



# Session 7 – Fire-pumps for the Oil & Gas Industries

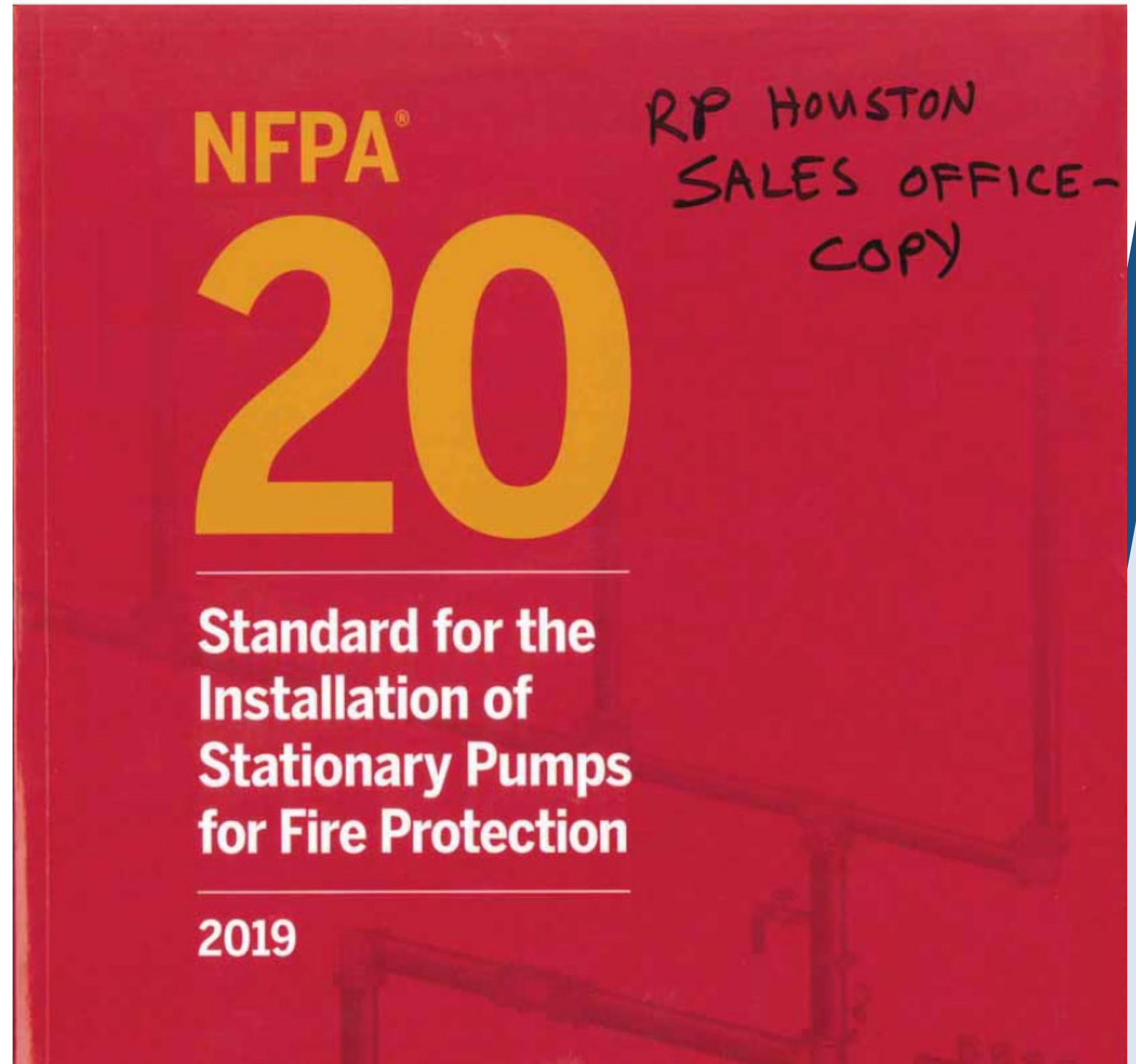
*Aimed at Process and Mechanical Engineers and Consultant Engineers specifying fire-pumping equipment for refineries and oilfield installations as well as Applications & Sales Engineers selecting and quoting them.  
As well as covering fire-pumps in general the course will cover engineered fire-pump packages for hazardous areas such as offshore oil platforms and refineries.*



# I – NFPA-20 Overview



You may also like to consider:  
NFPA 13 – Sprinkler Systems  
NFPA 22 - Water Tanks  
UL-448 Stationary Fire Pumps  
FM-1311 - Split Case Pumps  
FM-1312 Vertical Turbine Pumps  
FM-1313 - PD Pumps  
FM-1319 – End Suction  
FM-1372 – Vertical In-Line





# NFPA 20 Overview

- NFPA 20 protects life and property by providing requirements for the selection and installation of pumps to ensure that systems will work as intended to deliver adequate and reliable water supplies in a fire emergency.
- Divided in 14 main chapters:
  - Chapter 1 Administration
  - Chapter 2 Referenced Publications
  - Chapter 3 Definitions
  - Chapter 4 General Requirements
  - Chapter 5 Fire Pumps for High-Rise Buildings
  - Chapter 6 Centrifugal Pumps
  - Chapter 7 Vertical Shaft Turbine–Type Pumps
  - Chapter 8 Positive Displacement Pumps
  - Chapter 9 Electric Drive for Pumps
  - Chapter 10 Electric-Drive Controllers and Accessories
  - Chapter 11 Diesel Engine Drive
  - Chapter 12 Engine Drive Controllers
  - Chapter 13 Steam Turbine Drive
  - Chapter 14 Acceptance Testing, Performance, and Maintenance



## **II - GOVERNING BODIES & LISTING AUTHORITIES**



# APPROVED AND LISTED?

## APPROVED

- Acceptable to the Authority Having Jurisdiction (AHJ)

## LISTED

- Equipment, Materials or Services shall be included in a list published by an organization acceptable to the AHJ that is concerned with evaluation of products and which carries out periodic inspection of production and testing of listed products



## NATIONAL FIRE PROTECTION ASSOCIATION

- The National Fire Protection Association (NFPA) is a global self-funded non-profit organization in 1896 devoted to eliminating death, injury, property and economic loss due to fire, electrical and related
- Code/Standard # 20 – Refers to the installation of stationary pumps for fire protection.
  - ✓ *Pipe size of systems*
  - ✓ *Testing of equipment*
  - ✓ *Type of drivers, controllers and accessories*
  - ✓ *Installation design*
  - ✓ *Field testing of equipment*



## UNDERWRITERS LABORATORIES

- Lists and approves equipment for fire pump service.
- Witnesses testing of fire pumps for specific flow rates.
- UL-448 – Centrifugal Stationary Pumps for Fire-Protection Services
  - ✓ *Specification for fire pumps*
  - ✓ *Specification pump design and materials*
  - ✓ *Specification for pump testing*



## FACTORY MUTUAL

- Began in 1835 as Manufacturers Mutual Fire Insurance Company.
- Insurer in addition to being a testing and approval agency for all types of fire pumps and systems.
- Approves the installation & design of fire pump and fire protection systems. This is a requirement on a insured project.
  - ✓ *FM 1311 – Split case*
  - ✓ *FM 1312 – Vertical Turbine*
  - ✓ *FM 1313 – Positive Displacement*
  - ✓ *FM 1319 – End Suction*
  - ✓ *FM 1372 – In-line*



# III - DESIGN CONSIDERATIONS FOR FIRE WATER PUMPS

NFPA-20 INTRODUCTION



# Characteristics

- All pumps shall be tested.
- Shall be dedicated and listed for fire pump services.
- Centrifugal pumps design shall be:
  - Overhung Impeller
  - Between Bearing
  - Vertical Turbine





# Pump Selection

- Shall be selected so that the greatest single demand is less than or equal to 150% of rated capacity of the pump
- Pump certified rated capacity shall be as per NFPA-20 (2019) table 4.9.2.
- Certification for pumps above 5000GPM shall be subject to individual review by the AHJ and listing Laboratory.

Table 4.9.2 Centrifugal Fire Pump Capacities

gpm	L/min	gpm	L/min
25	95	1,000	3,785
50	189	1,250	4,731
100	379	1,500	5,677
150	568	2,000	7,570
200	757	2,500	9,462
250	946	3,000	11,355
300	1,136	3,500	13,247
400	1,514	4,000	15,140
450	1,703	4,500	17,032
500	1,892	5,000	18,925
750	2,839		



# Types of Fire Pumps

**VERTICAL  
TURBINE**



**HORIZONTAL SPLIT CASE**



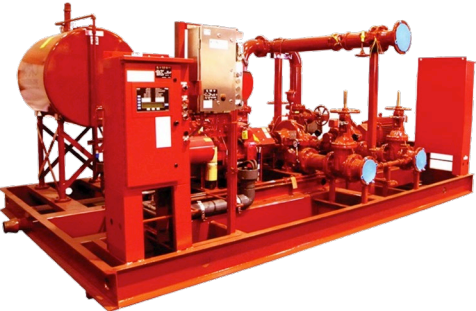
**IN-LINE**



**END SUCTION**

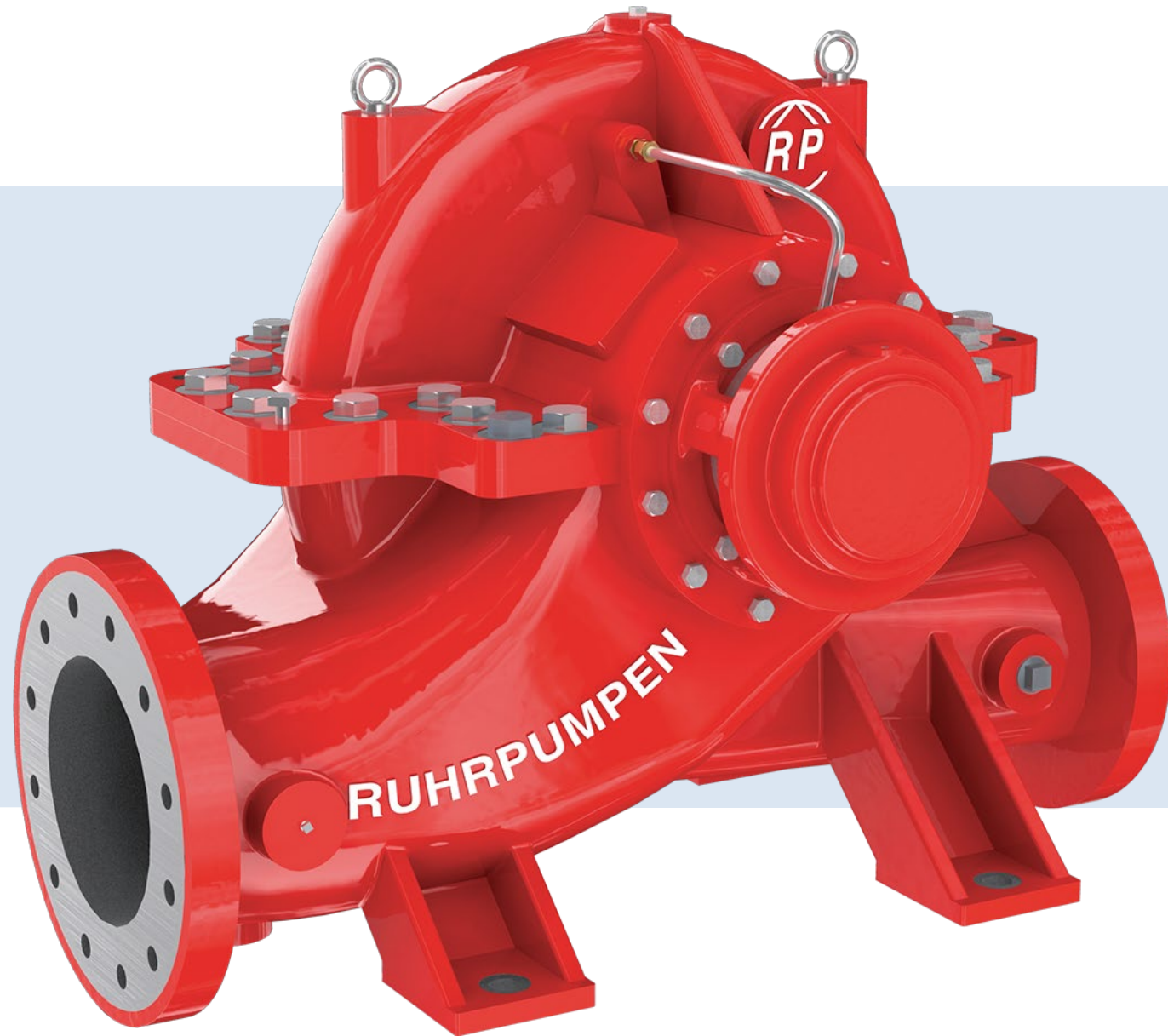


**PACKAGED SYSTEMS**





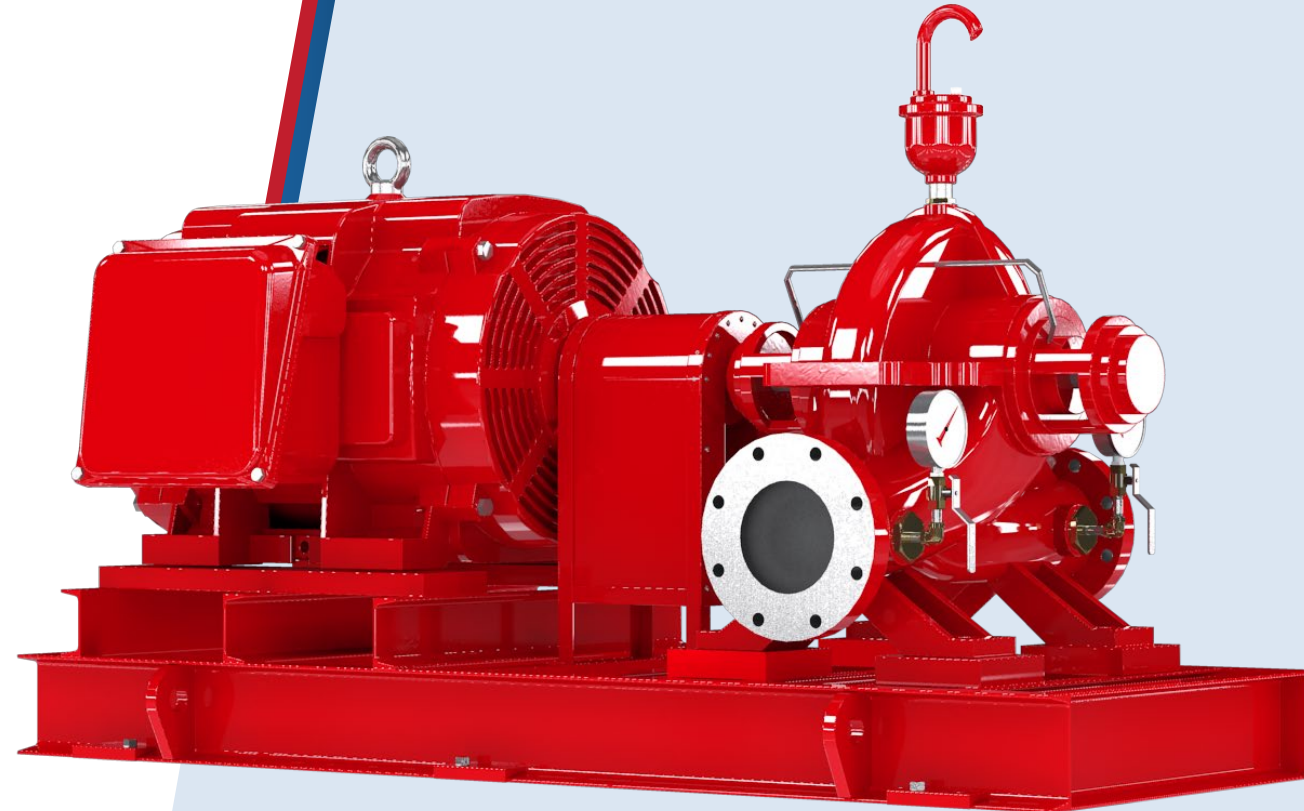
# Horizontal Split Case Pumps





# Horizontal Split Case

- System demand coverage from 150 to 7500GPM.
- Between bearing design, single stage.
- Pressure range from 40 to 355+psi.
- Available in special/exotic alloys such as:
  - Stainless Steel 316.
  - Duplex SS.
  - Nickel-Aluminum-Bronze.
  - Super Duplex SS.
- Electric Motor or Diesel Engine driven.
- Shall have positive suction supply.
- Designed, built and tested according to:
  - NFPA-20
  - UL-448
  - FM-1311





