



Specialist for Pumping Technology

Session 34— **Fire Pumps** for the Oil & Gas Industries

Simon Smith June 2024



Presenter Profile – Simon Smith

Simon graduated with an honours degree in Chemical Engineering from the University of Surrey in 1978 and began a long career in the engineered pump industry spanning 43 years (so far!) with Peerless Pump, BW/IP International / Flowserve, SPP Pumps, Ruhrpumpen and Ebara Cryodynamics.

Over his long career he has filled various roles as Applications Engineer / Manager, Project Manager, Key Account Specialist, Vertical Pump Product Specialist, International Sales Engineer / Manager / Director and he has considerable experience in Training & Mentoring young engineers.





Ruh*RP*umpen Short Courses

Here is a listing of all the previous courses.

- No 1 – API610 12th v 11th editions
- No 2 - Curve Shape (1)
- No 3 – The Importance of System Curves (1)
- No 4 - Selecting the Right Pump for the Application
- No 5 - NPSH & Nss
- No 6 - Mechanical Seals & Systems (1)
- No 7 - Firepumps
- No 8 - BB5 Barrel Pumps
- No 9 - Pump Instrumentation
- No 10 – Non-Destructive Examination
- No 11 - Vertical Pumps (Part 1) Type VS1, VS2, VS3
- No 12 – Vertical Pumps (Part 2) Type VS4, VS5, VS6 & VS7
- No 13 – Performance Testing of Centrifugal Pumps; the What, the Why & the How
- No 14 – Testing & Inspection of API 610 Pumps
- No 15 – Start-Up, Commissioning & Troubleshooting Centrifugal Pumps
- No 16 – Introduction to Positive Displacement (Plunger) Pumps
- No 17 – Refresher Session
- No 18 – Overhung Process Pumps OH1 & OH2

Continued next slide

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- No 19 – Vertical Overhung Process Pumps OH3-OH6
- No 20 – New Developments in the VS6 Market
- No 21 – BB4 Multistage Pumps for the Power Industry
- No 22 – Coking Process and Hydraulic Decoking Equipment
- No 23 – Pumps for the Desalination Market
- No 24 – Cryogenic Pumps
- No 25 – Magnetic Drive Pumps
- No 26 – Mechanical Seals & Systems (2)
- No 27 – The Importance of System Curves (2)
- No 28 – NPSH & Nss Made Simple (2)
- No 29 – Curve Shape, Head Rise & Allowable Tolerances (2)
- No 30 – Selecting the Right Pump for the Application (2)
- No 31 Comparison of API610 12th & 11th Editions (2)
- No 32 Pump Instrumentation (2)
- No 33 Handling Viscous Fluids with Centrifugal Pumps

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- Impeller Lift Procedure
- Newsletter Ruhrpumpen Fire Systems - December 2022
- VTP pumps for major water transfer project in Bolivia
- COVID-19 UPDATE
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Simon Smith
Solutions Expert





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SHORT COURSE 30

Selecting the Right Pump for the Application

- Full Session
- Download presentation
- Q&A Report

SHORT COURSE 31

Comparison of API610 12th and 11th Editions

- Full Session
- Download presentation
- Q&A Report

SHORT COURSE 32

Pump Instrumentation

- Full Session
- Download presentation
- Q&A Report

SHORT COURSE 33

Handling Viscous Fluids in Centrifugal Pumps, & Handling Slurries in Centrifugal Pumps

