard
- Horizontal model heating options available
- Space-saving vertical models
- Vertical models available with or without integral relief valve
- Pumps fitted with hardened timing gears and locating bearings so there is no contact between the screws
- Shaft stiffness maximized by the screw design hydraulic balance
- Maximum volumetric efficiency
- Excellent suction lift
- NPSH required is dependant on viscosity and speed, and can be as low as 0.5m
- Fully guaranteed
- Maintenance can normally be carried out without disconnecting either the suction or delivery pipe work and with the electric motor remaining situ





Technical Specifications

(Twin Screw Type)	
Nozzle Size	up to 20"
Capacity	up to 1500 m ³ /hr
Pressure	up to 30 bar
Max. temperature	350°C
Viscosity range	1-60.000 centistokes
Sealing	Packing or mechanical seal
Design Standard	API 676, Latest edition
Flange standard	ANSI (other standards also available)
Speeds	4-pole for normal duties 2-pole for smaller pumps 6 or 8-pole for oily water or very high viscosity (over 20.000 Cst)
Drive Mechanism	Direct with flexible/Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor/Diesel Engine
Material	Cast iron, cast steel, stainless steel, aluminum bronze or gunmetal, duplex alloys





Rotary External Gear/ Internal Lobe Pumps

Models: KP AP - HD & SMC

API 676 Standard

Manufactures joint venturely by K.P.Co. & Albany Engineering Co. (England)

► Application

Liquids

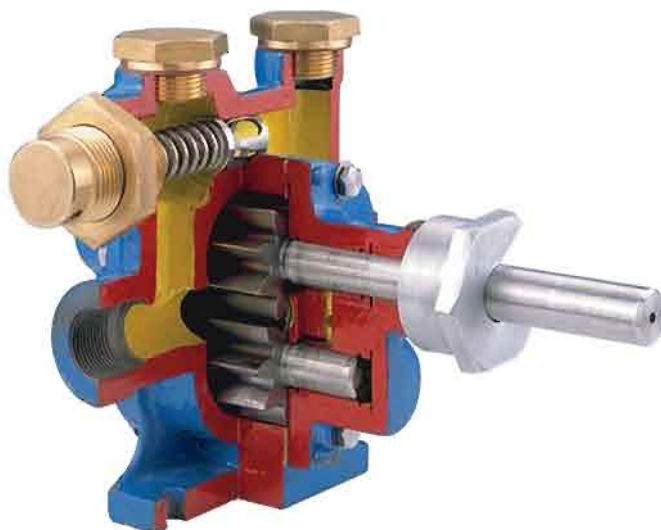
- Crude oil & oil products
- Lubricating oil
- Resins & paraffin
- Bitumen & asphalt
- Molasses
- Paints
- Petrol

Industrial Usage

- Industrial, oil exploration & petrochemical applications
- Viscous fuel for Storage plant

Design & Special Features

- Rotary gear
- API 676 standard
- Incorporated relief valve available on all models
- Many available with double helical rotors for quiet pulse-free operation
- High precision long life designs
- Thermal oil heated & electrically heated versions
- Close coupled compact range



Technical Specifications

(Gear Type)	
Nozzle Size	up to 6"
Capacity	up to 120 m ³ /hr
Pressure	up to 30 bar
Max. temperature	350°C
Viscosity	up to 250,000 centistokes
Sealing	Packing or mechanical seal
Design standard	API 676, Latest edition
Flange standard	ANSI (other standards also available)
Drive Mechanism	Direct with flexible/ Rigid spacer coupling
Drivers	Explosion proof or standard type (safe area) Electromotor / Diesel Engine
Material	Cast iron, cast steel, stainless steel, aluminum bronze or gunmetal, duplex alloys