# Vertical Turbine Pump





# Application

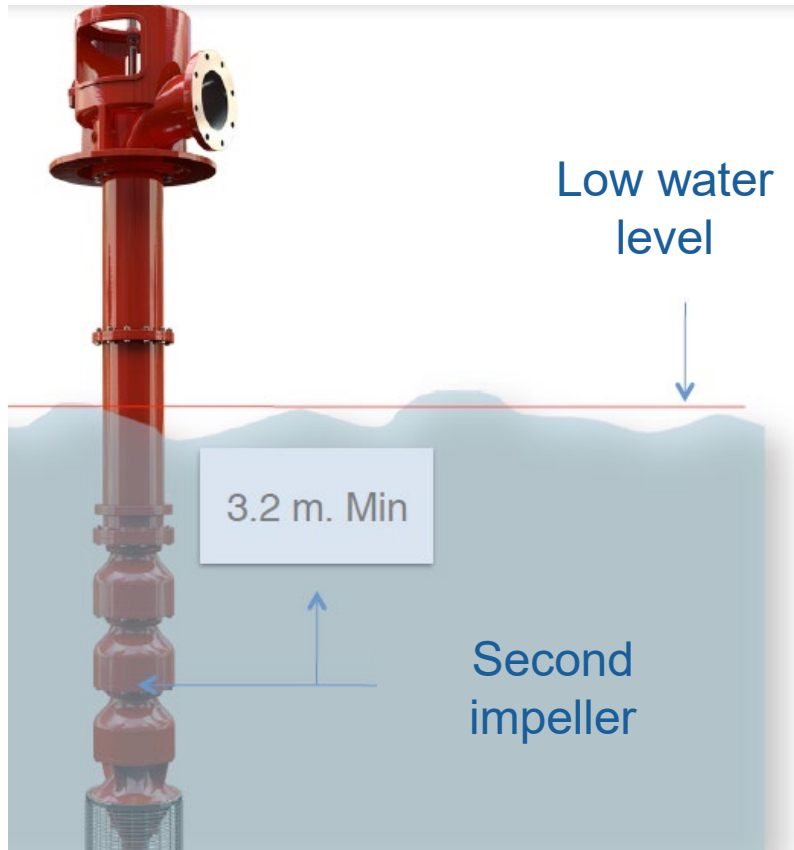
- System demand coverage from 400 to 8,250GPM.
- Vertically suspended, Single or multiple stages.
- Pressure range from 40 to 323+psi.
- Available in special/exotic alloys such as:
  - Stainless Steel 316.
  - Duplex SS.
  - Nickel-Aluminum-Bronze.
  - Super Duplex SS.
- Suction conditions:
  - Required where water supply is located below the discharge flange centerline
  - When source of water is from a lake a pond or sea.
  - Is the only listed pump for suction lift.
- Can be driven by Vertical Hollow shaft Electric Motor or a Right-Angle Gear Drive with vertical Hollow shaft.
- Designed, built and tested according to:
  - NFPA-20
  - UL-448
  - FM-1312



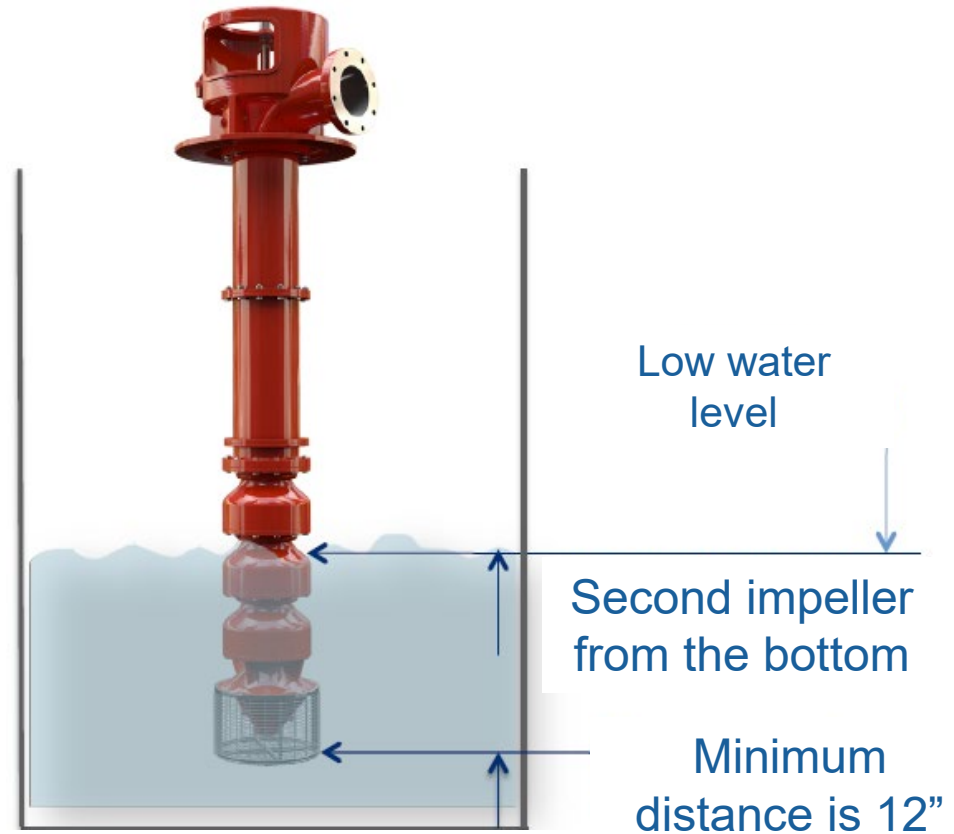


# Vertical Turbine Pump

## Well Installation



## Wet Pit Installation







# Jockey Pumps

- Pressure Maintenance Pumps
- Purpose:
  - Maintain the system pressurized
  - Protect main fire pumps from starting unnecessarily.
- Typically sized in the range of 1% to 10% Flow and maximum pressure above main fire pumps maximum working pressure.
- Motor driven
- Not required to be listed.
- Jockey pump control panel should be listed.
- Common type of jockey pumps
  - Vertical In-line Multistage
  - End suction
  - Submersible