- Full Session
- Download presentation
- Q&A Report

Session 34 – 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.*

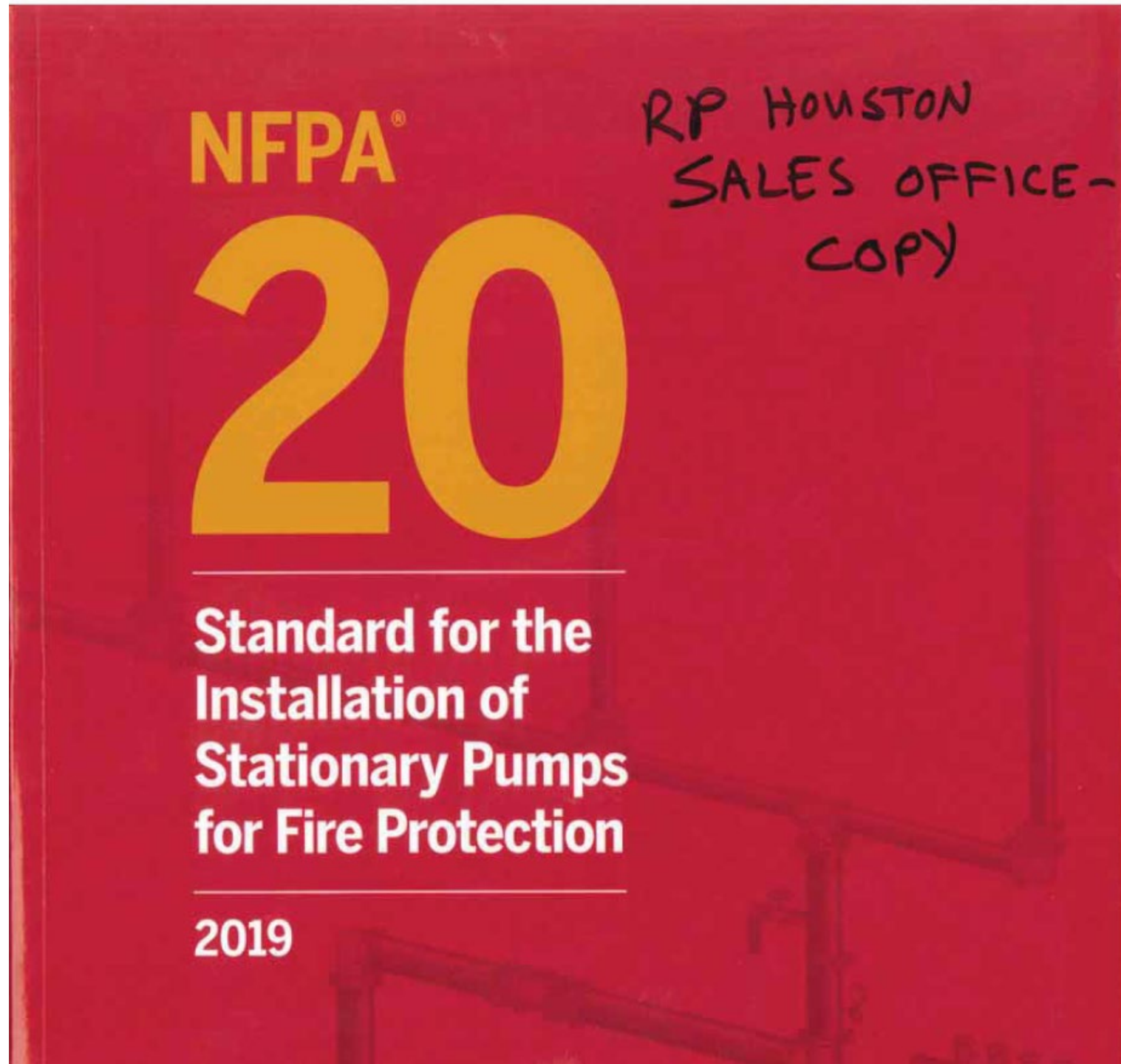


I – NFPA-20 Overview



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		

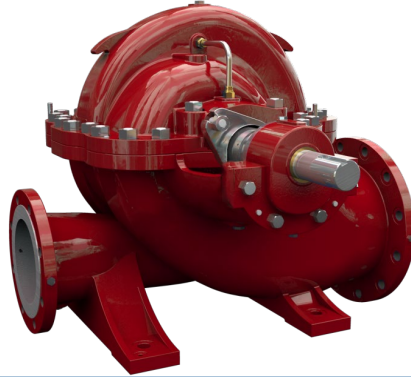


Types of Fire Pumps

**VERTICAL
TURBINE**



HORIZONTAL SPLIT CASE



IN-LINE



END SUCTION

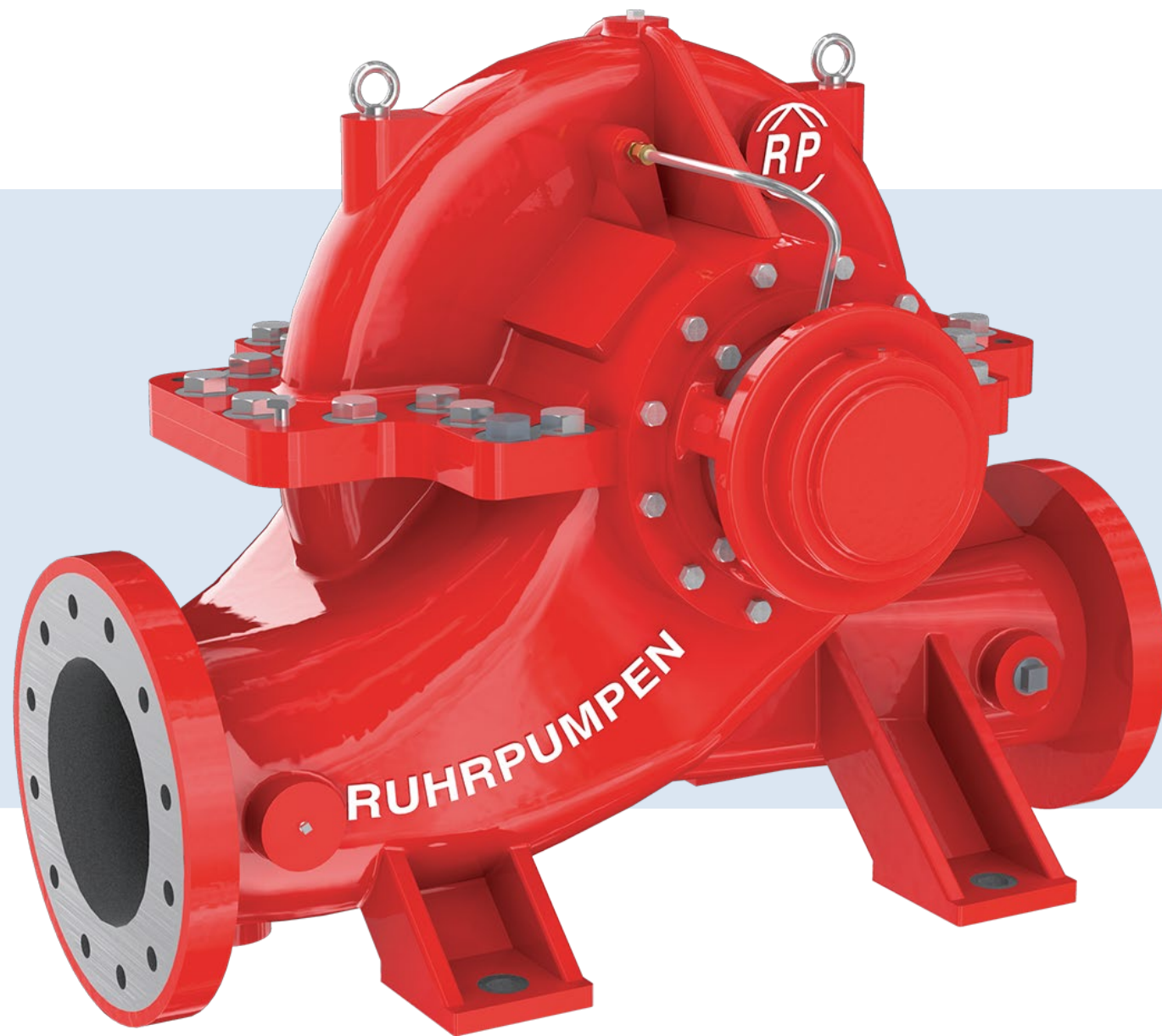


PACKAGED SYSTEMS