CAPACITY (m ³ /hr)	PUMP SPEED (rev/min)							CAPACITY (L/min)
	100	250	500	720	960	1420	2900	
135		6" SMC				AP15DH		2,260
90		5" SMC	HD12DH			HD10DH	APPLY TO ALBANY	2,000
					AP14DH	AP13.5DH		1,500
				HD10DH	HD8	HD8SH		1,300
45	6" SMC	4" SMC			HD7SH	AP13DH		800
34	5" SMC		HD10DH	HD7			700	
		3" SMC	HD8	HD6	HD5	HD5	600	
22.5			HD7	HD6	HD4	HD4	500	
18.0	4" SMC	HD10DH	HD6	HD5	HD3	HD3	400	
13.5		HD8	HD5	HD4	AP11.5	AP11	300	
9.00	3" SMC	HD7	HD4	HD3	HD3	HD3	200	
		HD6	HD3	AP10	AP10	AP10	150	
	HD10DH	HD5		AP9	AP9	AP9	120	
4.50	HD8	HD4	AP10		AP8	AP8	100	
	HD7		AP9	AP8	56.2250	56.2250	75	
	HD6	HD3			56.3250	56.3250	60	
	HD5		AP8		AP7	AP7	50	
		AP10		AP7	40.2750	40.1750	40	
2.25	HD4	AP9	AP7		AP6	AP6	30	
1.80	HD3			AP6	ARS-3	AP4 &	25	
1.35	AP10	AP8		AP5	40.1300	25.2000	15	
	AP9	AP7	AP6		AP4	25.1500	7.5	
0.90	AP8		AP5	AP4	25.2000		5	
	AP7	AP6	AP4		25.1500	25.750	3	
0.45	AP6				25.750			
	AP5				25.375	25.375		
		AP9						
	AP5				25.375			

Items below the line on the chart are stocked at 3 U.S. locations.
Over 400 pumps already in stock.

APPLY TO ALBANY



Fire Fighting package

Models: KP SPF Types

according to NFPA 20 Standard

- Single and Double Suction split case Fire Fighting Pumps
- End Suction Fire Fighting Pumps
- Vertical Turbine Fire Fighting Pumps
- Vertical and Horizontal single / Multistage Jockey Pumps

► Application

Liquids

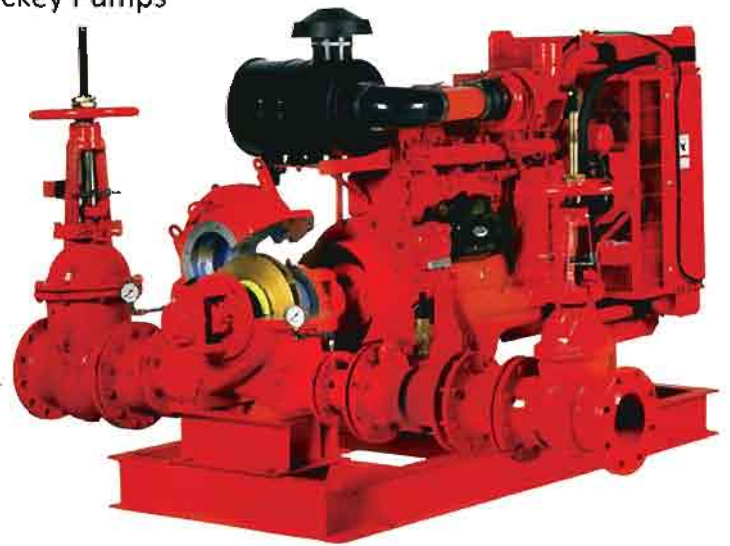
- Water and Sea water

Industrial Usage

- Refineries, Chemical and petrochemical plants, power plants, Marine industry
- High rise buildings, Airport and Hazardous Areas

Design & Special Features

- High Efficiency, Safety-Operating condition
- Easy maintenance, Low operation cost
- NFPA 20, UL, FM control panel for main and Jockey pumps
- Standard fuel tank for diesel Engine
- Installation time reduced
- Simplifies piping design
- Single source unit responsibility
- A complete package that will meet NFPA - 20 requirements





Technical Specifications

(KP SPF Type)

Nozzle Size	up to 20"
Capacity	up to 4000 m ³ /hr
Pressure	up to 30 bar
Sealing	Packing or mechanical seal (acc. to API 682)
Flange standard	ANSI (other standards also available)
Drivers	Motors, Diesel Engine
Material	Cast iron, Bronze alloy, stainless steel, Ni - AL Bronze, Duplex, Super Duplex



February 8th 2011

Tornatech specializes in the conception and manufacturing of fire pump controllers in accordance with the NFPA 20 standard, listed and approved with UL and FM.

With this letter we are confirming that we provide full technical support to Kalayepump Co. as our partner in Iran. Technical support includes, providing spare parts, on-site training and customising standard controllers according to the technical inquiries of Kalayepump Co and NFPA 20, UL and FM standards. All controllers for Kalayepump fire fighting packages are covered by the Tornatech warranty terms and conditions.