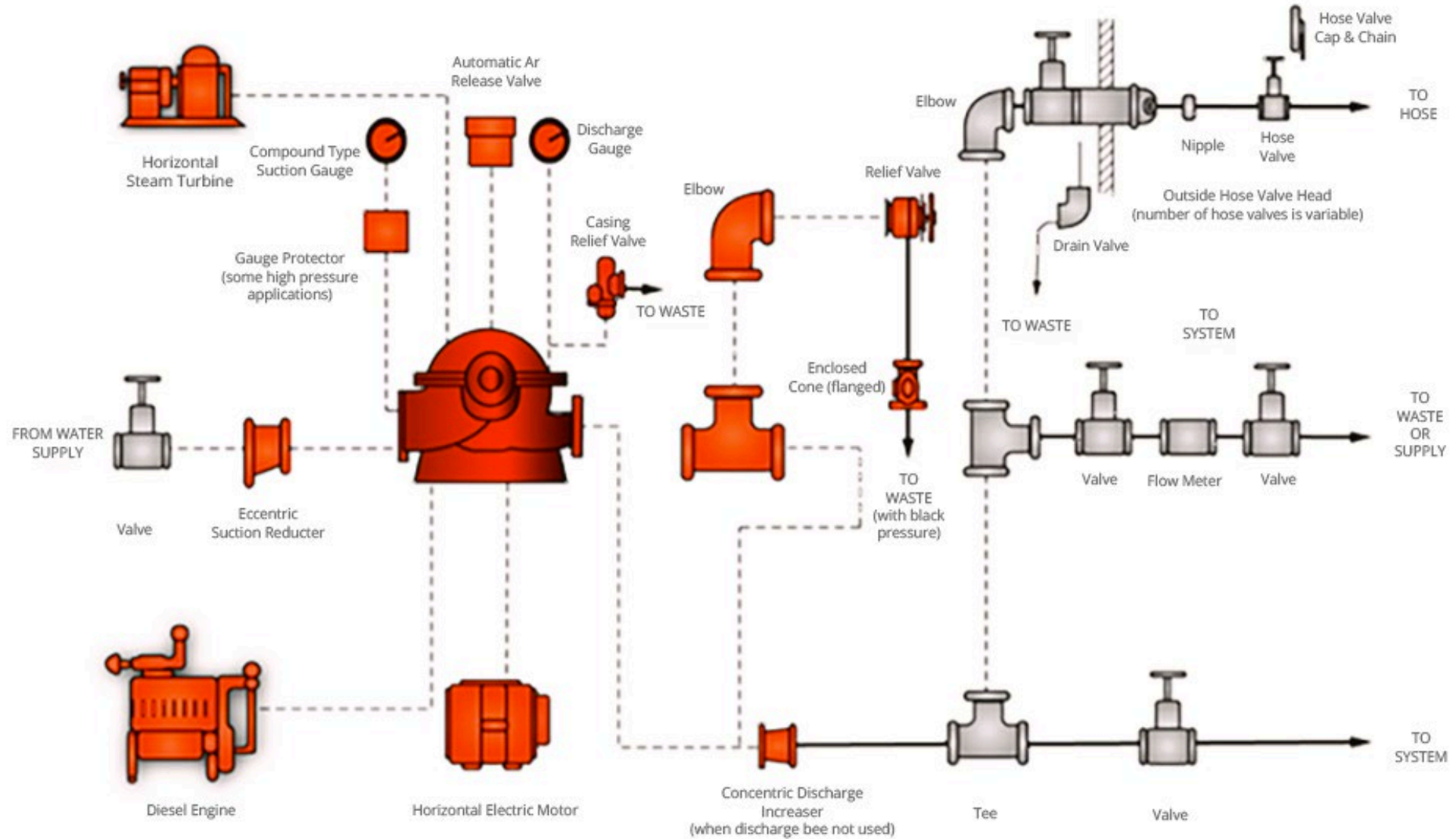


# IV - TYPICAL DESIGN AND INSTALLATION

FIRE PUMP INSTALLATION AS PER NFPA-20

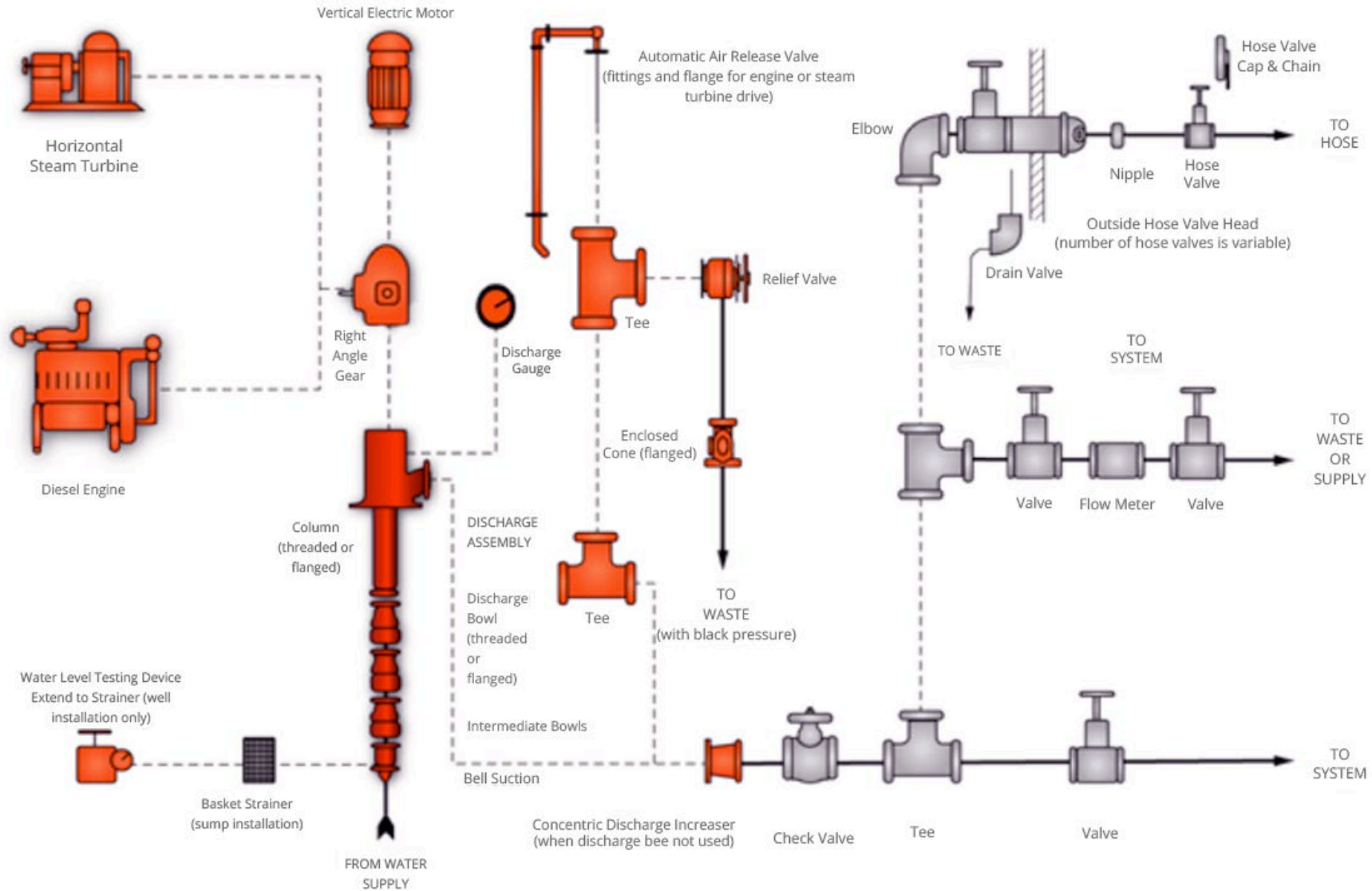


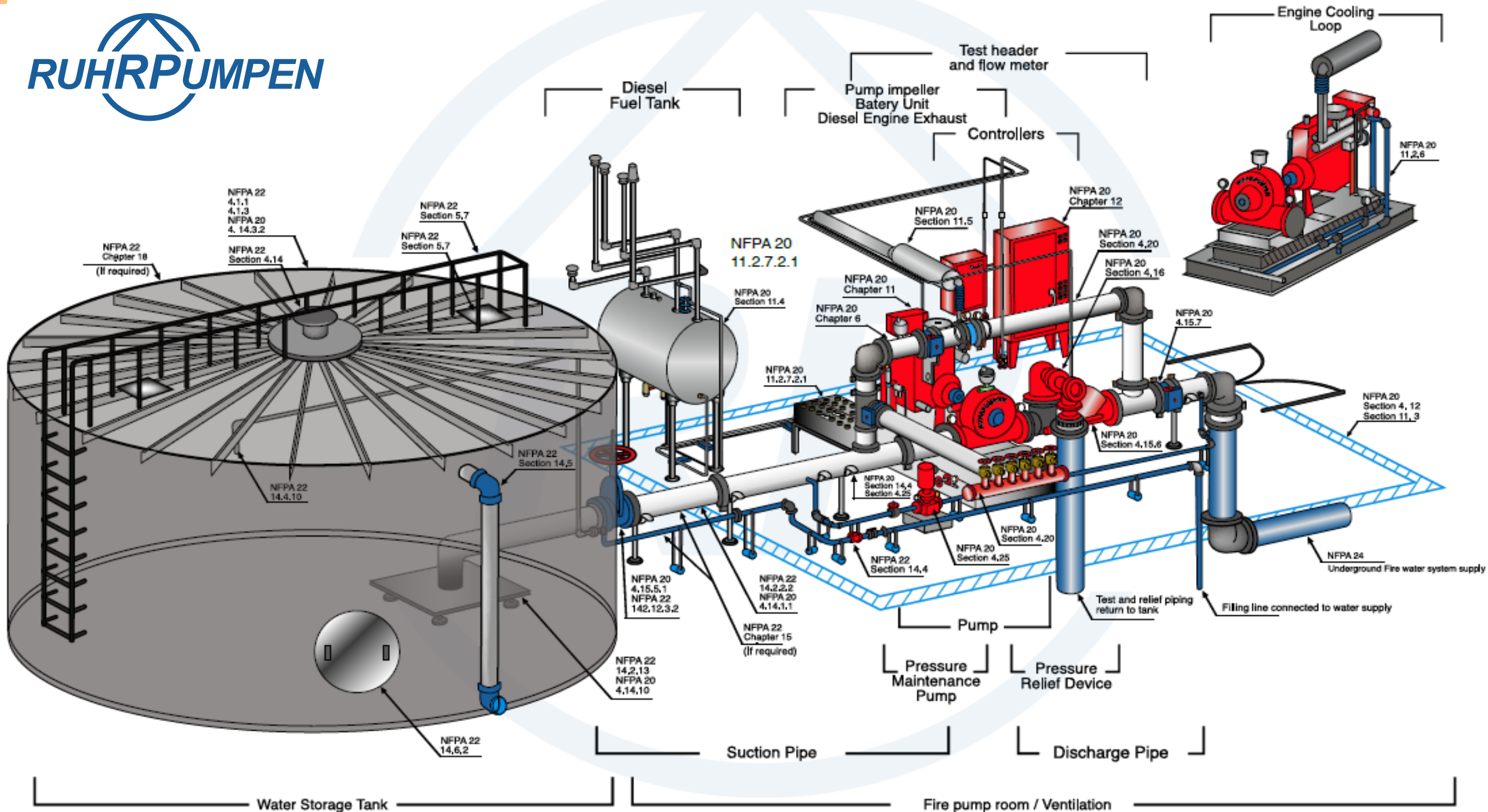
# Typical Accessories





# Typical Accessories

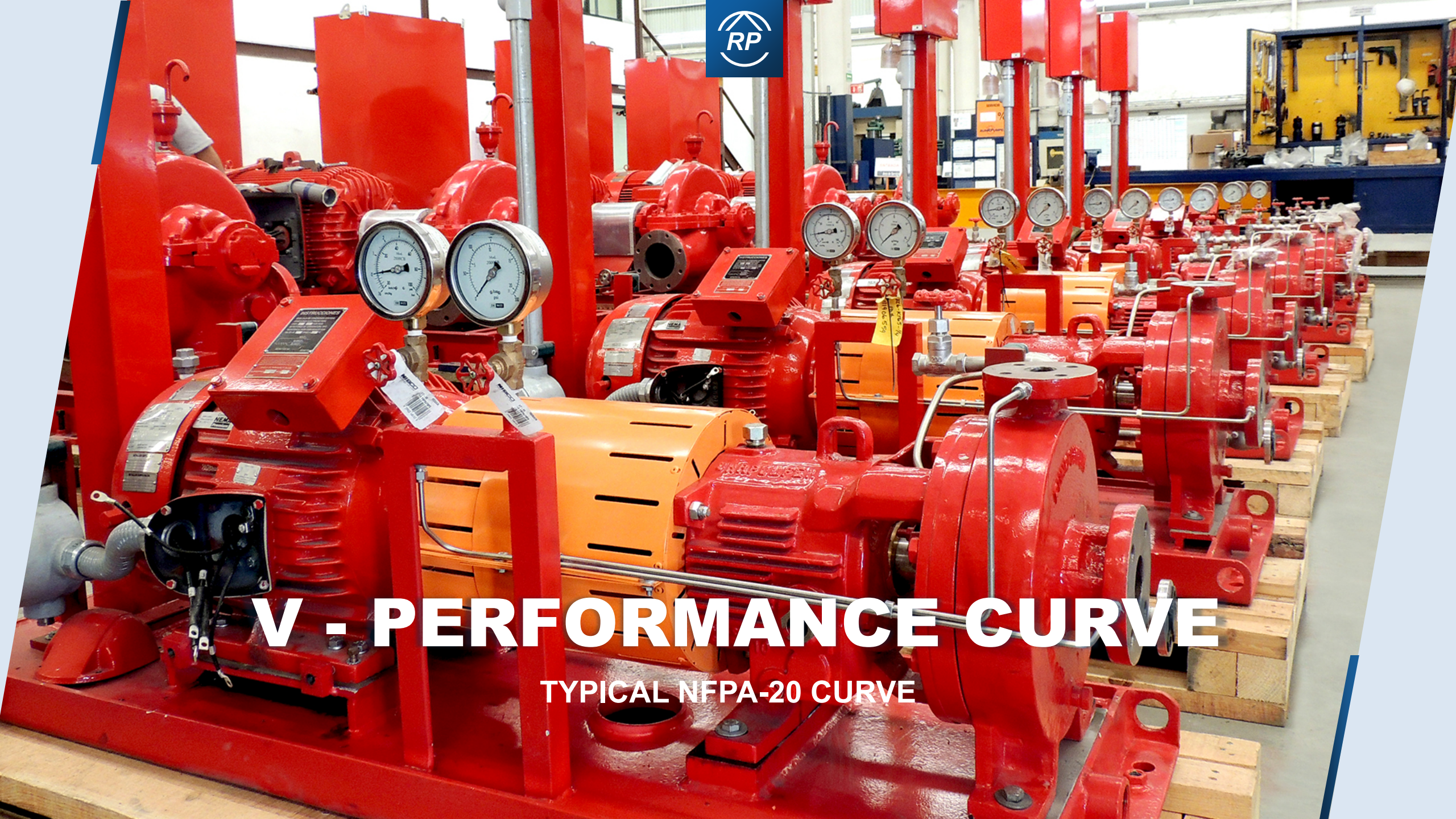






# V - PERFORMANCE CURVE

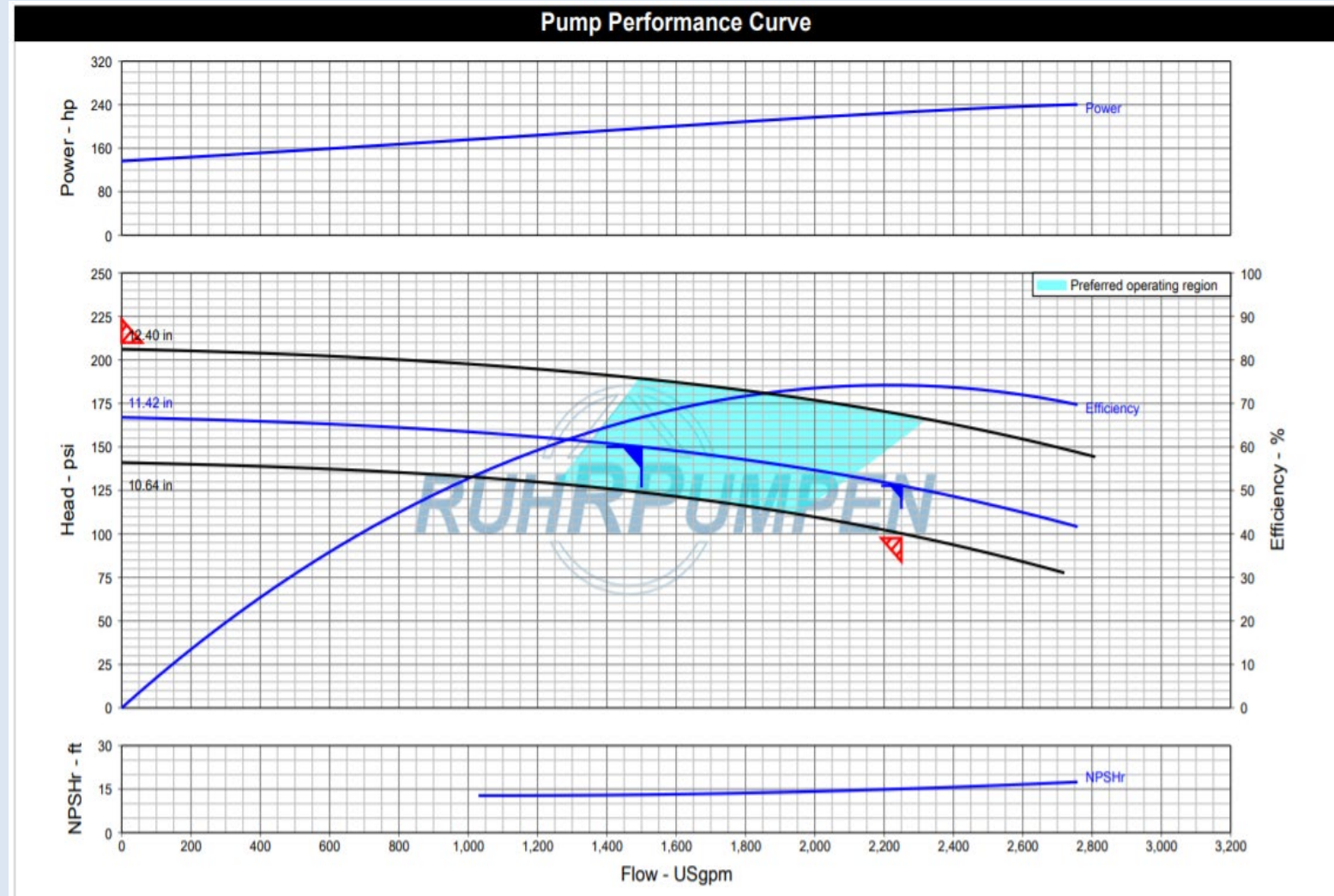
TYPICAL NFPA-20 CURVE





# NFPA-20 Curve

- 100% Flow at 100% head.
- Maximum of 140% of head.
- Minimum of 65% of head at 150% of rated flow
- The demand/duty flow must be between 90% and 140% of the rated certified pump capacity.





# PERFORMANCE COMPARISON

BETWEEN NFPA-20 FIRE PUMP & API PUMPS



International Standard that specifies requirements for centrifugal pumps for use in petroleum, petrochemical and gas industry process services

- Designed for continuous operation handling primarily hot, high pressure hazardous and flammable hydrocarbons.
- Rated flow close to BEP



This Standard deals with the selection and installation of pumps supplying liquid for private fire protection

- Not designed for continuous operation
- Selected to deliver 150% of rated flow





# CONSTRUCTION COMPARISON

BETWEEN NFPA-20 FIRE PUMP & API PUMPS



Most fire pump manufacturers will consider and comment on API610 and Oil Company pump specifications, but as the basic pump design is to water pump standards rather than API process pump standards the list of exceptions, comments and clarifications will be extensive.