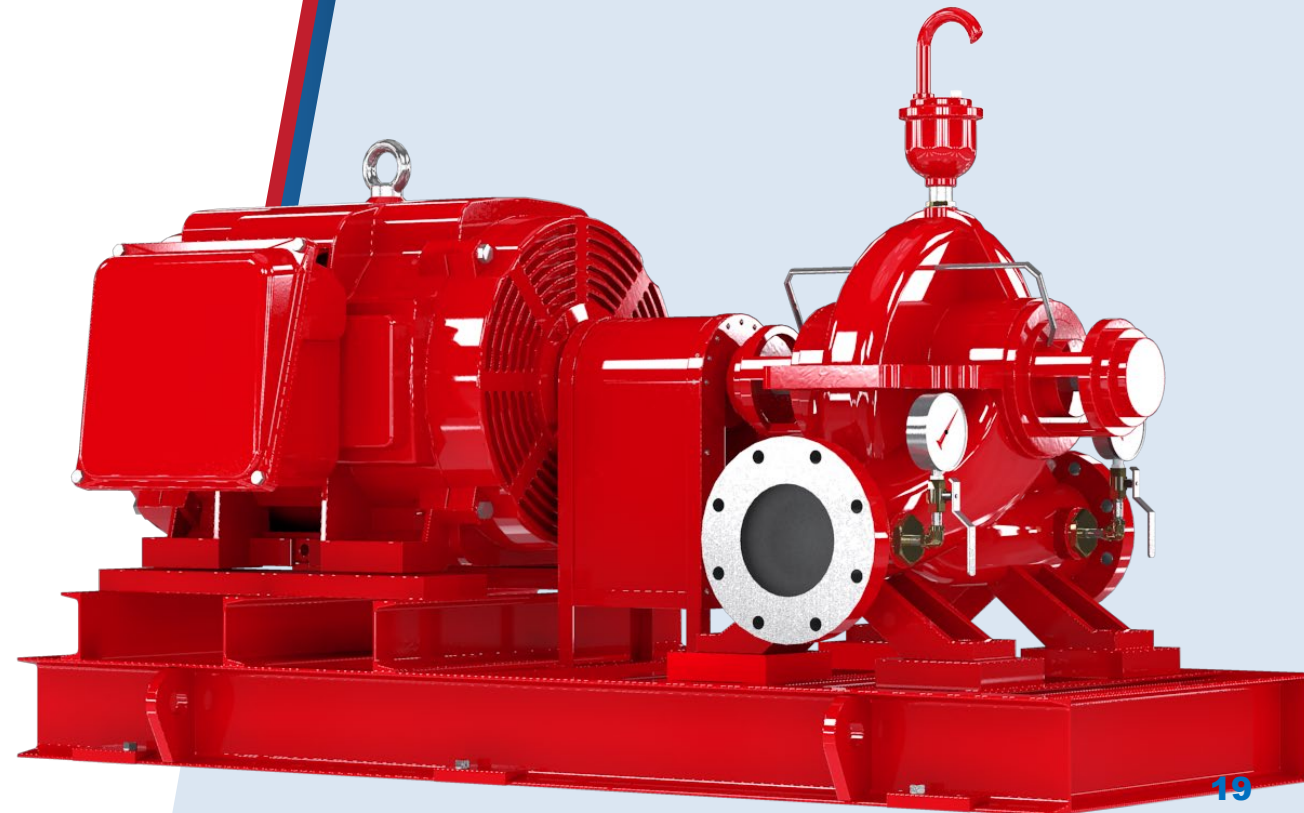
Horizontal Split Case Pumps





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



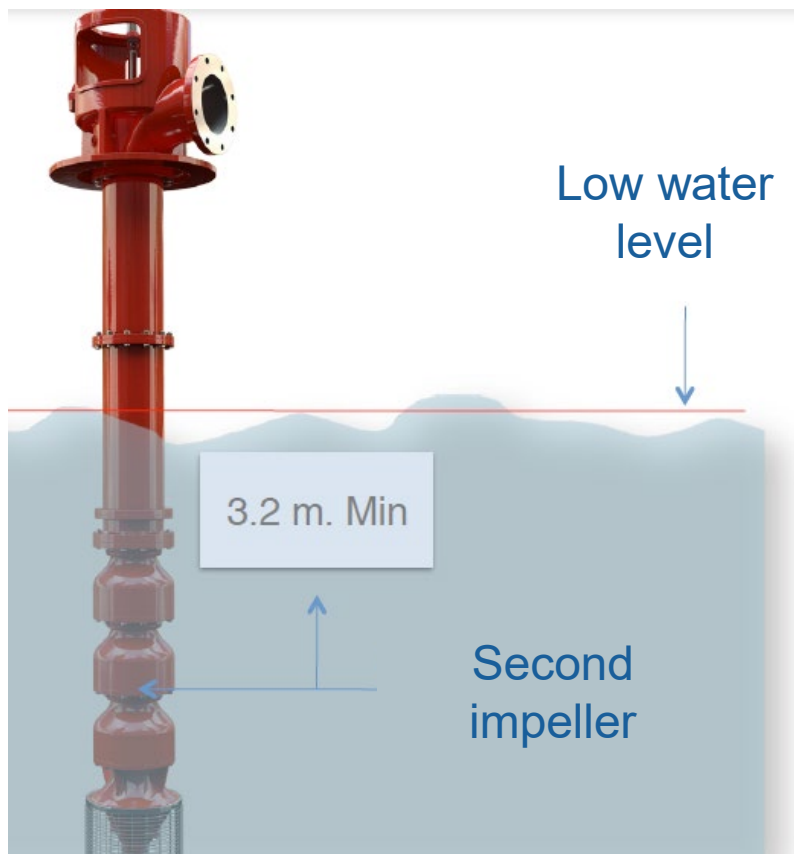
Application

- 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

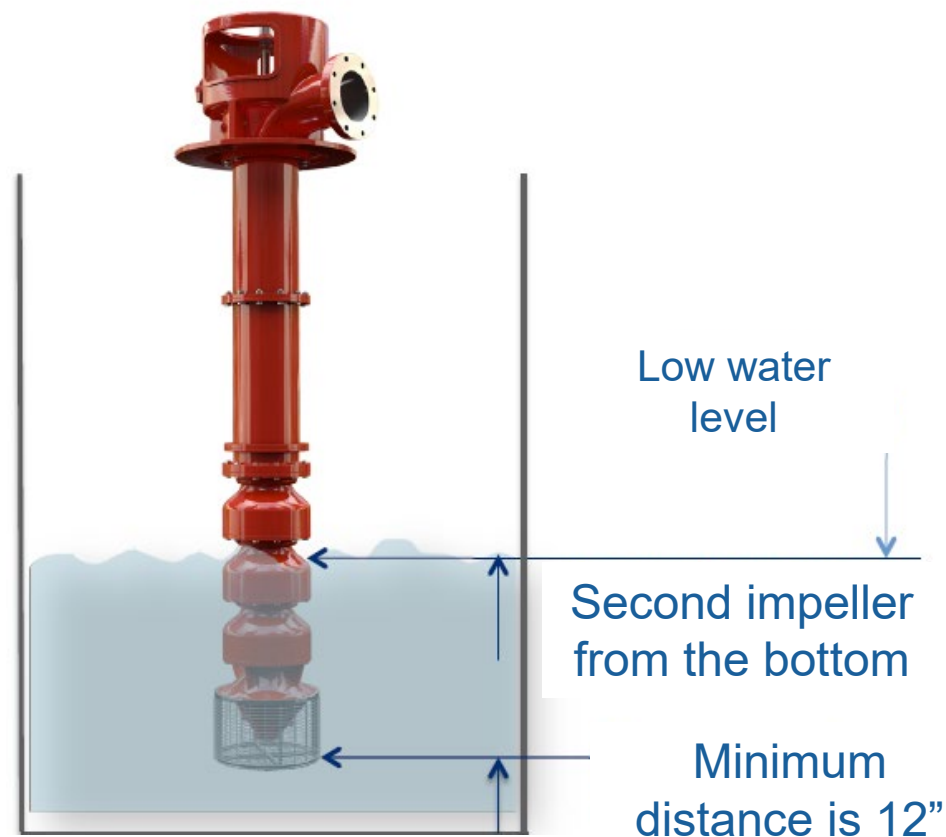


Vertical Turbine Pump

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



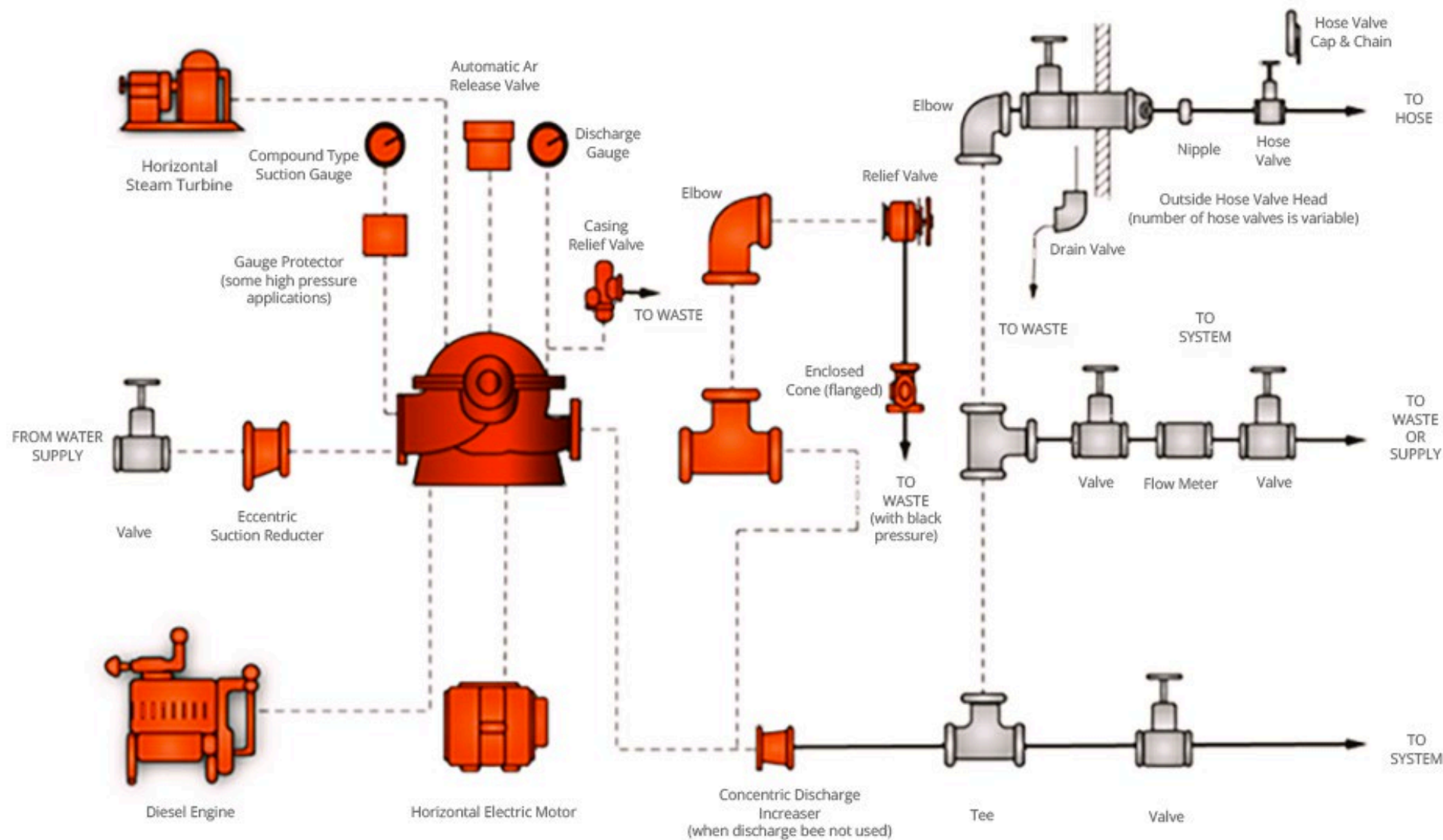


IV - TYPICAL DESIGN AND INSTALLATION