Thank you and Kind Regards,

André Rassi
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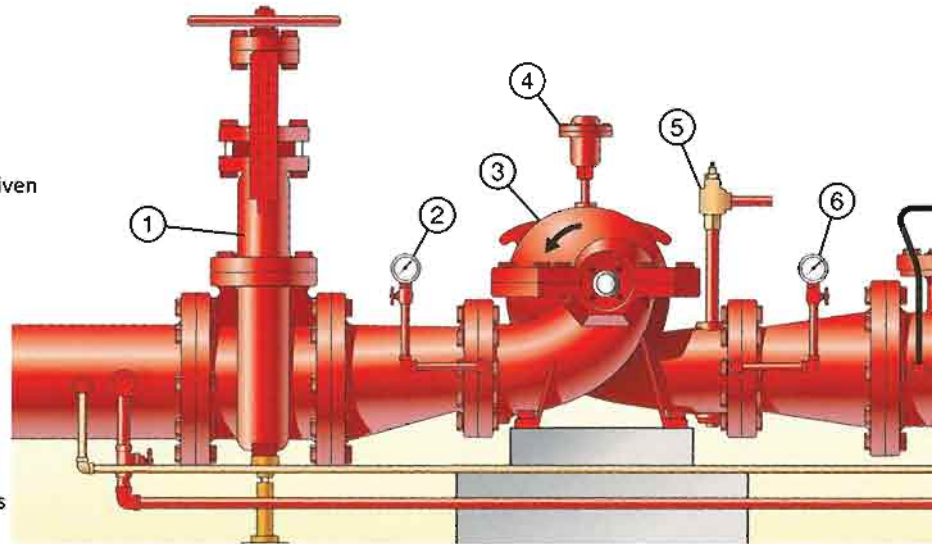
Tornatech FZ-LLC
PO Box 502222
Knowledge Village
Dubai, United Arab Emirates
Tel: 971 508574639





Horizontal Split Case Fire Pump System Electric Motor Driven

- 1 - Isolation Gate Valve (suction)
- 2 - Compound Suction Gauge
- 3 - Horizontal Split Case Fire Pump, Electric Motor Driven
- 4 - Automatic Air Release Valve
- 5 - Casing Relief Valve
- 6 - Discharge Pressure Gauge
- 7 - Low Suction Pressure Shutoff Valve
- 8 - Fire Pump Controller
- 9 - System Check Valve
- 10 - Jockey Pump Controller
- 11 - Jockey Pump
- 12 - Isolation Valves
- 13 - Ball Drip Valve
- 14 - Test Valve Manifold with Hose Valves, Caps & Chains



Pump: Horizontal split case, double-suction, mounted on a common base with and flexibly coupled to an electric motor. Pump sized for rated capacity and head. Also must be capable of producing 150% rated flow at not less than 65% rated head and not to exceed 140% rated head at a shutoff or noflow condition.

Electric Motor: Motor sized so as to not overload at any point on the pump hydraulic curve as per NFPA #20. Motors are open- drip proof type. Motor to be compatible with the type of controller (i.e., starting characteristics).

Coupling: Flexible type, sized to transmit the horsepower requirements of the pump.

Base: Fabricated steel design base capable of adequately supporting the weight of the pump and driver. After pump has been fully piped and accurately aligned with the motor, the base should be fully grouted into place.