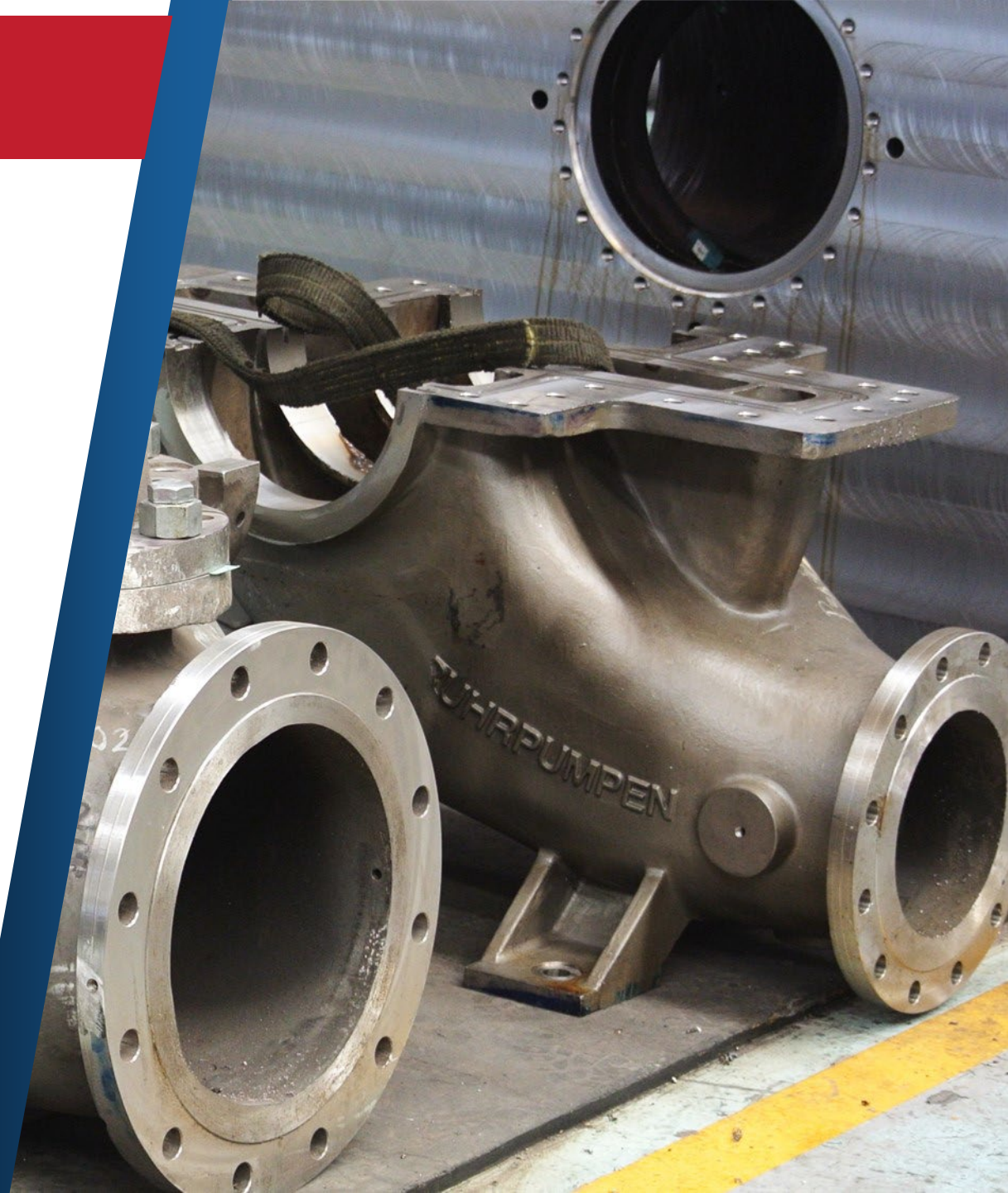
# VI - UL/FM CERTIFICATION REQUIREMENTS

GUIDELINES TO MODIFY AN EXISTING CERTIFICATE



# Not Just a **Red** Pump

- All calculations of bearing life, bolts and nuts strength, shaft deflection, forces must be sent to UL and FM for approval.
- UL and FM must witness the hydrostatic test of pump casing, bowls, discharge heads and column.
- UL and FM must witness the pump performance test.
- Constant facilities and product audits by UL and FM – Every three months.
- All drawings and Bills-of-Material must be approved by UL and FM, if any modification is required for these drawings, they must be reviewed and approved by UL&FM.





# Single Package Responsible

In accordance with FM requirements, the **pump manufacturer** has **overall package responsibility** including:

- Fire pump.
- Driver.
- Pump controller (electric motor or diesel engine).
- Flexible coupling or drive shaft.
- Suction and discharge pressure gauges.
- Pressure-relief valve and waste cone, when required.
- Automatic air release valve.
- Circulation-relief valve.
- Substantial bedplate for pump and driver.
- Diesel engine accessories: Batteries, cooling lines, fuel lines, exhaust piping, muffler and fuel tank.
- Right angle gear drive.





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**Ruhrpumpen, S.A. DE C.V.**  
 Niquel No. 9204, Ciudad Industrias Mitras, Garcia, N.L. México 66000  
 Fire Pump Installation Systems  Fire Pumps  Centrifugal Fire Pumps, Horizontal Split-Case Type  Horizontal Mounted

Product	Listing Country	Rated Capacity, (gal/min)	Rated Capacity, (dm <sup>3</sup> /min)	Rated Net Head at Rated Capacity, psi	Rated Net Head at Rated Capacity, kPa	Rated Speed, r/min	Suction Inlet, dia., in.	Discharge Outlet, dia., in.	Stage (s)	Certification Type	Class of Work
HSD 4 x 3 x 17A	Mexico	250	945	94-151	645-1041	1750	4	3	1	FM Approved	1311-Centrifugal Fire Pumps, Horz
HSR 4x6x11B	Mexico	500	1895	123-193	848-1331	3550	6	4	1	FM Approved	1311-Centrifugal Fire Pumps, Horz
HSD 6 x 4 x 17A	Mexico	750	2840	93-143	641-986	1750	6	4	1	FM Approved	1311-Centrifugal Fire Pumps, Horz
HSD 8 x 6 x 20A	Mexico	750	2840	108-197	745-1358	1750	8	6	1	FM Approved	1311-Centrifugal Fire Pumps, Horz



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**Company Name**

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Document Name ↕	Company Name ↕	UL CCN Description ↕
EEEE.MH61666	RUHRPUMPEN S A DE C V	ABOVEGROUND FLAMMABLE-LIQUID TANKS
EEEE7.MH61666	RUHRPUMPEN S A DE C V	ABOVEGROUND FLAMMABLE-LIQUID TANKS CERTIFIED FOR CANADA
FDNP.MH59925	RUHRPUMPEN S A DE C V	DRINKING WATER SYSTEM COMPONENTS
FDNP7.MH59925	RUHRPUMPEN S A DE C V	DRINKING WATER SYSTEM COMPONENTS CERTIFIED FOR CANADA
QNVB.MH59925	RUHRPUMPEN S A DE C V	LEAD CONTENT VERIFICATION OF PRODUCTS IN CONTACT WITH POTABLE WATER
QNVB7.MH59925	RUHRPUMPEN S A DE C V	LEAD CONTENT VERIFICATION OF PRODUCTS IN CONTACT WITH POTABLE WATER CERTIFIED FOR CANADA
QWZU.EX15974	RUHRPUMPEN S A DE C V	CENTRIFUGAL FIRE PUMPS, END SUCTION
QXJV.EX5213	RUHRPUMPEN S A DE C V	CENTRIFUGAL FIRE PUMPS, SPLIT CASE
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# VII - FIRE PUMP DRIVERS & CONTROLLERS





# Pump Drivers

- Each pump shall have its own dedicated driver.
- Electric Motor or Diesel Engine.
- Sized to the maximum pump power demand.







# Electric Driver

- Manufactured NEMA MG-1
- NEMA B design.
- UL 1004-5 Listed for fire service.
- Service factor 1.15
- Hollow Shaft Verticals
- Vertical with Non-Reverse
- System APG / TEFC enclosures
- Electric motors must be derated for elevation above 3,300 Feet (1,000 m) in accordance with NEMA MG-1.
- For electric motors operating at nominal voltages and frequencies, the Amps demand in each phase must not exceed the product of the ampere rating of the total load multiplied by the allowable service factor, as stated on the motor nameplate.



NRR



# RP Electric Driver

	Mark for U.S.	Mark for Canada	Mark for U.S. / Canada
Listing mark			
Recognition mark			





# Diesel Engine

- Listings for fire service.
- Must accelerate to rated speed in no more than 20 seconds.
- Selected for the maximum power required by the pump.
- Tier according to local regulations.
- Double battery bank: each one for 3 minutes of cranking attempt (6 cycles of 15 seconds of starting and 15 seconds of rest).
- Head losses must be compensated (VTP).
- Derated by altitude and temperature.  
3% for every 1000 'above 300'  
1% for every 10°F above 77°F
- It should be tested at least once a week for a minimum of half an hour.





# Diesel Tank

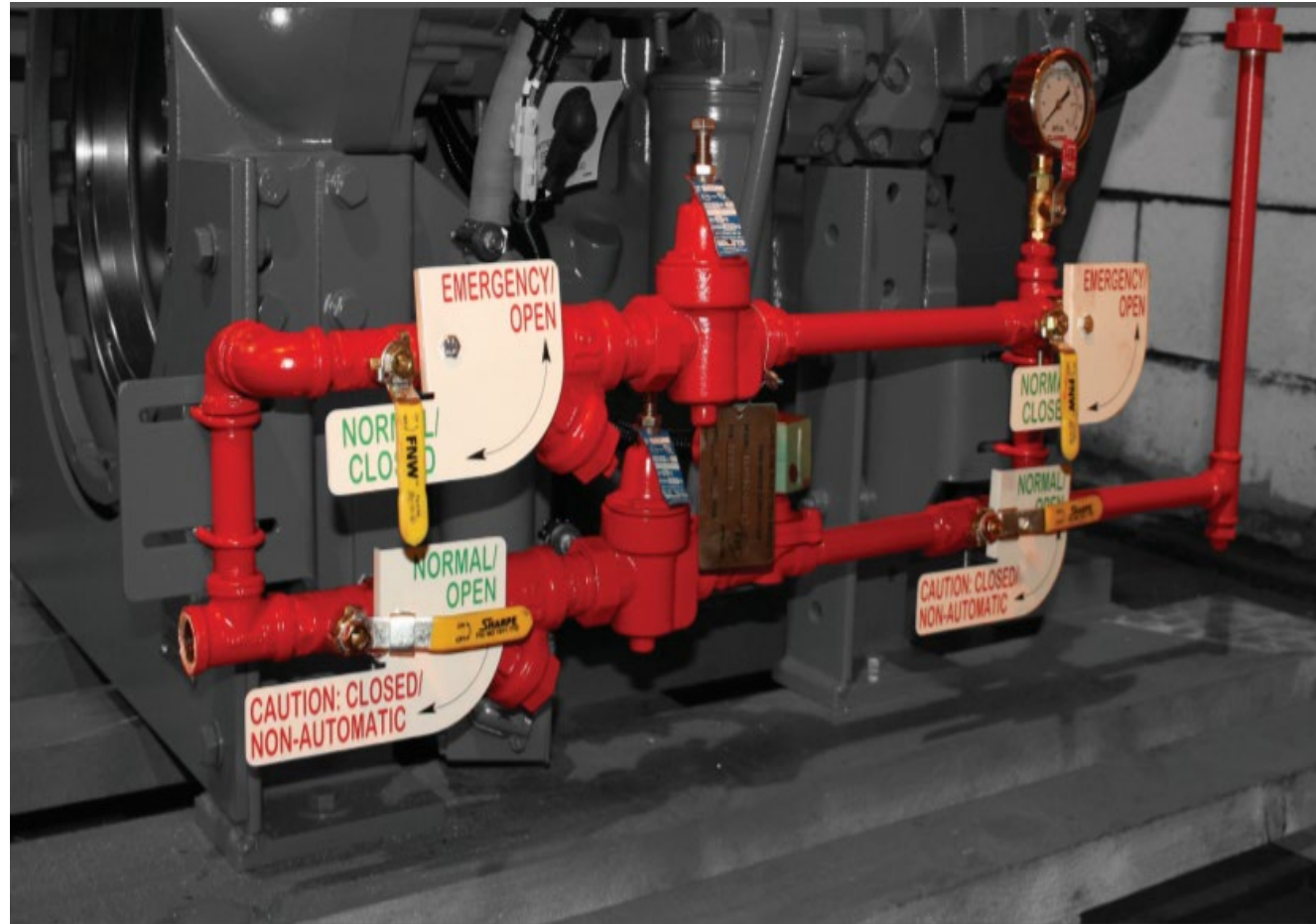
- Selected at 1.0 gal. per engine HP.
- 5% for expansion 5% for sediments
- Exclusive use of the fire fighting system.
- Located above ground level and above the engine's fuel pump.
- In areas with temperatures below 32°F it must be installed in the machine room.
- UL-142 Collection tank (bund) or double-walled tank.



# Engine Cooling System

## Cooling Loop

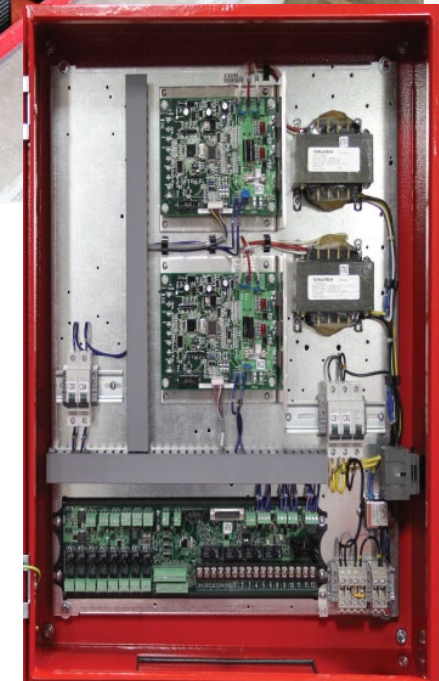
- FM Approved assembly
- Components materials are as listed by the engine manufacturer
- For horizontal split case pump or vertical pump application
- Cannot be modified by pump manufacturer



# Engine Starting Systems

## Electric Starting System

- Where electric starting is used, the electric starting device shall take current from a storage batteries.
- Two sets of storage batteries,
- Lead-Acid type or Nickel-Cadmium
- Sized to maintain the cranking during six consecutive cycles of 15 seconds of cranking and 15 seconds of rest each set.
- Two means of charging:
  - Engine alternator
  - Battery chargers inside the system control panel



# Engine Starting Systems

## Pneumatic Starting System

- Commonly used as a secondary starting system
- When used as a secondary cranking system, the air supply container shall be sized for 90 seconds of continuous cranking without recharging



# Engine Starting Systems

## Hydraulic Starting System

- Commonly used as a secondary starting system.
- It shall be a self contained system that will provide the required cranking forces and engine starting RPM
- The capacity of the hydraulic cranking system shall be capable of providing not fewer than six cranking cycles of not less than 15 seconds each (capacity for 90 seconds of total crank time)







# Gearbox

- Service Factor 1.5
- Hollow Shaft
- Non-reverse ratchet
- Cooling system
- FM approved
- Calculated for maximum power





# Controllers

- *All controllers must be listed as suitable for use as Fire Service Equipment.*
- *All controllers must be fully assembled, wired, and tested by the manufacturer prior to shipment.*
- *Enclosure shall be at least NEMA type 2, or, IP-31*

*Types:*

- *Controller for Main Electric Motor and Jockey*
- *Diesel Engine Controller*





# Electric Motor Controllers

- *Controllers should be located as close as possible to the controlled motors, whenever practical.*
- *Current-carrying controller parts must be at least 12 inches above ground level.*
- *A controller should not be used as a junction box to supply other equipment.*
- *An automatic controller must also be operable as a Manual controller.*
- *A pressure actuated switch or electronic pressure sensor with adjustable high or low pressure set points must be provided as part of the controller.*
- *The controller should be fully functional 10 seconds after power-up.*





# Electric Motor Controller



Alarm



Manual Operation



Solenoid Valve



Interface



USB Port



# Electric Motor Controller



Remote Alarm contacts



Over Voltage Protection

Emergency Start Handle

## Contacts for Remote Alarm:

- Available energy
- Motor, or, Pump operating.
- Phase inversion.
- Pump room common alarm
- Common alarm motor problems