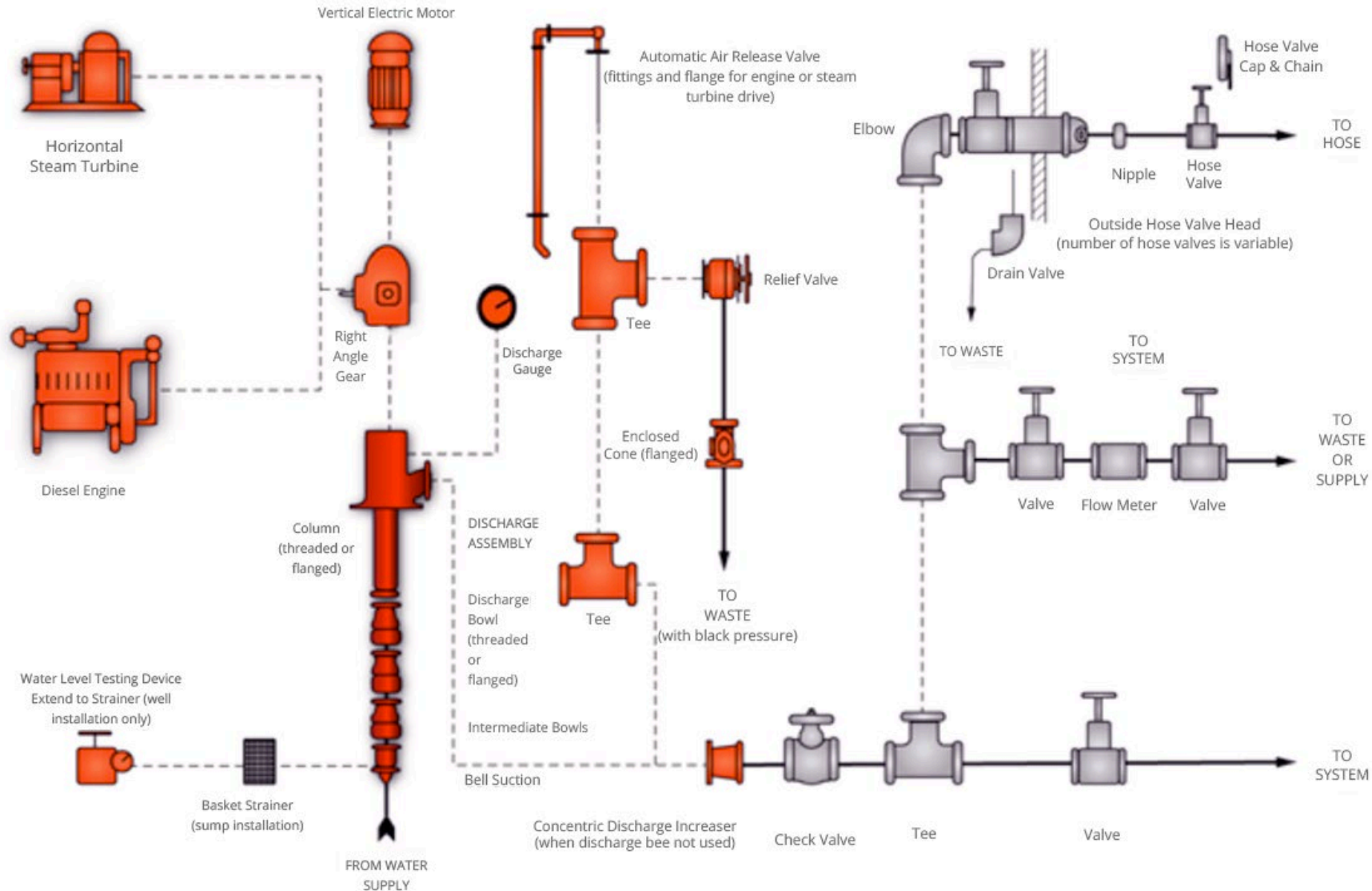
FIRE PUMP INSTALLATION AS PER NFPA-20

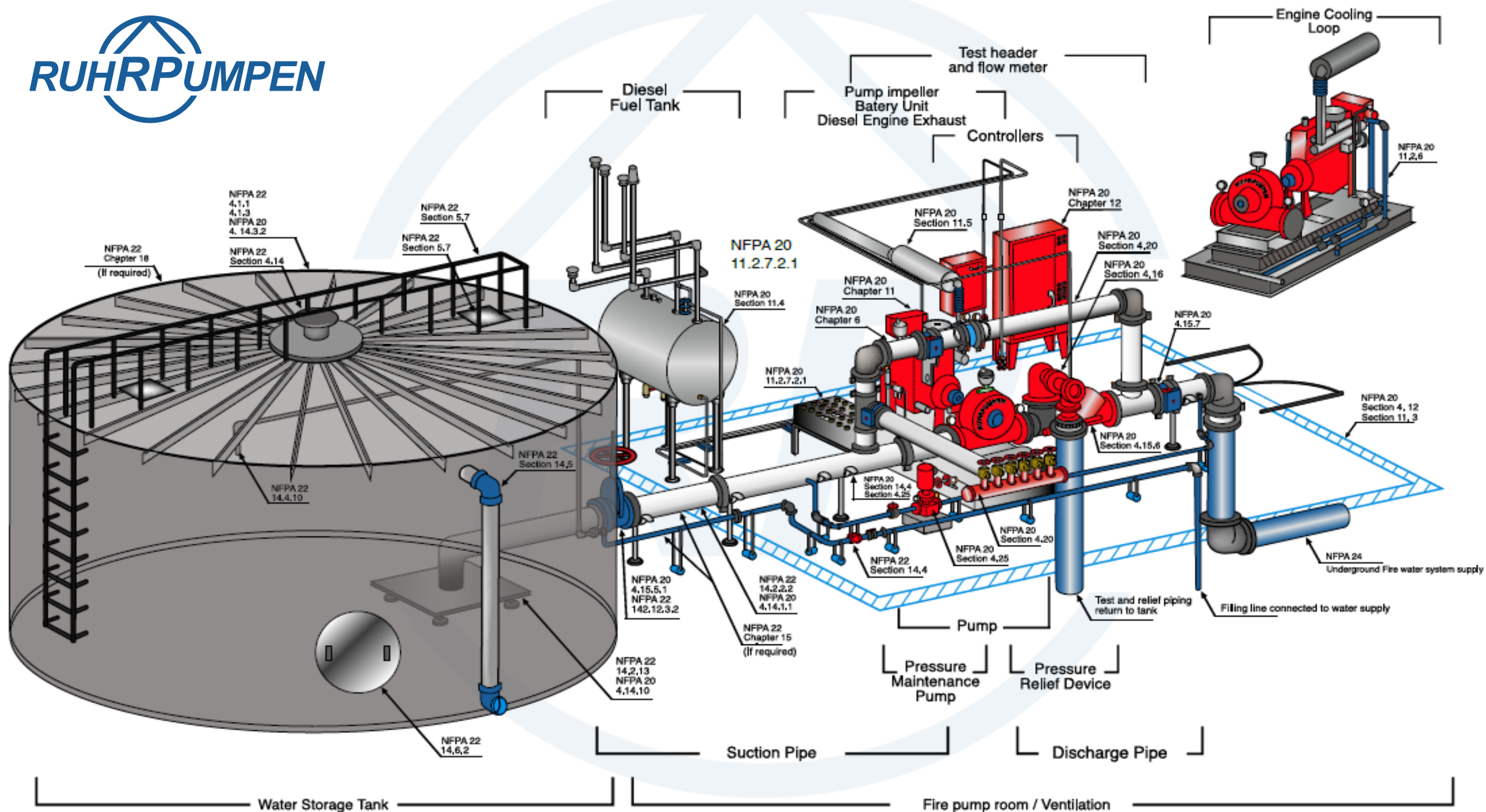


Typical Accessories



Typical Accessories







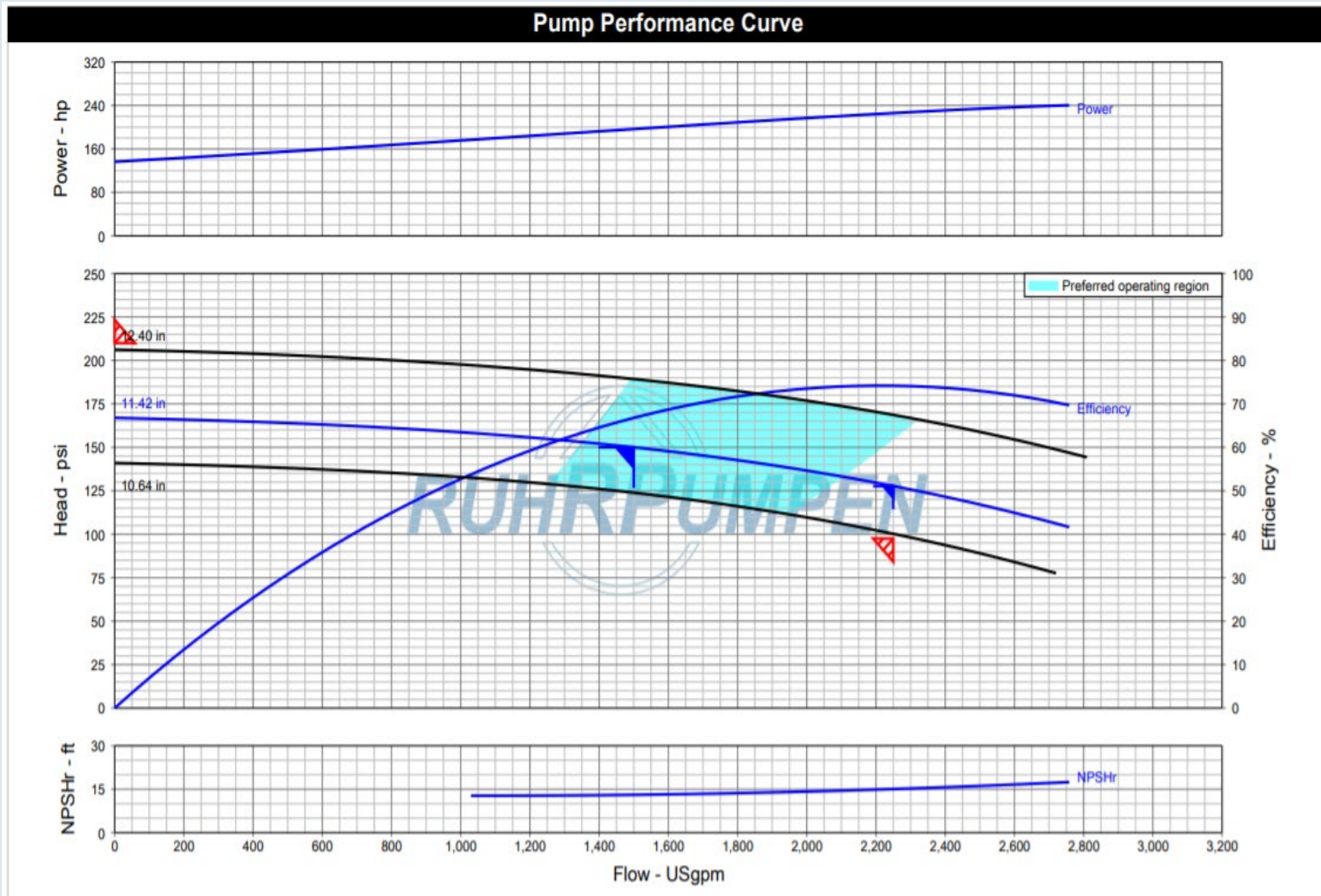
V - PERFORMANCE CURVE

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.

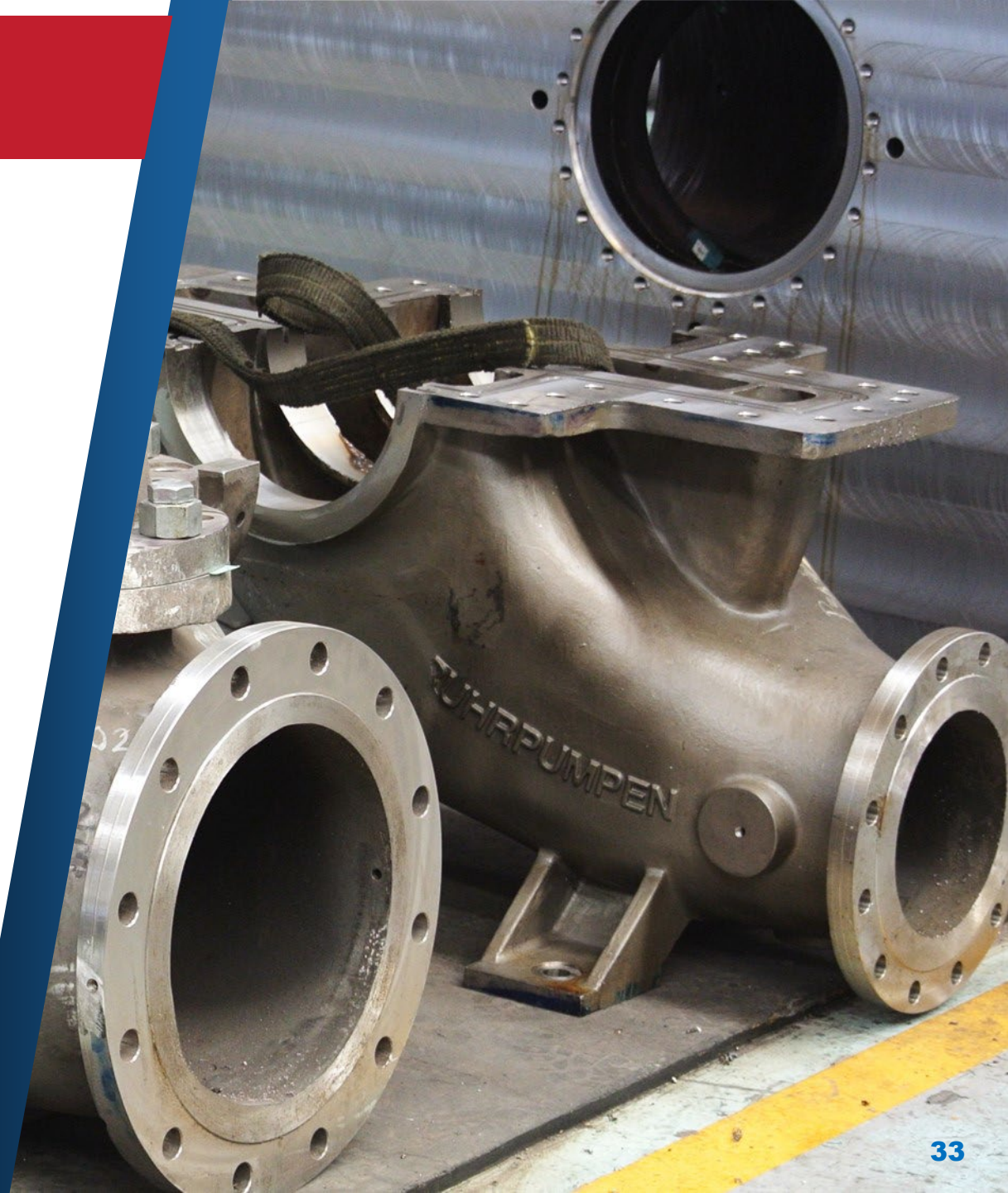


VI - UL/FM CERTIFICATION REQUIREMENTS

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.