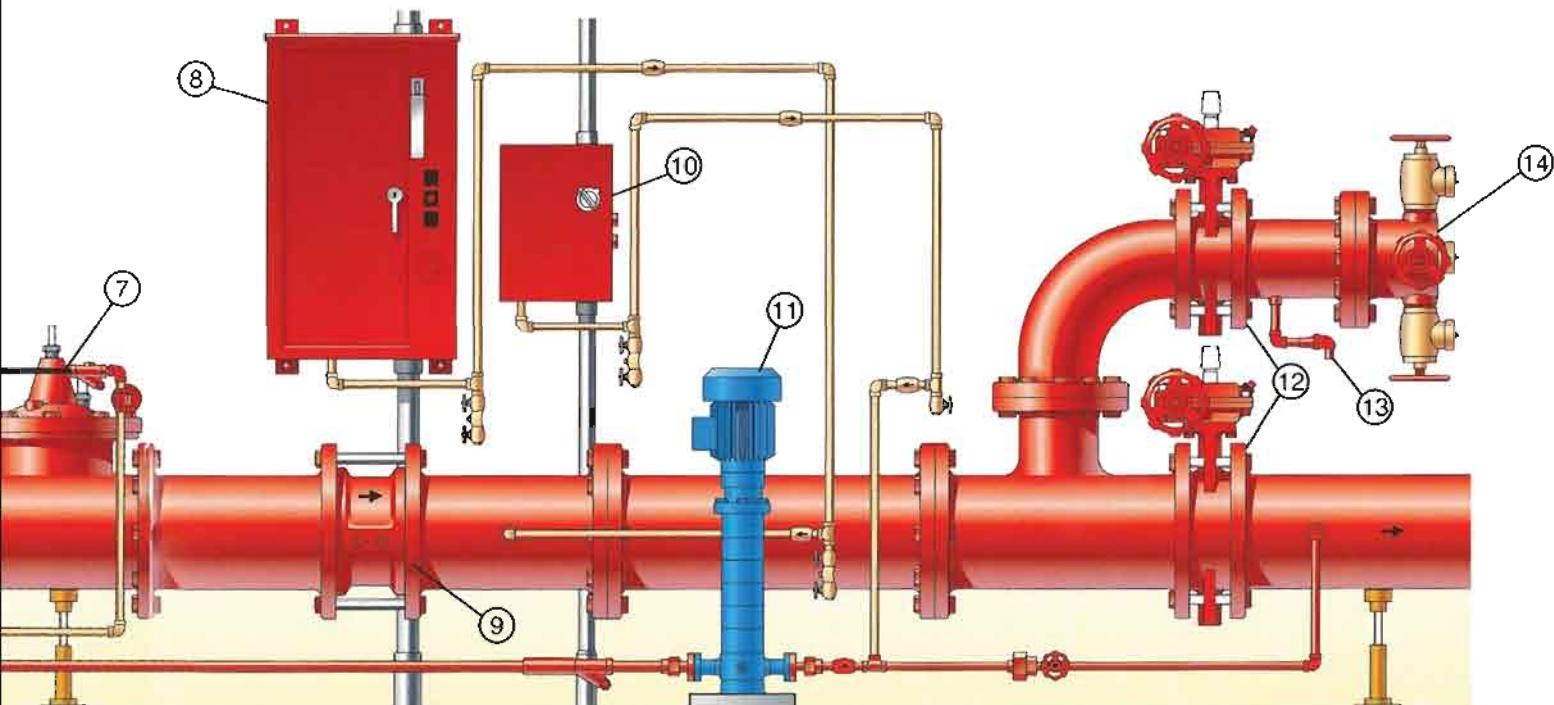
Controller: Electric motor controller starts the motor automatically on a loss of system pressure. System pressure is monitored via a sensing line from the system side of the check valve. Controller can also be manually started. The type of motor starting, and therefore the type of controller, varies depending upon the specifics of the application. Common types of controllers include:

across-the-line, primary resistor, part-winding, wye-delta, auto-transformer, and soft start.

Standard Accessories: Accessories can be furnished with the fire pump system include: suction and discharge gauges, casing relief valve and automatic air release valve. Other package can be included: hose valve manifold with hose valves, caps and chains, flowmeter, main relief valve and enclosed waste cone, ball drip valve, eccentric suction reducer concentric discharge increaser.

Jockey Pump: Jockey pump keeps pressure in the system to prevent the main fire pump from operation to maintain system pressure. Jockey pumps are generally a few gallons per minute sized to overcome small system leaks and typically sized for 10 PSI greater than the rated pressure of the main fire pump. Jockey pumps are not required to be UL Listed or FM Approved.

Jockey Pump Controller: Starts the jockey pump across the line by sensing the system pressure via a sensing line from the system side of the check valve. This sensing line must be independent from the main fire pump controller sensing line. Controller is sized per the jockey pump motor horsepower and voltage. Jockey pump controllers are UL Listed specifically for this service.