Automatic Transfer Switch



# Diesel Engine Controllers

- *It must have two battery units and be configured so that manual and automatic engine starting can be carried out with either unit.*
- *The starting current must be supplied first through one battery bank and then through the other bank.*
- *The battery bank change must be carried out automatically except when starting is manual.*
- *In the event that the engine does not start after completion of its attempt to cycle, the controller should stop successive engine starts and operate a visible indicator and audible alarm.*





# Diesel Engine Controller



Solenoid Valve



Pressure transducer



Interface



USB Port

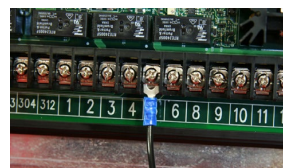


# Diesel Engine Controller

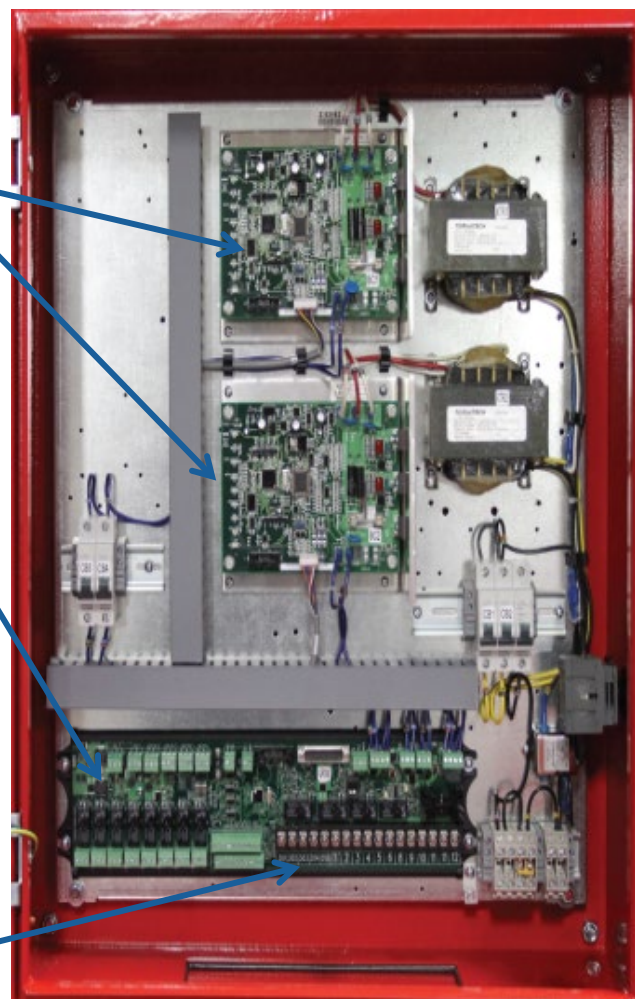
Battery  
Chargers



Remote Alarm  
contacts



Diesel Engine  
contacts



## Contacts for Remote Alarm:

- Engine Running
- Selector in Manual/Off position.
- Common Driver Problems
- Common Engine Problems
- Pump room common alarm



Power Input



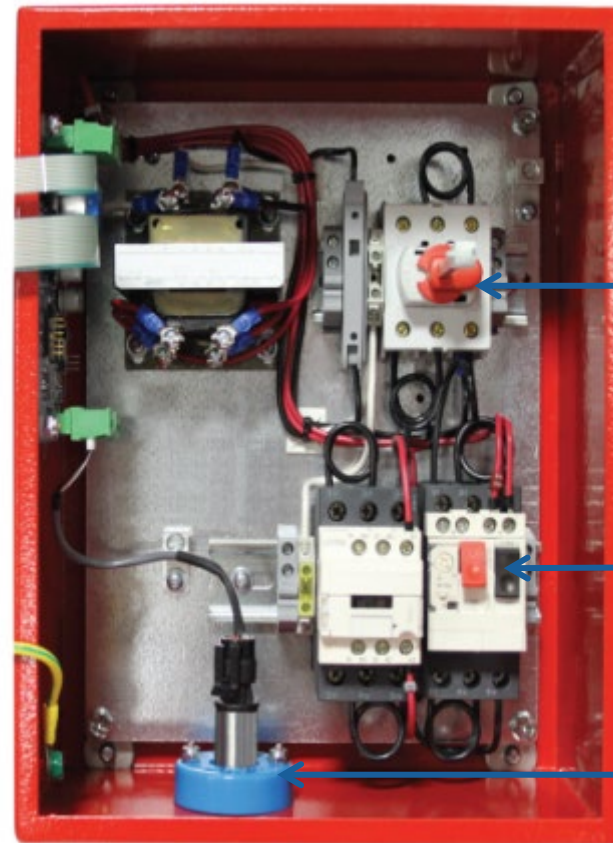


# Jockey Pump Controller



Interface

Rotary Main  
Switch



Disconnect  
Switch

Thermo Magnetic  
Starter

Pressure  
transducer



# VIII – Pre-Packaged Systems





# Packaged systems– NFPA 4.31

A packaged fire pump assembly, with or without an enclosure, shall meet all of the following requirements:

- The assembly shall be listed for fire pump service.
- The components shall be assembled and affixed onto a steel framing structure.
- Welders shall be qualified in accordance with the Section 9 of ASME or with the American Welding Society AWS.
- All electrical components, clearances, and wiring shall meet the minimum requirements of the applicable NFPA 70 articles.
- Packaged and prefabricated skid unit(s) shall meet all the requirements in NFPA 20, including those described in Sections 4.14 through 4.19.
- The structural integrity shall be maintained with minimal flexing and movement.
- The interior floor shall be permitted to be provided with grouting in accordance with 4.31.8 or installed after the packaged pump house is set in place in accordance with 4.31.10.



# Grouted or Open Skids

- *Comply with NFPA-20 & ETL.*
- *Floor drains piped to skid edge.*
- *Includes Suction, discharge, fuel, pressure sensing lines & test piping.*
- *Completely wired.*
- *Special coatings available upon request.*
- *Operator access to controls from outside of the skid.*
- *Hydrotested for complete piping assembly (2 hours).*
- *Point to point electric check continuity test before shipment.*





# Pump House

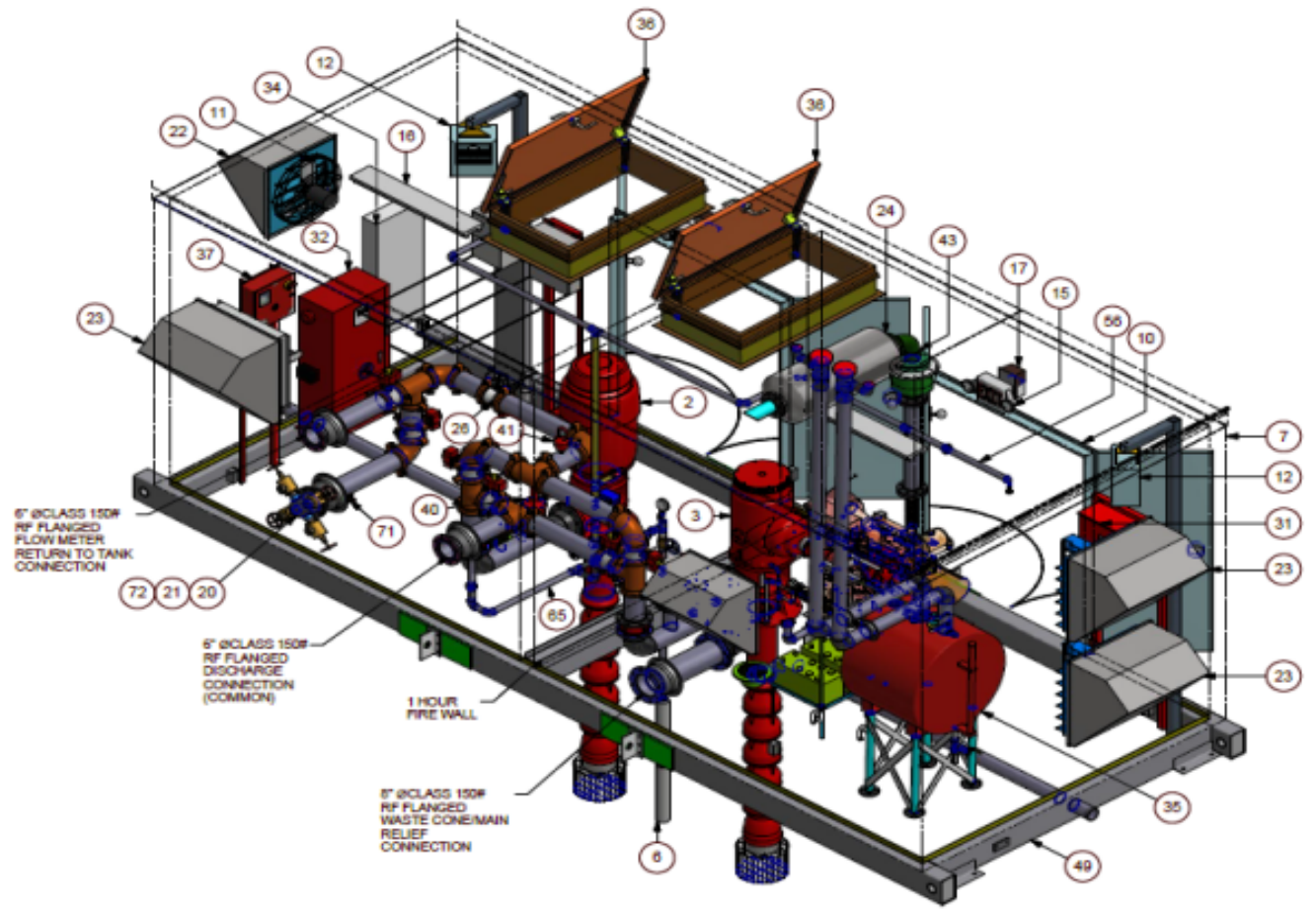
- *Comply with NFPA-20 & ETL*
- *Heating and Air Conditioning as applicable.*
- *When necessary, an approved or listed heating device must be installed to maintain a pump room temperature above 40 F (4 C).*
- *Indoor and outdoor artificial light*
- *LV power distribution (single power source, upon request).*
- *PE stamped drawings upon request.*
- *Emergency light*
- *Custom layouts for personnel access available upon request.*





PUMP HOUSE - VERTICAL TURBINE

REV	DESCRIPTION	OWN	CHK	DATE
5	SENT FOR INFORMATION	R. BRAVO	A. FLORES	6/9/2016



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**NOTES:**

- ALL DIMENSIONS ARE FOR REFERENCE ONLY
- DO NOT SCALE DRAWING
- MANUFACTURING DRAWING
- LINEAR TOLERANCE ± .18"
- ANGULAR TOLERANCE ± .5°
- DO NOT SCALE DRAWING
- ALL DIMENSIONS ARE IN INCHES
- DIMENSIONS ARE PER ANSI Y14.5

**SCALE:** NTS





# SKID MOUNTED VERTICAL TURBINE

PRINCIPAL COMPONENTS		
ITEM	QTY	DESCRIPTION
1	1	DISCHARGE HEAD
2	1	GEAR DR DRIVE
3	1	TORSIONAL COUPLING
4	1	CONTROL PANEL
5	1	BASEPLATE
6	1	AIR RELEASE VALVE
7	1	PRESSURE GAUGE
8	1	VERTICAL PUMP
9	2	1/4" X 108 FLANGED COLUMN
10	1	BASKET STRAINER
11	1	DRIVE SHAFT
12	1	DIESEL ENGINE
13	1	DRIVE SHAFT GUARD

CUSTOMER DATA		
CUSTOMER:	BASS ENGINEERING	
END USER:		
SITE:	TBD	
PROJECT:		
GPS #:	321576	
CUSTOMER P.O.:	TBD	
SERVICE/DIESEL:	VERTICAL FIRE PUMP	

PRINCIPAL COMPONENTS					
ITEM	DESCRIPTION	SIZE	TYPE	CONNECTION	
A	DISCHARGE SPOOL	14 1/2" FF	FLANGED	BY RUHRPUMPEN	
B	INLET COOLING LOOP	1 1/4" NPT	THREADED	BY RUHRPUMPEN	
C	OUTLET COOLING LOOP	1 1/2" 150# RF	FLANGED	BY OTHERS	
D	GEAR DRIVE COOLING WATER DRAIN	1/2" 150# RF	FLANGED	BY OTHERS	
E	PRESSURE GAUGE CONNECTION	1/4" NPT	THREADED	BY RUHRPUMPEN	
F	AIR RELEASE VALVE CONNECTION	3" NPT	THREADED	BY RUHRPUMPEN	
G	FUEL SUPPLY	1/2" 150# RF	FLANGED	BY OTHERS	
H	FUEL RETURN	1/2" 150# RF	FLANGED	BY OTHERS	
I	SENDING LINE	1/2" NPT	THREADED	BY RUHRPUMPEN	
J	EXHAUST FLANGE	8" 150# FF	FLANGED	BY OTHERS	

TAG NO.		
PUMP NO.	ENGINE NO.	RF JOB
001	---	TBD

PUMP			
TYPE AND MODEL VTP-20C-600			
COOLING ---			
<b>RUHRPUMPEN</b>			
<b>FIRE PUMP DIMENSIONAL DRAWING</b>			
DESIGNED BY <b>E. GARCIA</b>	CHECKED BY <b>A. LOPEZ</b>	SCALE NONE	DATE 1/19
DATE 3/14/2014	DATE 3/14/2014	PROJECT NO. <b>R140000</b>	REV <b>A</b>

**GENERAL NOTES:**

- 1: DIMENSIONS IN INCHES (DIM)
- 2: PRESSURE RELIEF VALVE SHIPPED LOOSE.
- 3: FLOW METER DEVICE SHIPPED LOOSE.
- 4: WASTE CONE SHIPPED LOOSE.
- 5: DIESEL TANK 700 GAL DOUBLE WALL UL 142 LISTED NFPA 30 ACCORDANCE, SHIPPED LOOSE.
- 6: \*CATALOG DIMENSIONS.