FM

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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 ³ /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, Horiz
HSR 4x6x11B	Mexico	500	1895	123-193	848-1331	3550	6	4	1	FM Approved	1311-Centrifugal Fire Pumps, Horiz
HSD 6 x 4 x 17A	Mexico	750	2840	93-143	641-986	1750	6	4	1	FM Approved	1311-Centrifugal Fire Pumps, Horiz
HSD 8 x 6 x 20A	Mexico	750	2840	108-197	745-1358	1750	8	6	1	FM Approved	1311-Centrifugal Fire Pumps, Horiz



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Document Name	Company Name	UL CCN Description
EEEV.MH61666	RUHRPUMPEN S A DE C V	ABOVEGROUND FLAMMABLE-LIQUID TANKS
EEEV7.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
QNV8.MH59925	RUHRPUMPEN S A DE C V	LEAD CONTENT VERIFICATION OF PRODUCTS IN CONTACT WITH POTABLE WATER
QNV87.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
QXJY.EX5213	RUHRPUMPEN S A DE C V	CENTRIFUGAL FIRE PUMPS, SPLIT CASE
QXJY7.EX5213	RUHRPUMPEN S A DE C V	CENTRIFUGAL FIRE PUMPS, SPLIT CASE CERTIFIED FOR CANADA

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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



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

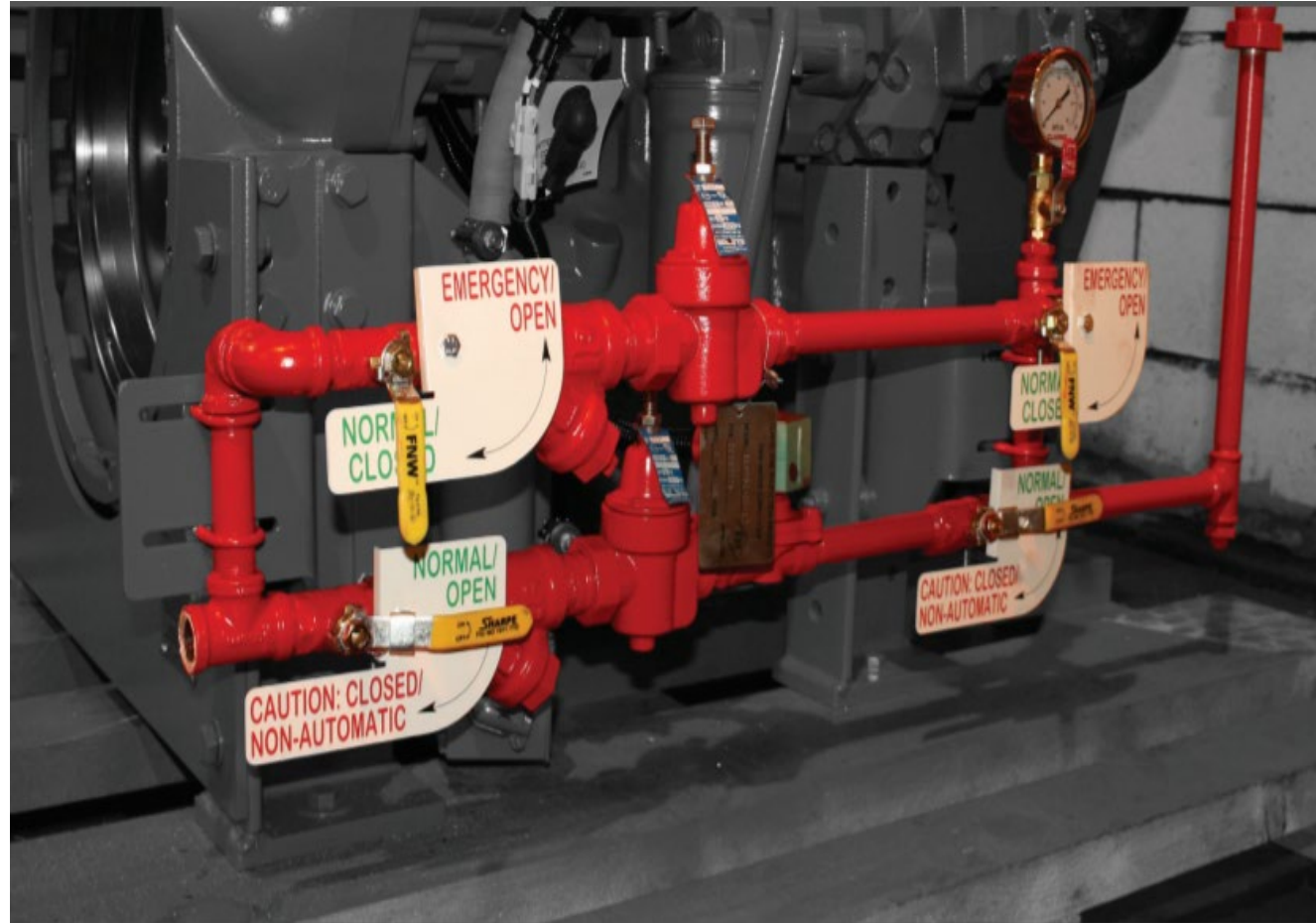
- Selected at 1.0 gal. per engine HP.
- 5% for expansion 5% for sediments
- Exclusive use of the fire fighting system.
- Located above ground level and above the engine's fuel pump.
- In areas with temperatures below 32°F it must be installed in the machine room.
- UL-142 Collection tank (bund) or double-walled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



Engine Cooling System

Cooling Loop

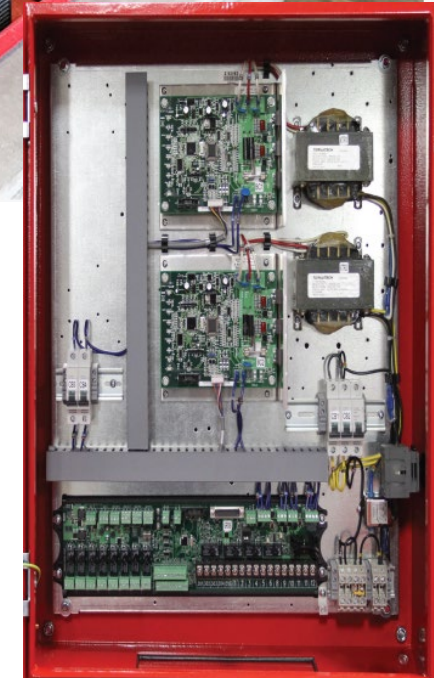
- FM Approved assembly
- Components materials are as listed by the engine manufacturer
- For horizontal split case pump or vertical pump application
- Cannot be modified by pump manufacturer