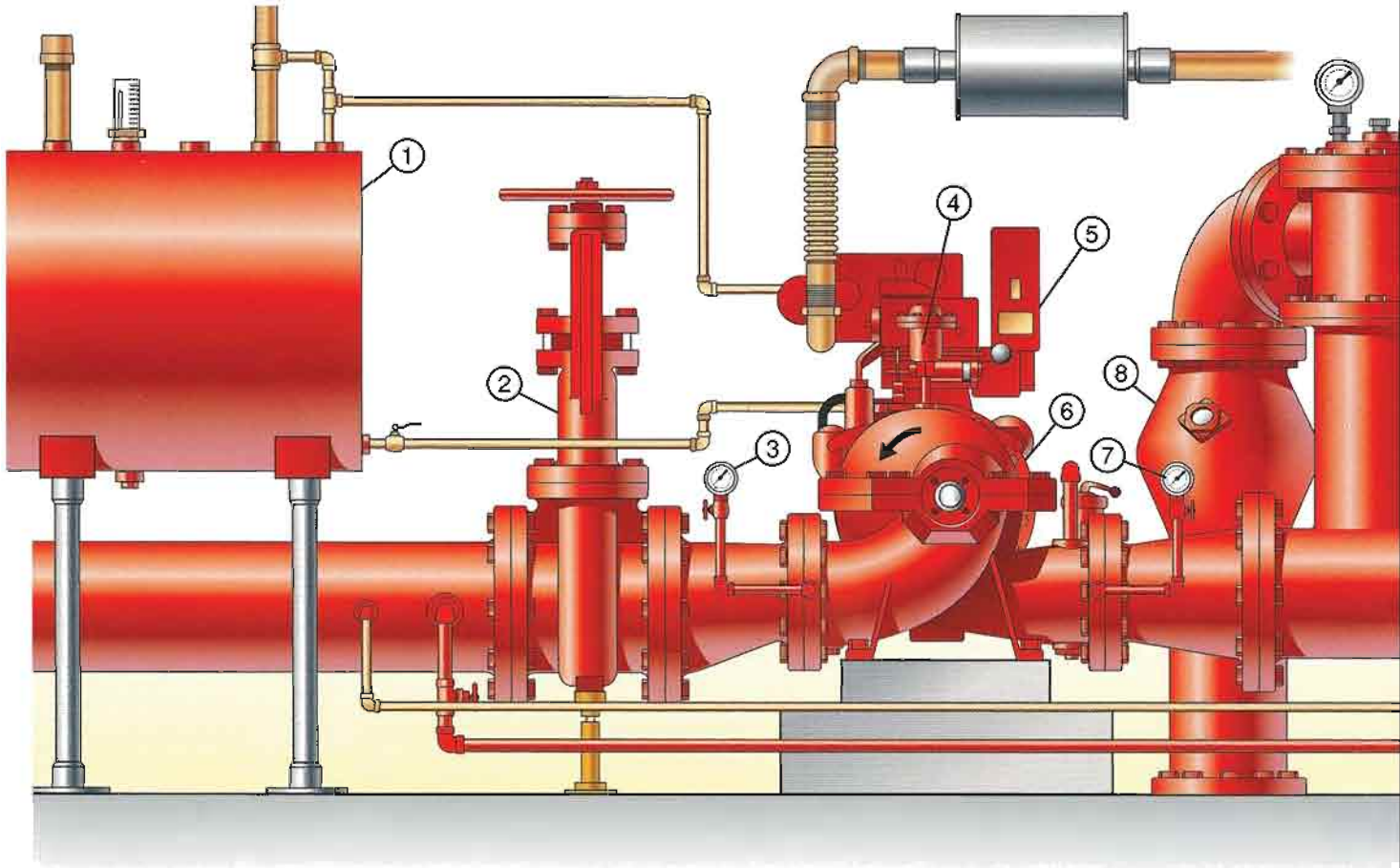


APPROVED CONTROLLER STARTING METHODS

TYPE STARTING	CHARACTERISTICS	ADVANTAGES	RESTRAINTS	STARTING CURRENT (% MOTOR FULL LOAD STARTING CURRENT)	STARTING TORQUE (% LOCKED ROTOR TORQUE)	TYPE TRANSITION
Across the line	Connects motor directly to power source. Full voltage applied to motor when controller is actuated.	*Least expensive *Highest starting torque *Low maintenance *Standard motor used	*High inrush current	600%	100%	N/A
Primary Resistance Reduced Voltage	When controller is actuated, a resistance is connected to each phase. Resistors are by-passed after a time delay and motor then runs at full voltage.	*Smooth starting *Low shock to motor *Standard motor used	*High power loss through resistors *Must dissipate heat *Low torque per ampere input *Medium relative cost *Not recommended for transfer switch applications	300%	25%	Closed
Part Winding	Motor starts on one winding. After a time delay, second winding is connected in parallel to the line	*Low relative cost *Low starting torque *Low maintenance	*Not recommended for frequent starting *Low starting torque *Special motor required	390%	42%	Closed
Wye-Delta Open-Transition	On controller activation, motor windings wye-connected for starting. After a time delay, automatically converts to delta connection for running, applying full voltage to motor windings. Most often used with transfer switch/emergency generator applications.	*Moderate to low relative cost *Low motor stress *Low starting current	*Medium starting torque *Special motor required for 200V *Power line transients *Can affect other equipment sharing same power source.	200%	33%	Open
Wye-Delta Closed-Transition	Same sequence as Open Transition. Connected to resistors in each phase during transition from wye to delta.	*Moderate to high relative cost *Low motor stress *Low starting current *No line transients	*Medium starting torque *Special motor may be required for 200V	200%	33%	Closed