**REVISION HISTORY**

REV	DESCRIPTION	DESIGNER	DATE
A	ISSUED FOR INFORMATION	E. GARCIA	03/14/2014

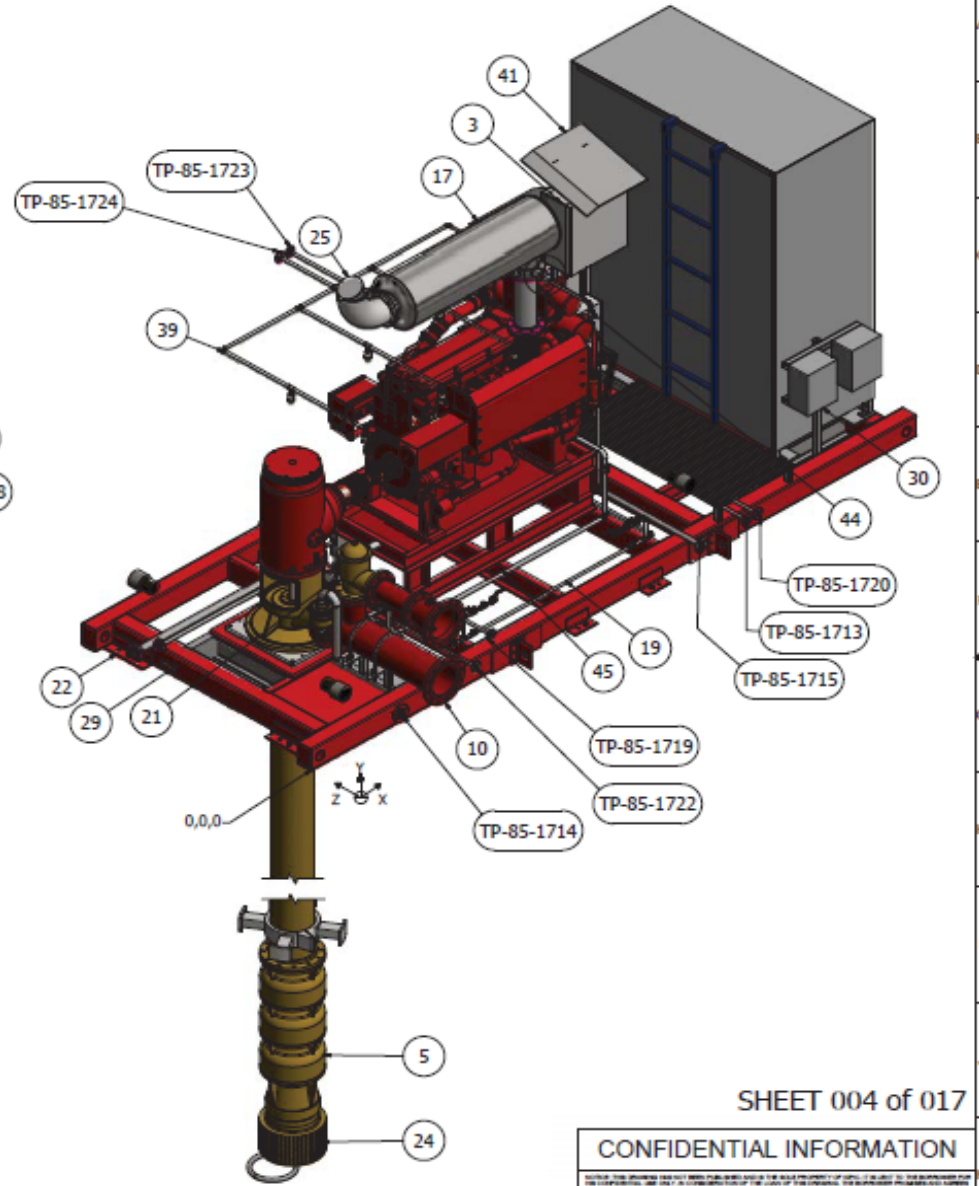
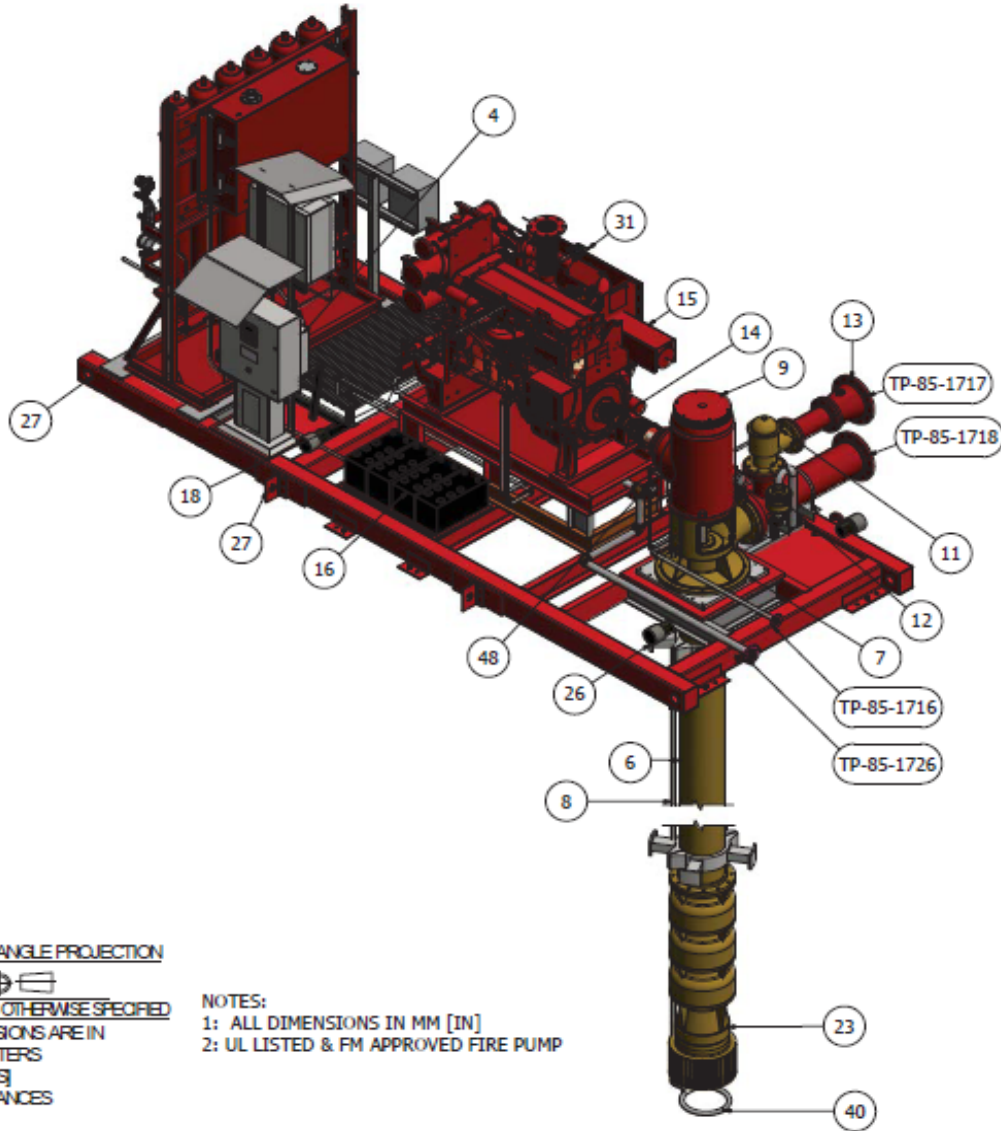
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SKID SYSTEM VERTICAL TURBINE



THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED  
 DIMENSIONS ARE IN  
 MILLIMETERS  
 [INCHES]  
 TOLERANCES  
 ±0.35  
 [± 1/4]

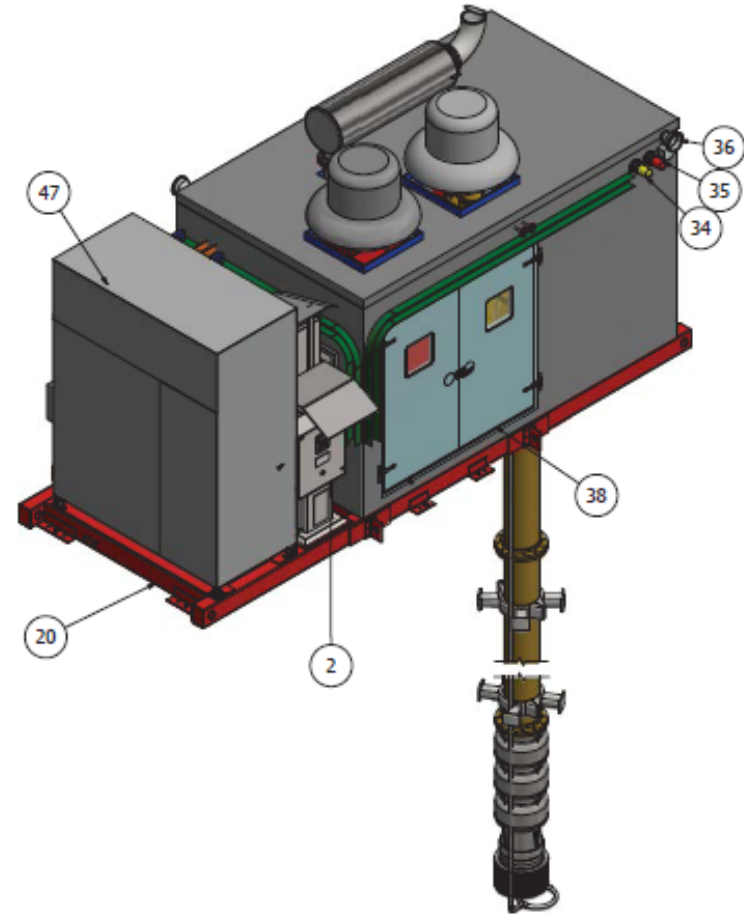
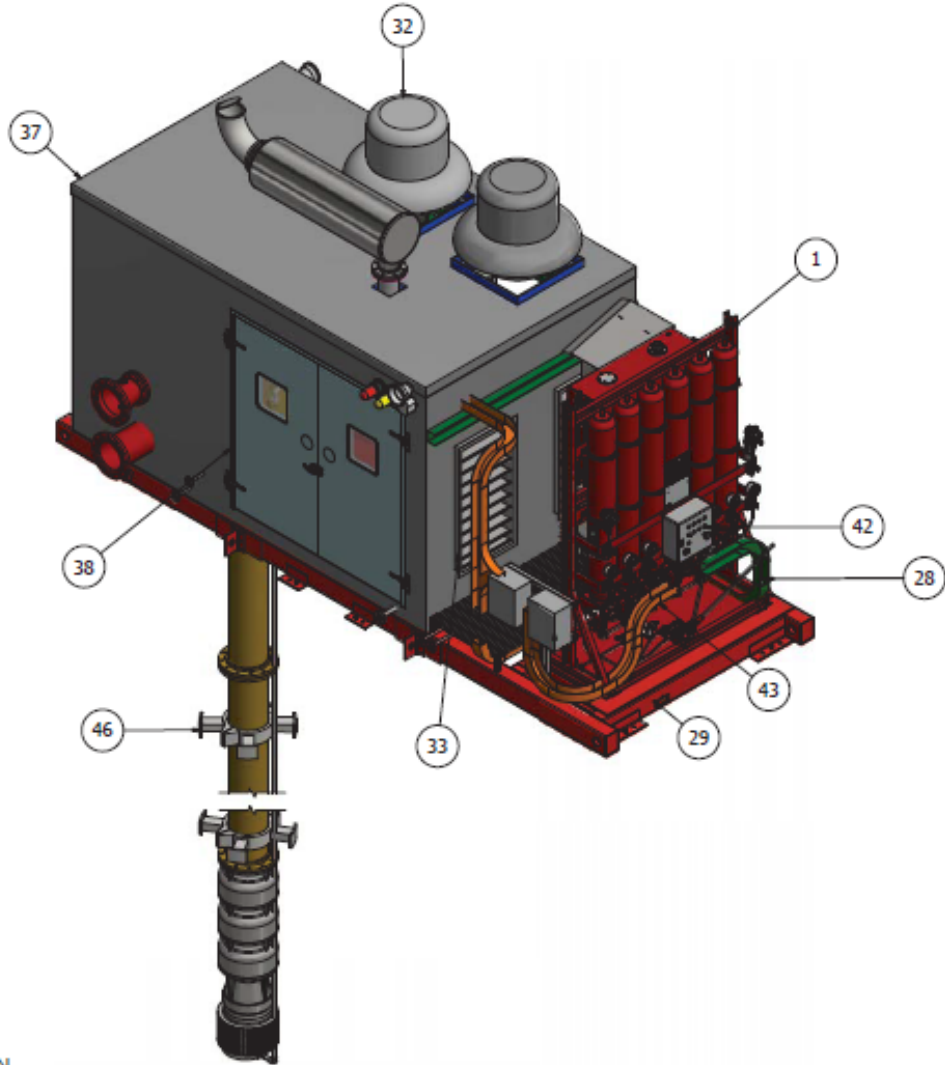
NOTES:

- 1: ALL DIMENSIONS IN MM [IN]
- 2: UL LISTED & FM APPROVED FIRE PUMP

SHEET 004 of 017

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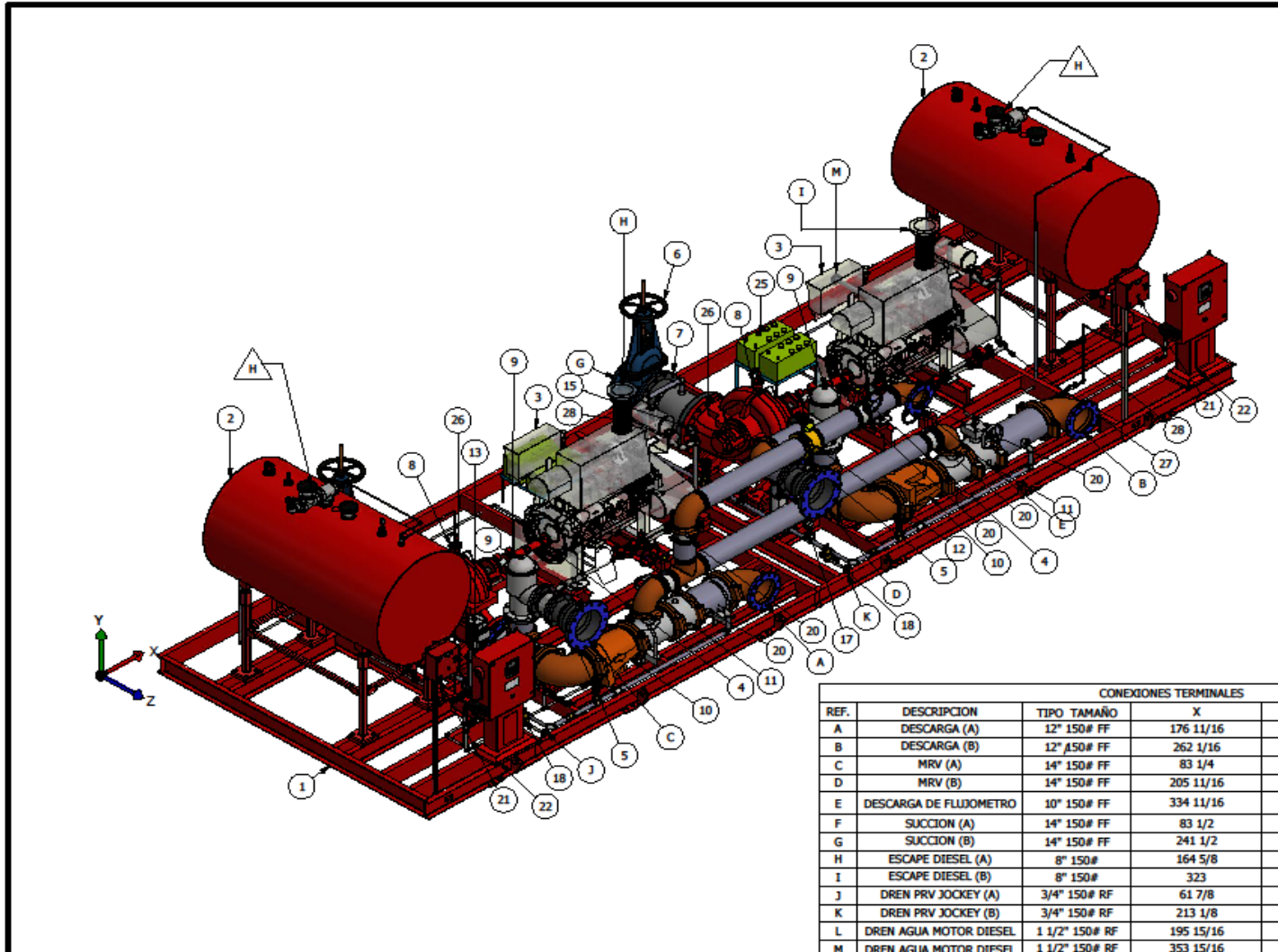
THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN  
MILLIMETERS