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



Solenoid Valve



Manual Operation



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



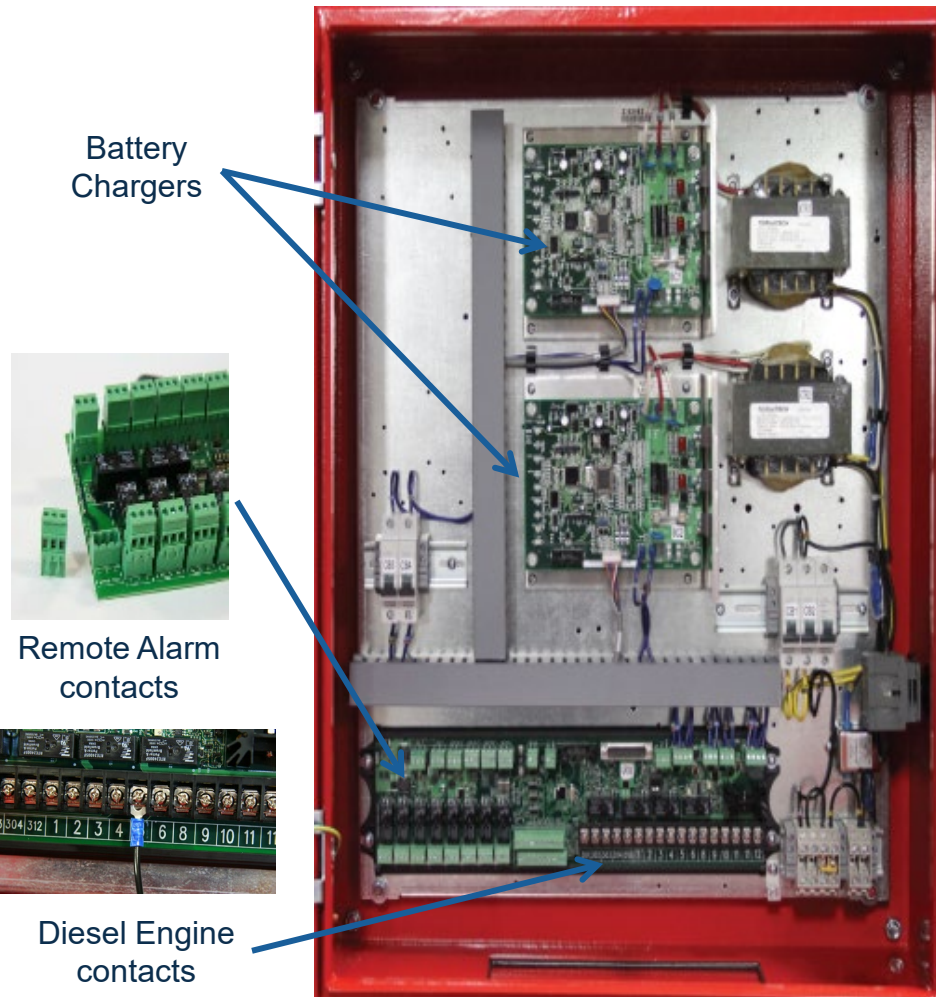
Interface



USB Port



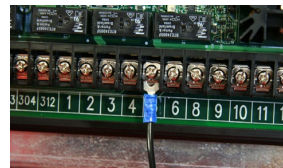
Diesel Engine Controller



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

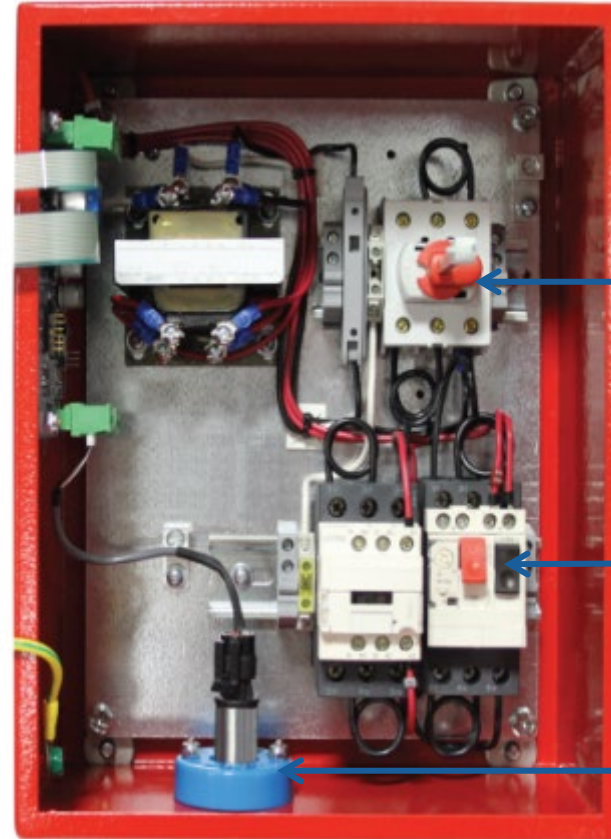


Jockey Pump Controller



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.*



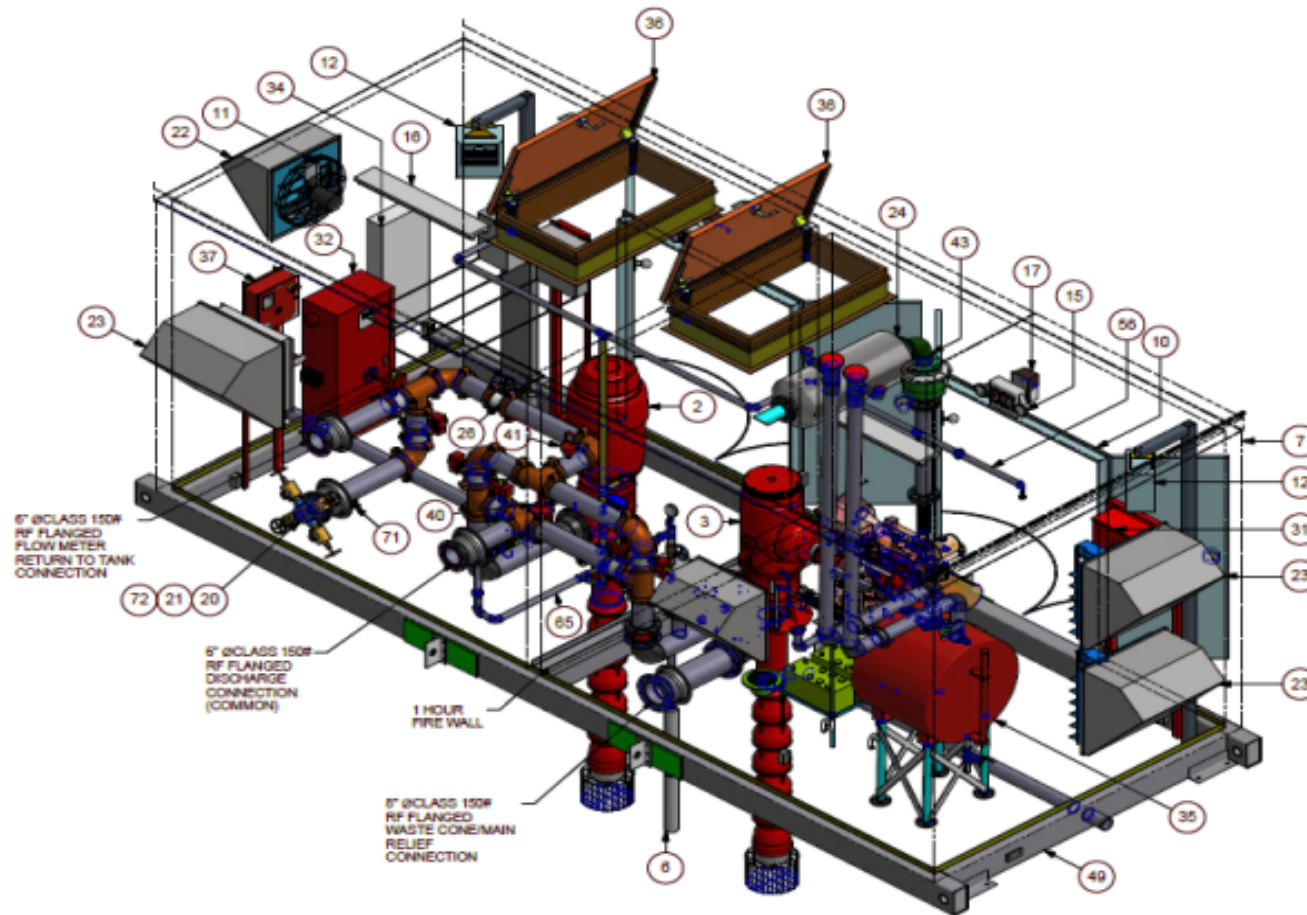
Pump House

- *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

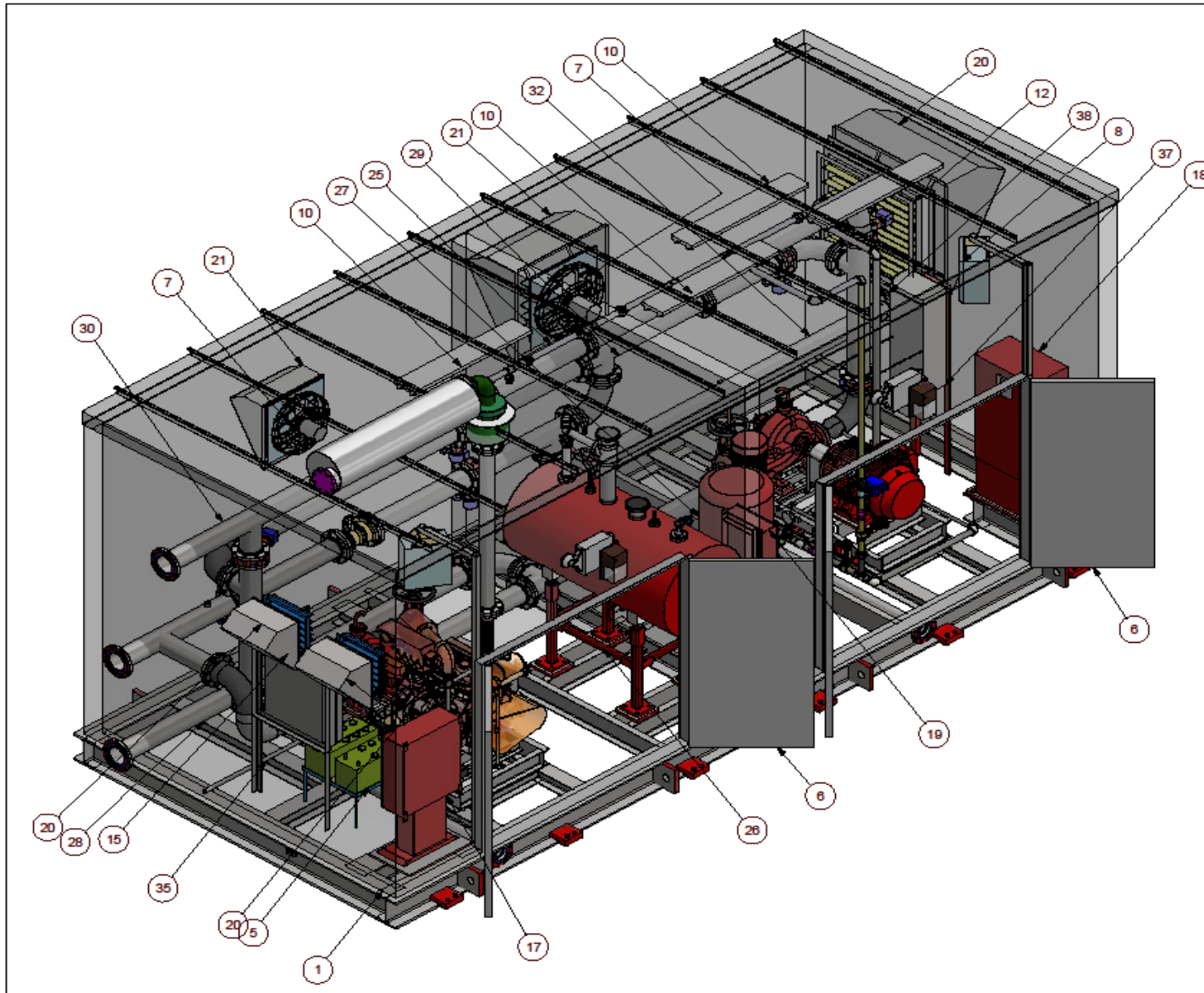


REV	DESCRIPTION	OWN	CHK	DATE
5	SENT FOR INFORMATION	R. BRAVO	A. FLORES	6/9/2016

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GENERAL NOTES	DATE: 6/9/2016
- ALL DIMENSIONS ARE FOR REFERENCE ONLY	BY: R. BRAVO
- DO NOT SCALE DRAWING	DATE: 6/9/2016
MANUFACTURING NOTES	BY: A. FLORES
- LINEAR TOLERANCE $\pm 1/8"$	FOR: GAPMLO-004
- ANGULAR TOLERANCE $\pm 5'$	CUSTOMER: CONSTRUCCIONES E INSTALACIONES MODERNAS SA DE CV
- DO NOT SCALE DRAWING	NAME: OUTLINE
- ALL DIMENSIONS ARE IN INCHES	POWER: PAGE - 5
- DIMENSIONS ARE PER ANSI Y14.5	DRAWING # 8001350024-5
SHEET: 0	



PUMP HOUSE HORIZONTAL SPLIT CASE

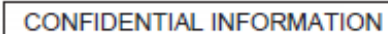


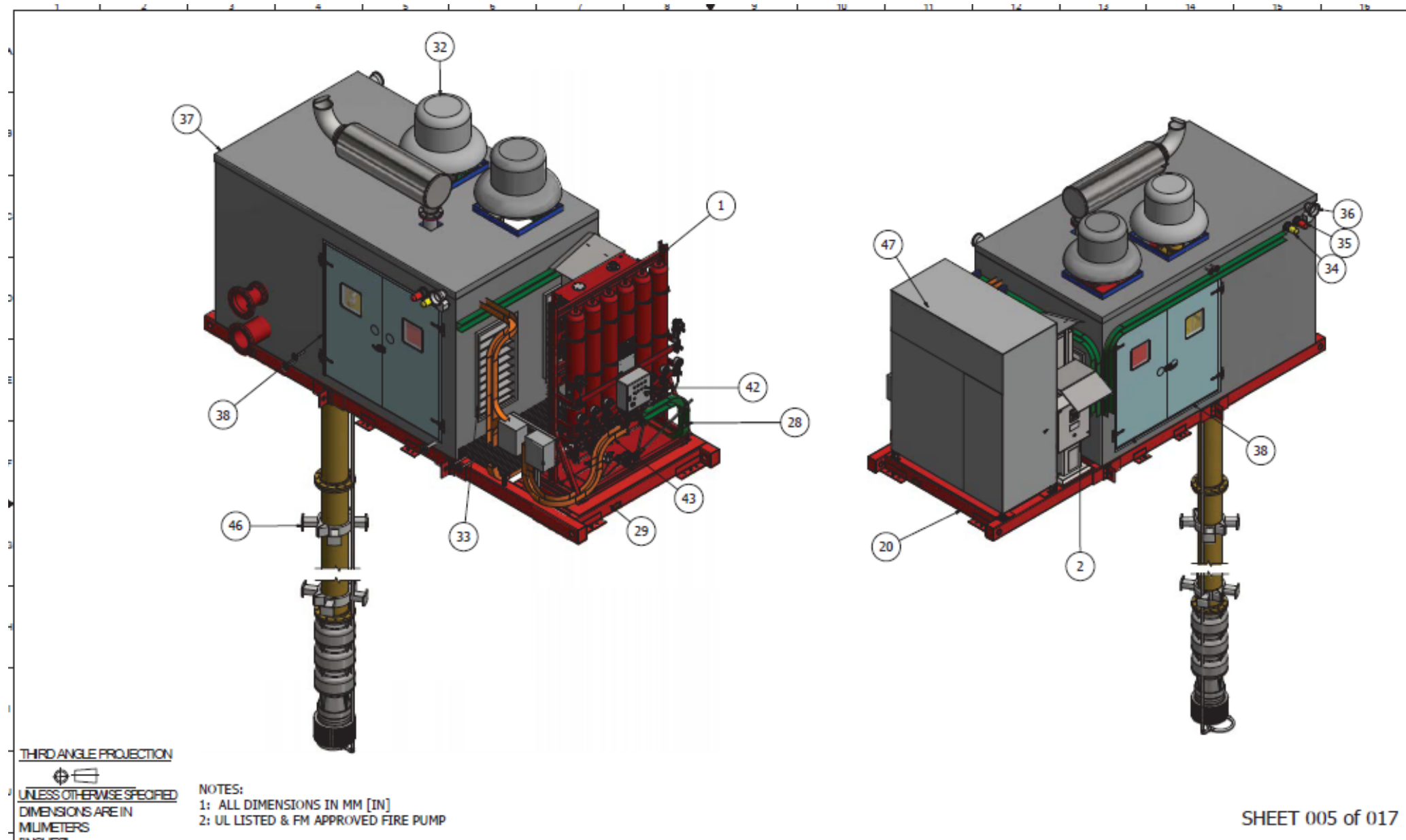
BILL OF MATERIALS		
SYM	QTY	DESCRIPTION