Auto Transformer Reduced Voltage	Starters supply reduced voltage starting at motor terminals through use of tapped, 3-phase autotransformer. A timing relay causes transfer of motor from reduced voltage start to line voltage operation without disconnecting motor from power source.	*Good for heavy starting loads *Highest starting torque *Standard motor used *Low starting current *Starting torque adjustable	*High relative cost	150% 252% 384%	25% 42% 64%	Closed
Soft Start/Stop	Reduces inrush current to motor with adjustable ramp time. Stop sequence reduces possibility of surges occurring in the system.	*Low inrush current *Adjustable ramp time *Reduces system surges *Standard motor used	*High relative cost	Adjustable 50-500%	Varies	Closed



Horizontal Split Case Fire Pump System Diesel Engine Driven



- | | | |
|------------------------------------|---|--|
| 1. Fuel Tank, Diesel Engine | 7. Discharge Pressure Gauge | 13. Jockey Pump Controller |
| 2. Isolation Gate Valve (suction) | 8. Enclosed Waste Cone with Sight Glasses | 14. Jockey Pump |
| 3. Compound Suction Gauge | 9. Main Relief Valve | 15. Isolation Valves |
| 4. Automatic Air Release Valve | 10. Low Suction Pressure Shutoff Valve | 16. Ball Drip Valve |
| 5. Diesel Engine Drive | 11. Fire Pump Controller | 17. Test Valve Manifold with Hose Valves,
Caps & Chains |
| 6. Horizontal Split Case Fire Pump | 12. System Check Valve | |

Pump: Horizontal split case, double-suction, Mounted on a common base with and flexibly coupled to a diesel engine. Pump sized for rated capacity and head. Also must be capable of producing 150% rated flow at not less than 65% rated head and not to exceed 140% rated head at a shutoff or no-flow condition.