NOTES:

- 1: ALL DIMENSIONS IN MM [IN]
- 2: UL LISTED & FM APPROVED FIRE PUMP



COMPONENTES PRINCIPALES		
ITEM	QTY	DESCRIPTION
1	1	BASE
2	2	TANQUE 700 GAL
3	2	MOTOR DIESEL J66H-UFAD88
4	2	BARRA CARDAN
5	2	CONO DE DESPERDICIO 6X1 1/2 150# FF
6	2	VALVULA COMPUERTA OS&Y- 14"
7	2	REDUCTOR EXCENTRICO SUCCION 16X14"
8	2	VALVULA LIBERADORA DE AIRE - 1"
9	2	VALVULA LIBERADORA DE PRESION- 8"
10	2	VALVULA CHECK - 12"
11	2	VALVULA MARIPOSA 12" C/TAMPER SWITCH
12	1	FLUJOMETRO 10"
13	2	BOMBA JOCKEY CR 15-09
14	2	MANOMETRO
15	2	MANOVACUOMETRO
16	2	MANOVACUOMETRO JOCKEY
17	2	MANOMETRO JOCKEY
18	2	VALVULA DE RECIRCULACION JOCKEY
19	1	VALVULA LIBERADORA DE AIRE - 1"
20	4	VALVULA MARIPOSA C/TAMPER - 10"
21	2	PANEL DE CONTROL JPS TORNATECH
22	2	PANEL DE CONTROL GPD TORNATECH
23	1	TUBERIA SUMINISTRO DE COMBUSTIBLE
24	1	TUBERIA RETORNO DE COMBUSTIBLE
25	2	KIT DE BATERIAS 24 VDC CON RACK
26	2	ZW 16X12X20 (A)
27	2	COOLING LOOP
28	2	MOTOR COOLER

PESO TOTAL APROXIMADO: 10014.50 Kg

CONEXIONES TERMINALES					
REF.	DESCRIPCION	TIPO TAMAÑO	X	Y	Z
A	DESCARGA (A)	12" 150# FF	176 11/16	20 13/16	142
B	DESCARGA (B)	12" 150# FF	262 1/16	20 13/16	142
C	MRV (A)	14" 150# FF	83 1/4	48 11/16	142
D	MRV (B)	14" 150# FF	205 11/16	20 13/16	142
E	DESCARGA DE FLUJOMETRO	10" 150# FF	334 11/16	60 5/16	142
F	SUCCION (A)	14" 150# FF	83 1/2	21 13/16	0
G	SUCCION (B)	14" 150# FF	241 1/2	21 13/16	0
H	ESCAPE DIESEL (A)	8" 150#	164 5/8	92 1/4	80 3/16
I	ESCAPE DIESEL (B)	8" 150#	323	92 1/4	80 3/16
J	DREN PRV JOCKEY (A)	3/4" 150# RF	61 7/8	10 15/16	142
K	DREN PRV JOCKEY (B)	3/4" 150# RF	213 1/8	10 15/16	142
L	DREN AGUA MOTOR DIESEL	1 1/2" 150# RF	195 15/16	11 7/16	142
M	DREN AGUA MOTOR DIESEL	1 1/2" 150# RF	353 15/16	11 7/16	142

CUSTOMER DATA		
CUSTOMER:	INDIGO-ISIVEN	
END USER:	YPFB	
SITE:	SANTA CRUZ / BOLIVIA	
PROJECT:	ICA PRIMERA FASE	
GPS #:	559200 REV 5	
CUSTOMER P.O.:	450000033/32	
SERVICE:	4000 GPM @ 130 PSI	

TAG NO.		
PUMP NO.	MOTOR NO.	RP JOB
001		363200492
002		

PUMP	
TYPE AND MODEL	ZW 16X12X20 (A)
COOLING	---

THROUGHT PROJECTION	NOTAS GENERALES:
	1: DIMENSIONES EN MILIMETROS (PULGADAS)
	2: DIMENSIONES ENTRE (*) SON SUSCEPTIBLE A CAMBIAR POR PROVEEDOR.
	3: BOMBA LISTADA UL & APROBADA FM.
	4: BATERIAS SUMINISTRADA POR SEPARADO
	5: REVISAR QUE EL TANQUE ESTE LIBRE DE CONTAMINANTES Y/O AGUA
	6: PESO TOTAL SIN LIQUIDOS

REV	DESCRIPTION	DATE	APPROVED
H	AS-BUILT	4/2/2019	JAMV
G	AS-BUILT	4/2/2019	JAMV
F	AS-BUILT	11/14/2018	JAMV
E	COMENTARIOS APLICADOS	9/28/2018	JAMV
D	AGREGADO DREN DE MOTOR DIESEL	5/18/2018	JAMV
C	COMENTARIOS APLICADOS	5/02/2018	JAMV

**APPROVAL DRAWING NOTES**

- PURCHASER'S COMMENTS AND/OR CORRECTIONS, WITHIN THE SCOPE OF CONTRACT, WILL BE MADE ON THE FIRST COMPLETED CERTIFIED DRAWING SUBMITTED BY RUHRPUMPEN INC. PUMP DIVISION AND RETURNED FOR CORRECTION.
- CORRECTIONS, ALTERATIONS, ADDITIONS AND/OR MODIFICATIONS OUTSIDE SCOPE OF CONTRACT OR MADE AFTER FIRST SUBMITTAL, WILL REQUIRE AN ENGINEERING SERVICE CHARGE AND MAY CHANGE PRICE.
- ITEMS CONDITIONALLY APPROVED OR NEEDING DEFERRED APPROVAL BY PURCHASER, MUST BE SPECIFICALLY STATED. DELIVERY MAY BE AFFECTED.

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DRAWING TITLE			
DWN BY	CHKD BY	SCALE	DRAWING NO.
JAMACIAS	A.FLORES	NONE	8008370226
DATE	DATE	SHEET NO.	REV
12/15/2017	12/15/2017	4 OF 4	H

The background image shows a large industrial facility with several red pumps. The pumps are mounted on a red metal frame and have various pipes and gauges attached. The word 'RUHRPUMPEN' is embossed on the side of the pumps. The scene is brightly lit, and the overall color scheme is dominated by red and white.

# IX - RUHRPUMPEN PROJECT REFERENCES





# YPF Argentina

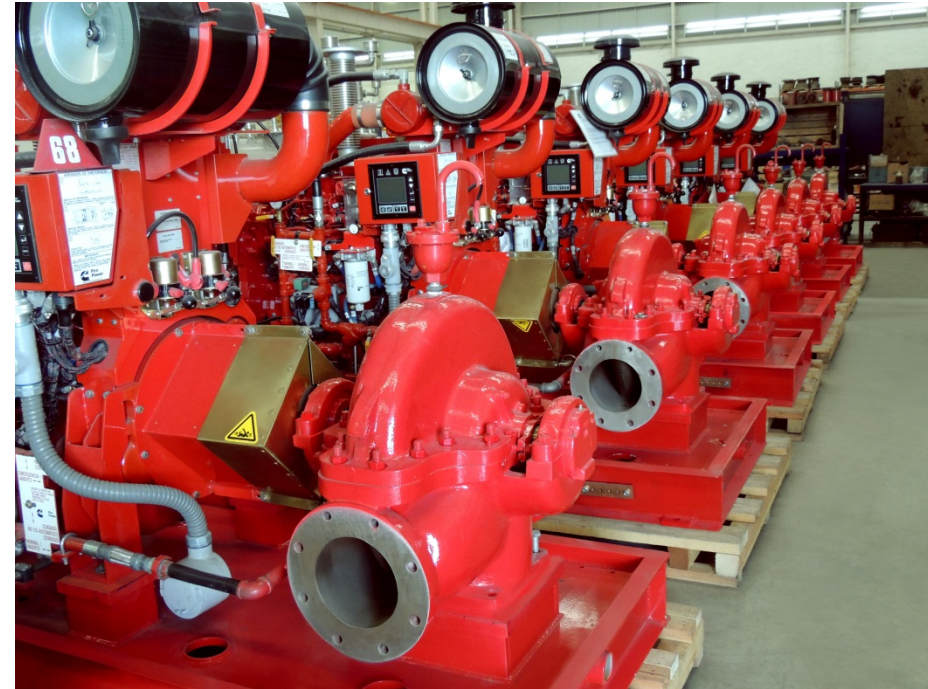
- Model: ZW 8x5x12F
- Flow: 1000 GPM / T.D.H: 202.0 Ft
- Diesel 98HP/ Weatherproof Enclosure/ Ni Cad Battery





# PETRÓLEOS MEXICANOS

- Batería 5 Presidentes.
- Model: HSD 8x6x20A / CI – Bze
- Flow: 1250 GPM / T.D.H.: 323.4 Ft
- D. Engine 305 HP / E. Motor 200 HP





# GNL NORTE – MEJILLONES, CHILE

- Model: HD 8x14x21
- Flow: 2500 GPM / T.D.H: 319.2 Ft
- Electric Motor 350 HP – 4160V







# GNL NORTE – MEJILLONES, CHILE

- Model: HD 10x14x22
- Flow: 5000 GPM / T.D.H: 319.2 Ft
- Diesel Engine 638 HP





# GNL NORTE – MEJILLONES, CHILE

- Model: 24B440 – 2 Stgs / NiAlBze
- Flow: 5000 GPM / T.D.H: 478.8 Ft
- Diesel Engine 1,000 HP





# PETRÓLEOS MEXICANOS

- Offshore
- Model: 24B440 – 2 Stgs / NiAlBze
- Flow: 5000 GPM / T.D.H: 478.8 Ft



# PETRÓLEOS MEXICANOS

- Offshore
- Model: 24B440 – 4  
Stgs / NiAlBze
- Flow: 3500 GPM /  
T.D.H: 430 Ft – Diesel  
610 HP / Starting  
Electric – Pneumatic.





# PETRÓLEOS MEXICANOS

- Offshore
- Model: 8A12– 13 Stgs / NiAlBze
- Flow: 125 GPM / T.D.H: 340 Ft
- Electric Motor-Jockey





# P.T. FAJAR INDONESIA

- Model: 15C277 – 6 Stgs / CI-Bze
- Flow: 1500 GPM / T.D.H: 460 Ft
- Electric Motor 250HP – 6000V/50Hz





# P.T. FAJAR INDONESIA



- Model: 15C277 – 6 Stgs / CI-Bze
- Flow: 1500 GPM / T.D.H: 460 Ft
- Electric Motor 250HP – 6000V/50Hz
- Diesel Engine JU6H-UFADX8  
305HP – 1760 RPM



# PETRÓLEOS MEXICANOS

- Offshore
- Model: 24B440 – 2 Stgs / NiAlBze
- Flow: 5000 GPM / T.D.H: 478.8 Ft







# PETRÓLEOS MEXICANOS

- Offshore
- Model: 18D410 – 4 Stgs / NiAlBze
- Flow: 2500 GPM / T.D.H: 438.9 Ft





# SHELL PIPELINE

- Houma LA
- Model: 20C600 – 3 Stgs  
- 316SS/316SS
- Flow: 3500 GPM / T.D.H:  
584.4 Ft
- Diesel Engine 925HP  
Weather Enclosure





# C.P.Q. CANGREJERA

- Model: 24C730 – 4 Stgs/ WCB – 316SS/ 5000 GPM – 160 PSIG
- Diesel Engine 700 HP / Electric Motor 700 HP – 4160V.
- Model: 10A30 – 3 Stgs/ WCB – 316SS/ 50 HP – 460V.