1	1	PUMP: RUHRPUMPEN MODEL ZW 6X4X12 (CW) / MOTOR: US MOTORS, FRAME 405TS, 100HP@3000RPM
2	1	PUMP: RUHRPUMPEN MODEL ZW 6X4X12 (CW) / ENGINE: CLARKE, JU4H-LF34, 115HP@3000RPM
3	1	PUMP: JOCKEY, GRUNFOS MODEL CR 10-12/ MOTOR: 4KW@300RPM, 220-240V50-60HZ
4	1	ENVIRONMENTAL ENCLOSURE
5	2	BATTERY RACK ASSEMBLY
7	2	EXHAUST FAN WITH DAMPER
8	2	HEATERS AND THERMOSTATS
9	2	LIGHT, EMERGENCY / EXIT FIXTURE
10	5	LIGHT FIXTURE
11	2	LIGHT, EXTERIOR WALL MOUNT, W/LAMP & PHOTOCELL
12	1	SHUTTER WALL, POWERED, PWR CLOSE, SPRING OPEN
13	2	SHUTTER, MOTORIZED
14	1	EXHAUST
15	1	CONTROL PANEL DISTRIBUTION
16	1	HYDRONEUMATIC TANK
18	1	CONTROLLER, FIRE PUMP (ELECTRIC)
19	1	CONTROLLER (JOCKEY)
20	3	RAIN HOOD, FOR VENT
21	2	RAIN HOOD FOR FAN
22	1	ASSEMBLY SKID
23	1	ASSEMBLY, JOCKEY PUMP/DISCHARGE, LINE
24	1	ASSEMBLY, JOCKEY PUMP, SUCTION, LINE
25	4	ASSEMBLY, SPRINKLER LINE
26	1	ASSEMBLY, DOUBLE WALL, FUEL TANK
27	1	ASSEMBLY, SUCTION ELECTRIC PUMP
28	1	ASSEMBLY, SUCTION DIESEL PUMP
29	1	ASSEMBLY, DISCHARGE ELECTRIC PUMP
30	1	ASSEMBLY, DISCHARGE DIESEL PUMP
31	1	ASSEMBLY, MAIN RELIEF VALVE LINE
32	1	ASSEMBLY, DISCHARGE HEADER
33	1	ASSEMBLY, RELIEF VALVE JOCKEY
34	1	PRESSURE RELIEF VALVE, ELECTRIC PUMP
35	1	ASSEMBLY, DIESEL ENGINE COOLING WATER OUTLET
36	1	ANCHOR BOLT
37	1	MIN-POWER CENTER WITH TRANSFORMER AND CIRCUIT BREAKER
38	1	HOSE VALVE HEADER
39	1	WASTE CONE
40	2	EARTHING LUG