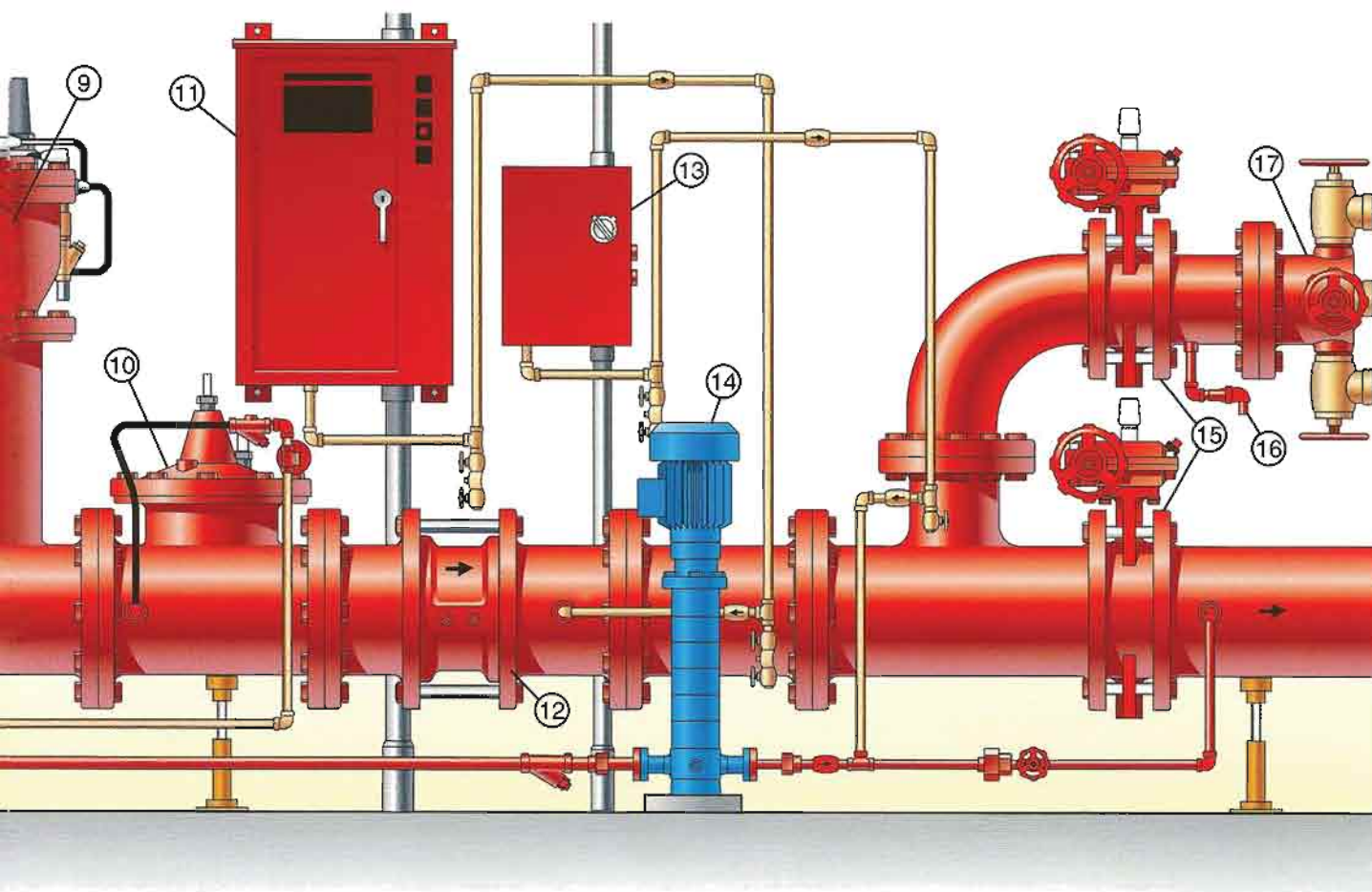
Diesel Engine:

Diesel engine adequately sized so as to not overload at any point on the pump hydraulic curve. Consideration must be given and de-rates applied based on job site elevation and ambient temperature. Engines must be specifically designed for fire protection service.

Coupling: Flexible type, sized to transmit the horsepower requirements of the pump.

Base: Fabricated steel design base capable of adequately supporting the weight of the pump and driver. After pump has been fully piped and accurately aligned with the engine, the base should be fully grouted into place.

Controller: Diesel engine controller starts the engine automatically on a loss of system pressure, System pressure is monitored via a sensing line from the system side of the check valve. Controller can also be manually started.



Standard Pump Accessories: Accessories can be furnished with the fire pump system include: suction and discharge gauges and automatic air release valve. Other accessories commonly can be furnished as part of the fire pump package include: hose valve manifold with hose valves, caps and chains, flowmeter, main relief valve and enclosed waste cone, ball drip valve, eccentric suction reducer, concentric discharge increaser.

Standard Engine Accessories: Accessories can be furnished with the diesel engine include: engine starting batteries, battery rack, battery cables, engine exhaust flexible connector and silencer.

Jockey Pump: Jockey pump keeps pressure in the system to prevent the main fire pump from operation to maintain system pressure. Jockey pumps are generally a few gallons per minute sized to overcome small system leaks and typically sized for 10 PSI greater than the rated pressure of the main fire pump. Jockey pumps are not required to be UL Listed or FM Approved.

Jockey Pump Controller: Starts the jockey pump across the line by sensing the system pressure via a sensing line from the system side of the check valve. This sensing line must be independent from the main fire pump controller sensing line. Controller is sized per the jockey pump motor horsepower and voltage.



Part Manufacturing

Design / Reverse Engineering and Manufacturing

Scope of works

- Shaft, Impeller, Gear, Screws, Volute case, Bearing housing, Ring and Bushes
- In accordance to API, NFPA, IPS, DIN, ISO, ANSI, BS, ASME, ASTM, ...
- In wide rang of Material stainless steels, carbon steel, cast Iron, Brass or Bronze Alloy, Ni-resist, Duplex,...

Parts and elements for machines

- Centrifugal, Reciprocating, Gear and Screw pumps
- Gas, Steam and water turbines
- Centrifugal, Gear and Reciprocating compressors
- Mixer, Gear Box, Valve, fitter, Flexible/Rigid Spacer couplings, ...