# ENPPI – CAIRO REFINERY- EGYPT

ENPPI – CAIRO REFINERY - EGYPT



HSC 8x14x21 CI / Brz. Flujo 3000 GPM TDH 328 FT – Diesel 460 HP



# ENPPI – CAIRO REFINERY- EGYPT



HSC 8x14x21 CI / Brz. Flujo 3000 GPM TDH 328 FT – Diesel 460 HP



ENPPI – CAIRO REFINERY - EGYPT

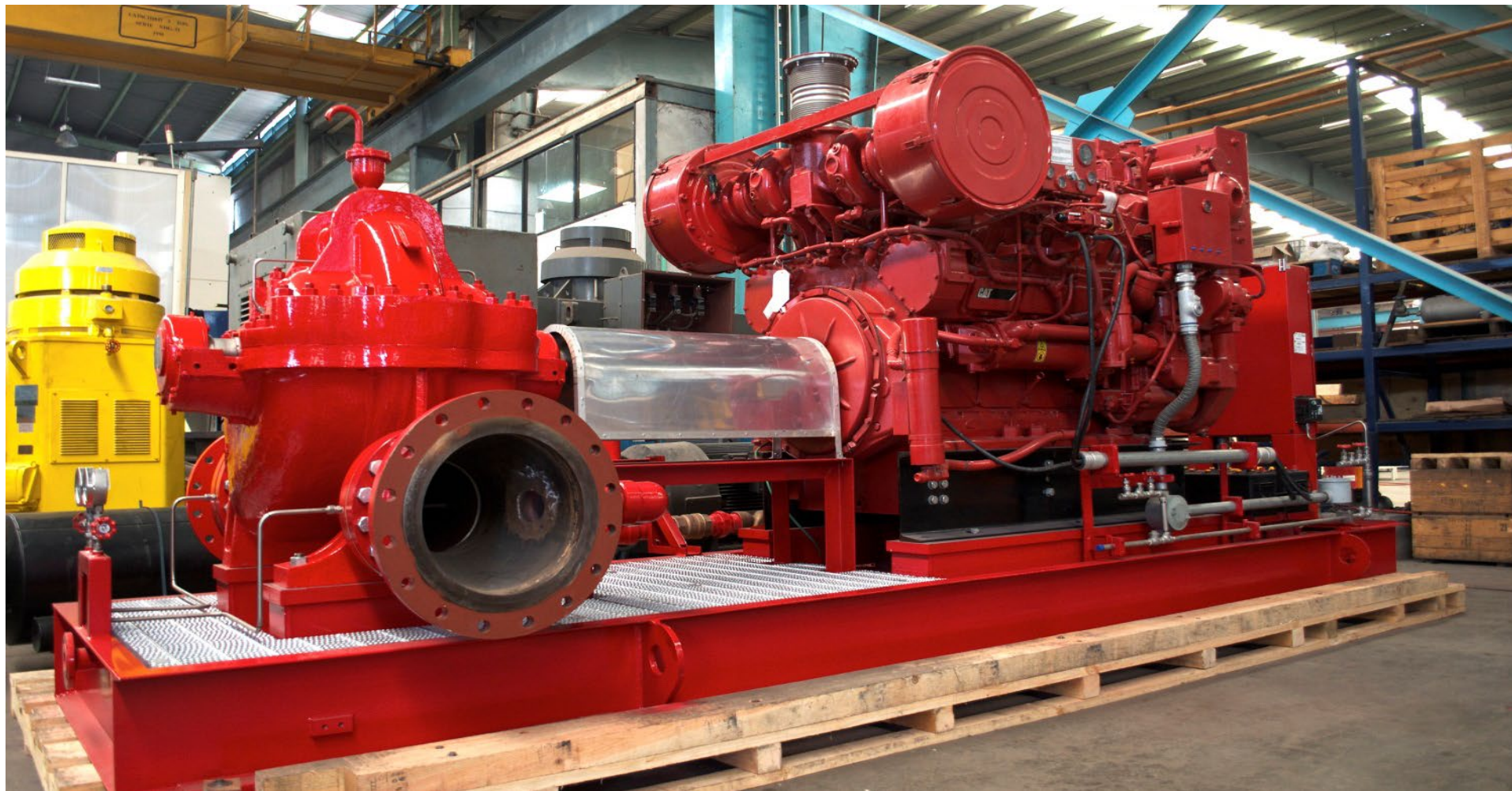
# ENPPI – CAIRO REFINERY- EGYPT



HSC 8x14x21 CI / Brz. Flow 3000 GPM TDH 328 FT – Diesel 460 HP



# ARABIAN OIL & GAS PIPELINES



ZW 20x14x25 WCB / 316SS Flow 5000 GPM TDH 328 FT – Diesel 825 HP



# TRANSALTA CHIHUAHUA – SAMALUYA, CHIH.

- Model: HD 10x8x17
- Flow: 2000 GPM / T.D.H: 297.9 Ft – Electric Motor 200HP and Diesel Engine 218 HP







# PETRÓLEOS MEXICANOS

- Portable Pump Package
- Model: HSC 8x14x21 – Self Priming System
- Flow: 3000 GPM / T.D.H: 346.5 Ft – Diesel Engine 418 HP





# YPFB REFINACION

- Portable Pump Package with Noise Enclosure
- Model: SCE 3x1.5x12.25 – API 610
- Material S-6
- Flow: 140 GPM / T.D.H: 436.6 Ft – Diesel Engine





# STAR REFINERI A.S.

- Socar Turkey Enerji
- Model: ZW  
14x10x24FH  
Material: Ductile  
Iron /Bronze
- Flow:6000 GPM
- T.D.H: 495.0 Ft  
Diesel Engine 1,253  
HP





# STAR REFINERI A.S.

- Socar Turkey Enerji





# IBERDOLA ENERGÍA ESCOBEDO

- Model: HSC  
8x14x21E
- Material: Cast  
Iron/Bronze
- Flow: 2500 GPM  
T.D.H: 325.0 Ft  
Motor 300 HP /  
4000V / 60Hz





# IBERDOLA ENERGÍA ESCOBEDO

- Model: HSC  
8x14x21E
- Material: Cast iron  
/Bronze
- Flow: 2500 GPM  
T.D.H: 325.0 Ft  
Diesel Engine 376  
HP





# SUNCOR ENERGY OIL SANDS LIMITED - CANADA

- Model: 24C-730 – 4 Stages
- Material: Cast iron /Bronze
- Flow: 5000 GPM  
T.D.H: 450.5 Ft  
Diesel Engine 982 HP  
Noise Enclosure





# SUNCOR ENERGY OIL SANDS LIMITED - CANADA

- Model: 24C-730 – 4 Stages
- Material: Cast iron /Bronze
- Flow: 5000 GPM  
T.D.H: 450.5 Ft  
Diesel Engine 982 HP  
Noise Enclosure







# YPF Bolivia

- 2 Diesel PMP SYS  
ZW 16X12X20 (F)  
4000 GPM / 130  
PSI
- 2 Diesel Engine 617  
HP/1760 RPM
- 2 Jockey PMP SYS  
In Line





# YPF Bolivia

- 2 Diesel PMP SYS  
ZW 16X12X20 (F)  
4000 GPM / 130  
PSI
- 2 Diesel Engine  
617 HP/1760 RPM
- 2 Jockey PMP SYS  
In Line



# TÉCNICAS REUNIDAS

- 1 Diesel PMP SYS  
ZW 8X6X19 1/2 (F)
- 1 Electric PMP SYS  
ZW 8X6X19 1/2 (F)
- 1 Jockey PMP SYS  
CPP 3X2X10





# McDERMOTT / CB&I

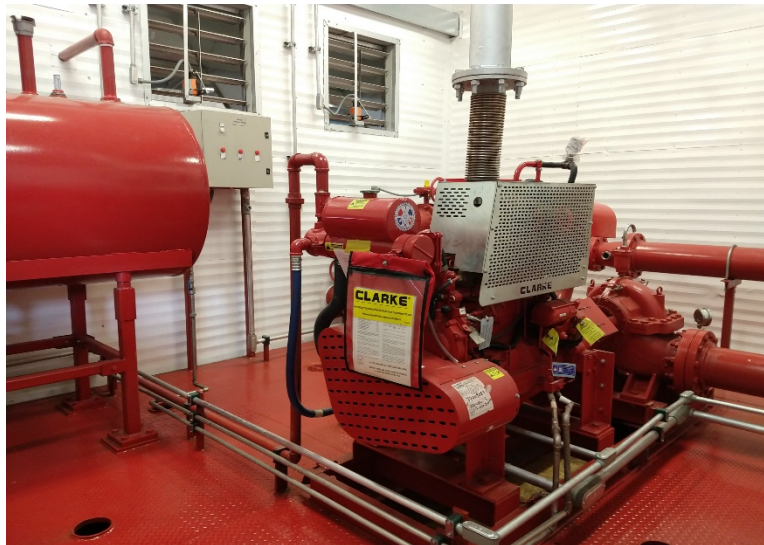
- 1 Diesel PMP SYS HSC 8X12X18A1
- 1 Electric PMP SYS HSC 8X12X18A1
- 1 Jockey PMP SYS VSE 15-5-100





# KIEWIT

- 1 Diesel PMP SYS  
HSC 8X12X18A1
- 1 Electric PMP SYS  
HSC 8X12X18A1
- 1 Jockey PMP SYS  
VSE 15-5-100





# ALUAR ALUMINIO ARGENTINO

- 1 Diesel PMP SYS ZW 6X4X12F
- 1 Electric PMP SYS ZW 6X4X12F
- 1 Jockey PMP SYS CR 10-12





# ALUAR ALUMINIO ARGENTINO

- 1 ELEC PMP SYS ZW 6X4X12F 500 GPM / 150 PSIG / 2960 RPM MOTOR 100 HP / 380V / 50 Hz
- 1 Jockey PMP SYS CR 10-12



- 1 Diesel PMP SYS ZW 6X4X12F 500 GPM / 150 PSIG / 3000 RPM
- Clarke JU4H-UF34-115HP





# HOKCHI ENERGY, SA de CV

- 2 ZW 12x10x24F / Ductile Iron – Bronze
- 3500 GPM / 156 PSIG / 1775 RPM
- Cummins CFP15E-F45 / 585 HP
- 1 Jockey CPP21 3x1.5x10

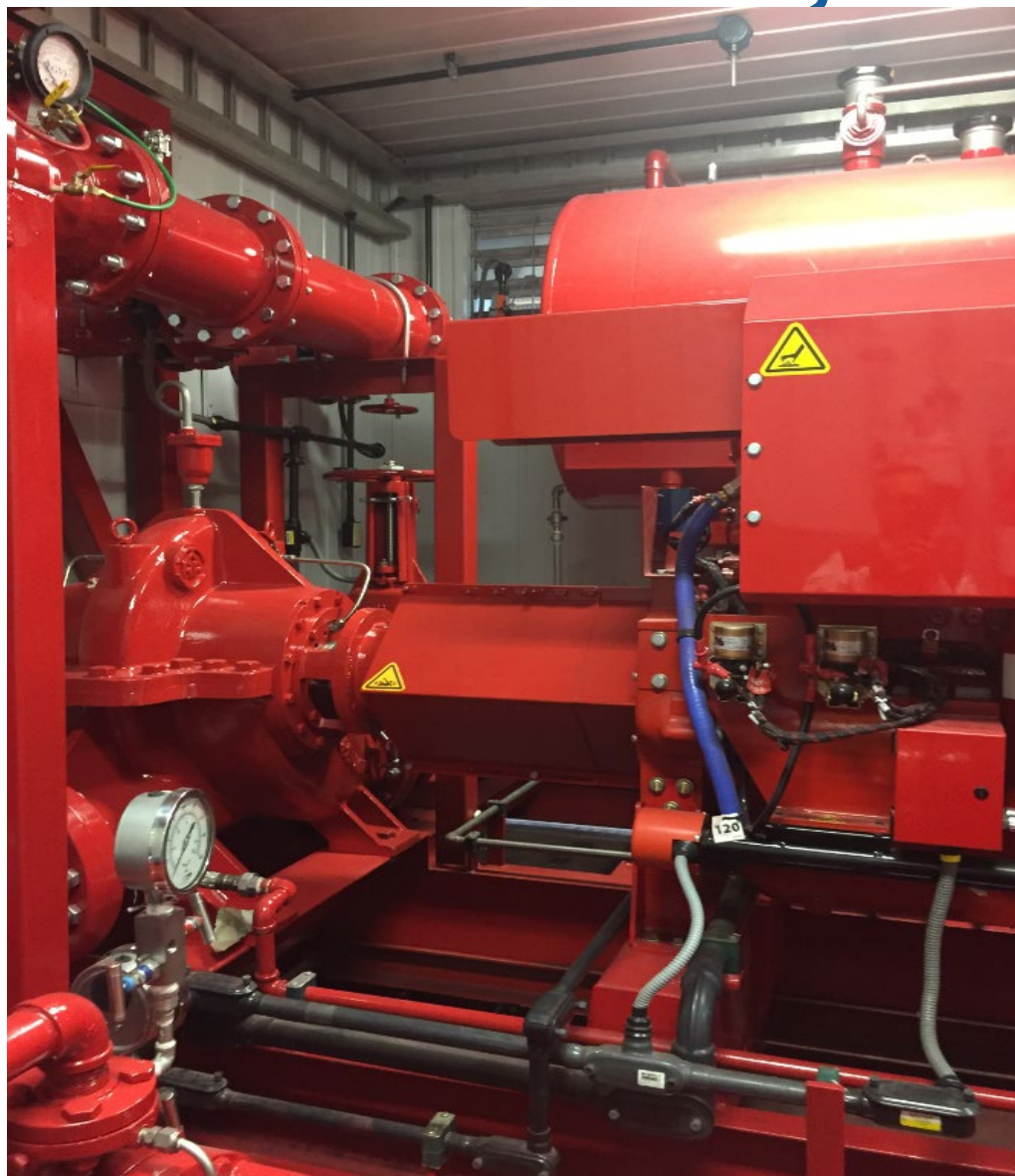






GRUPO AVANZIA, SA de CV

# HOKCHI ENERGY, SA de CV





# MEXICANA DE COBRE, SA de CV

- 1 Pump HSC 8x14x21E / Cast Iron – 316SS
- 2500 GPM / 195 PSIG / 1775 RPM
- Motor 450HP/4160V
- 1 Jockey In Line VSE 15-8-50



# SA de CV

- 1 Pump HSC 8x14x21E / Cast Iron – 316SS
- 2500 GPM / 195 PSIG / 1775 RPM
- Cummins CFP15E-F60 650HP





# PEMEX EXPLORACION Y PRODUCCION (OffShore)

- 10 VTP 18D410-3 Stgs - 316SS / 316SS
- 3000 GPM / 185 PSIG / 1775 RPM
- Cummins CFP15E-F20 / 494 HP
- Electric/Pneumatic Starting System





# CALPINE GEYSERS

- 1 Pump Cornell 3419MX – Self Primer Pump
- 400 GPM / 113 PSIG
- Cummins CFPE-F10 175HP/1760 RPM (NL)



- 1 Pump Cornell 4414T – Self Primer Pump
- 1500 GPM / 113 PSIG
- Cummins CFPE-F40 215HP/2100 RPM (NL)



# MUBADALA PETROLEUM (OffShore)

- 2 VTP 20C600-3 Stgs - NiAlBze / NiAlBze
- 4500 GPM / 193 PSIG / 1775 RPM
- Caterpillar 3508 / 1066HP
- Electric/Hydraulic Starting System
- ATEX Certification Zone 1 – Ex de IIC T4



# MUBADALA PETROLEUM (OffShore)

- Electric/Hydraulic Starting System
- ATEX Certification Zone 1 – Ex de IIC T4



# PETROBEL

- 4 ZW 16x12x20F – Super Duplex/Super Duplex
- 4000 GPM / 131 PSIG / 1775 RPM
- Cummins CFP15E-F50 / 610HP
- Electric/Pneumatic Starting System





# KNPC AL ZOUR REFINERY (OffShore)

- 2 VTP 18D410-3 Stgs - NiAlBze / NiAlBze
  - 2500 GPM / 150 PSIG / 1770 RPM
  - Engine Cummins CFP15E-F10 / 460 HP
  - Electric/Pneumatic Starting System
  - Noise Enclosure with Water Mist System
- 3 VTP 18D410-4 Stgs – NiAlBze / NiAlBze
  - 2500 GPM / 179 PSIG / 1770 RPM
  - Engine Cummins CFP15E-F20 / 494 HP
  - Electric/Hydraulic Starting System
  - Noise Enclosure with Water Mist System







SAIPEM

# KNPC AL ZOUR REFINERY (OffShore)



# KNPC AL ZOUR REFINERY (OffShore)

- Water Mist System





## Coming Attractions 😊

### “Double Case Pumps (Barrel Pumps – BB5)”

Thur 14<sup>th</sup> October – 08.00 (UK BST) (Eastern Hemisphere) & 17.00 (UK BST) (Western Hemisphere)

*Aimed at Process and Mechanical Engineers and Consultant Engineers specifying pumping equipment for refineries and oilfield installations as well as Applications & Sales Engineers selecting and quoting them.*

Future subjects in preparation include:

- Condition monitoring instrumentation for pumps (temperature, vibration etc)