Production precess

- Reverse Engineering
- Drawings
- Process planning
- Modeling and Grinding
- Heat treatment
- Quality control and certificates
- Documentation
- Packing and shipment

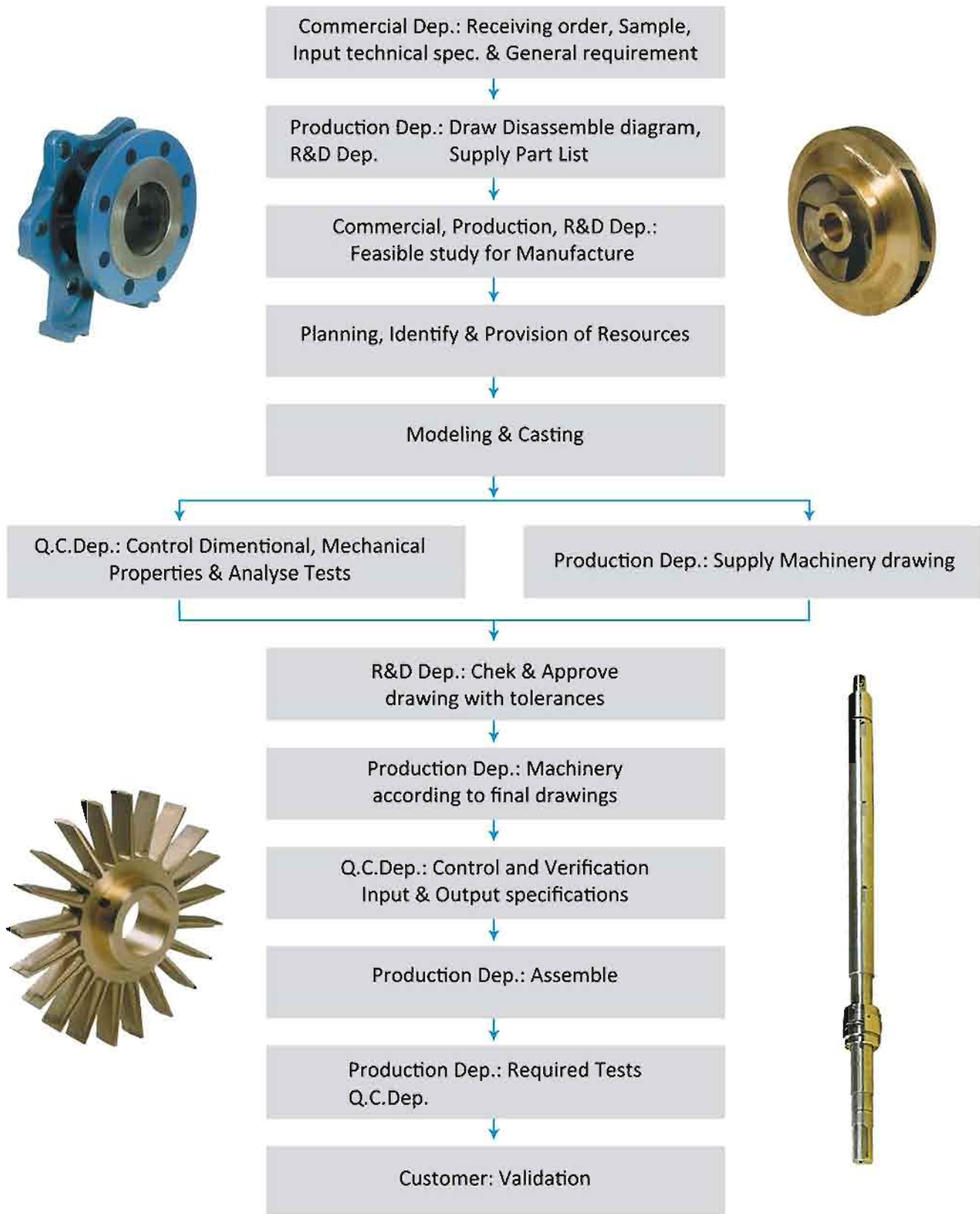
Documentation

- Instruction Books for Installation and Operation
- Instruction Books for Maintenance and Assembly
- Instruction Books for Test and Certificates
- Process Plans and quality plans
- Parts, sectional and out line drawings





Reverse Engineering Flow Diagram for Part Manufacturing







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