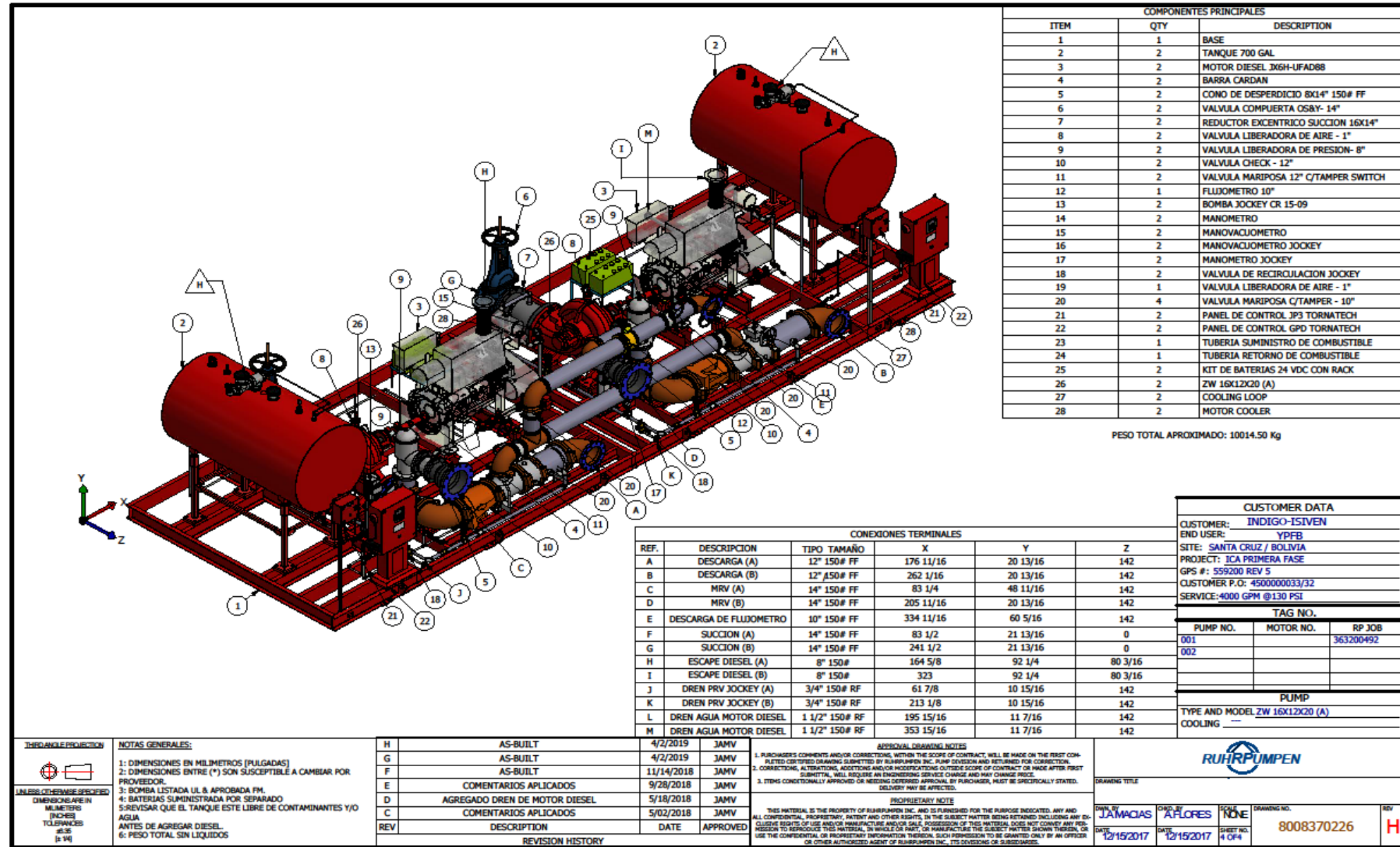


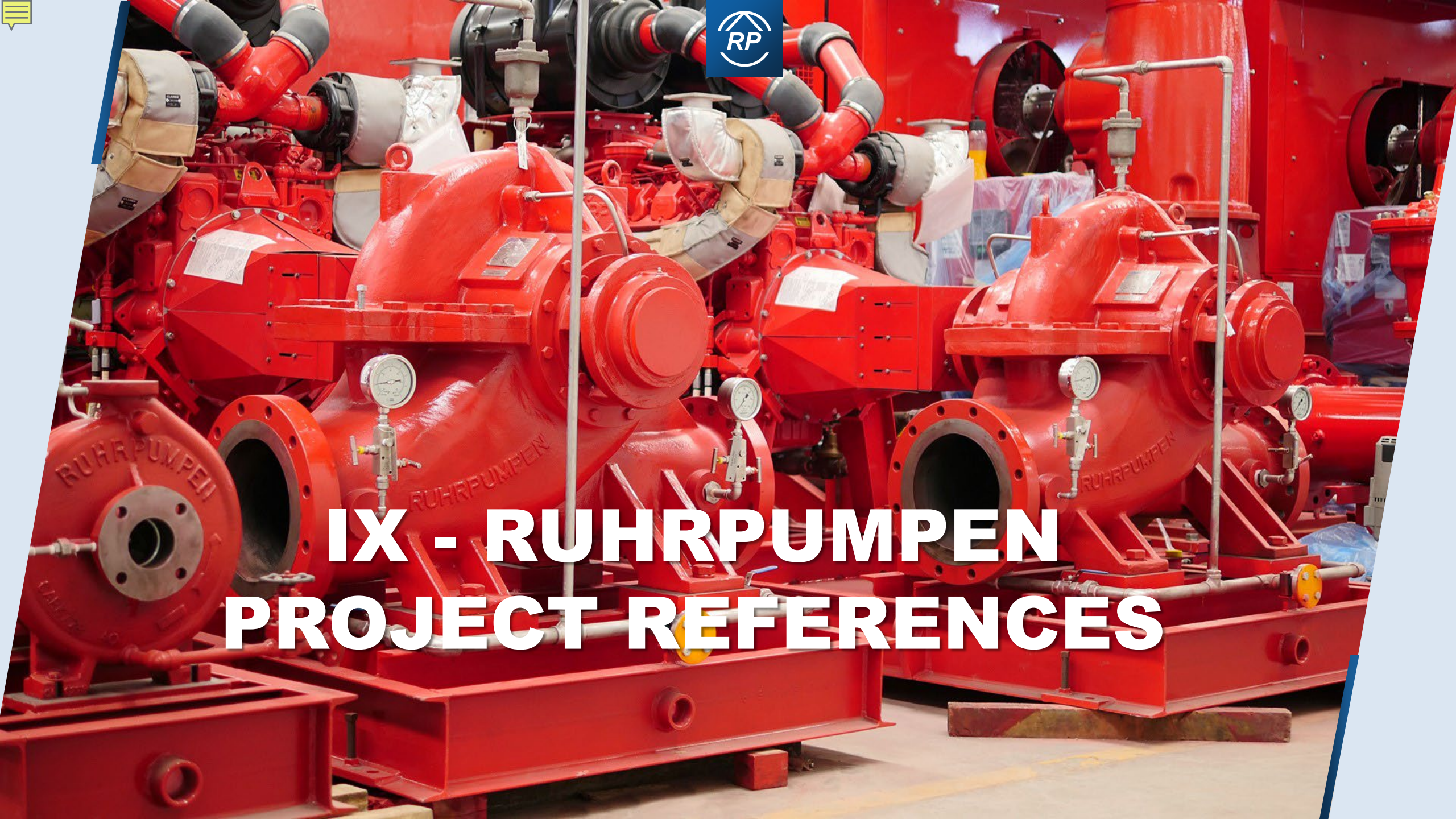
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1 SUBMITTAL DRAWING	DATE: 15/03/2018	DRAWN BY: M. GARCIA
- ALL DIMENSIONS ARE FOR REFERENCE ONLY	DATE: 15/03/2018	CHECKED BY: A. FLORES
- DO NOT SCALE DRAWING		
2 MANUFACTURING DRAWING	DATE: 15/03/2018	DRAWN BY: M. GARCIA
- LINEAR TOLERANCE $\pm 1"$		
- ANGULAR TOLERANCE ± 5		
- DO NOT SCALE DRAWING		
- ALL DIMENSIONS ARE IN INCHES		
- DIMENSIONS ARE PER ANSI Y14.5		
NO AUTOMATIC DIMENSION PROPAGATION		
THIRD ANGLE PROJECTION		
NTS		
PAGE #	PAGE - 4	
ORGANIZATION #	8008670263-7	
REV	4	









The background of the slide is a photograph of several large, red industrial pumps. The pumps are mounted on a red metal frame and have various pipes, valves, and gauges attached to them. The word 'RUHRPUMPEN' is visible on the side of the pumps. The overall scene is industrial and brightly lit.

IX - RUHRPUMPEN PROJECT REFERENCES



YPF Argentina

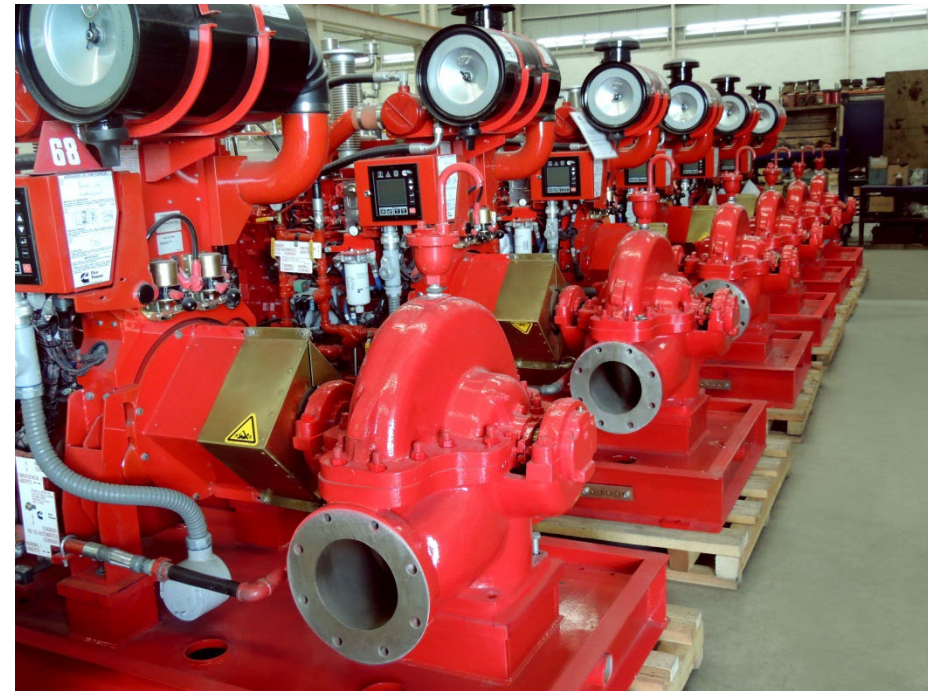
- Model: ZW 8x5x12F
- Flow: 1000 GPM / T.D.H: 202.0 Ft
- Diesel 98HP/ Weatherproof Enclosure/ Ni Cad Battery





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





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



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

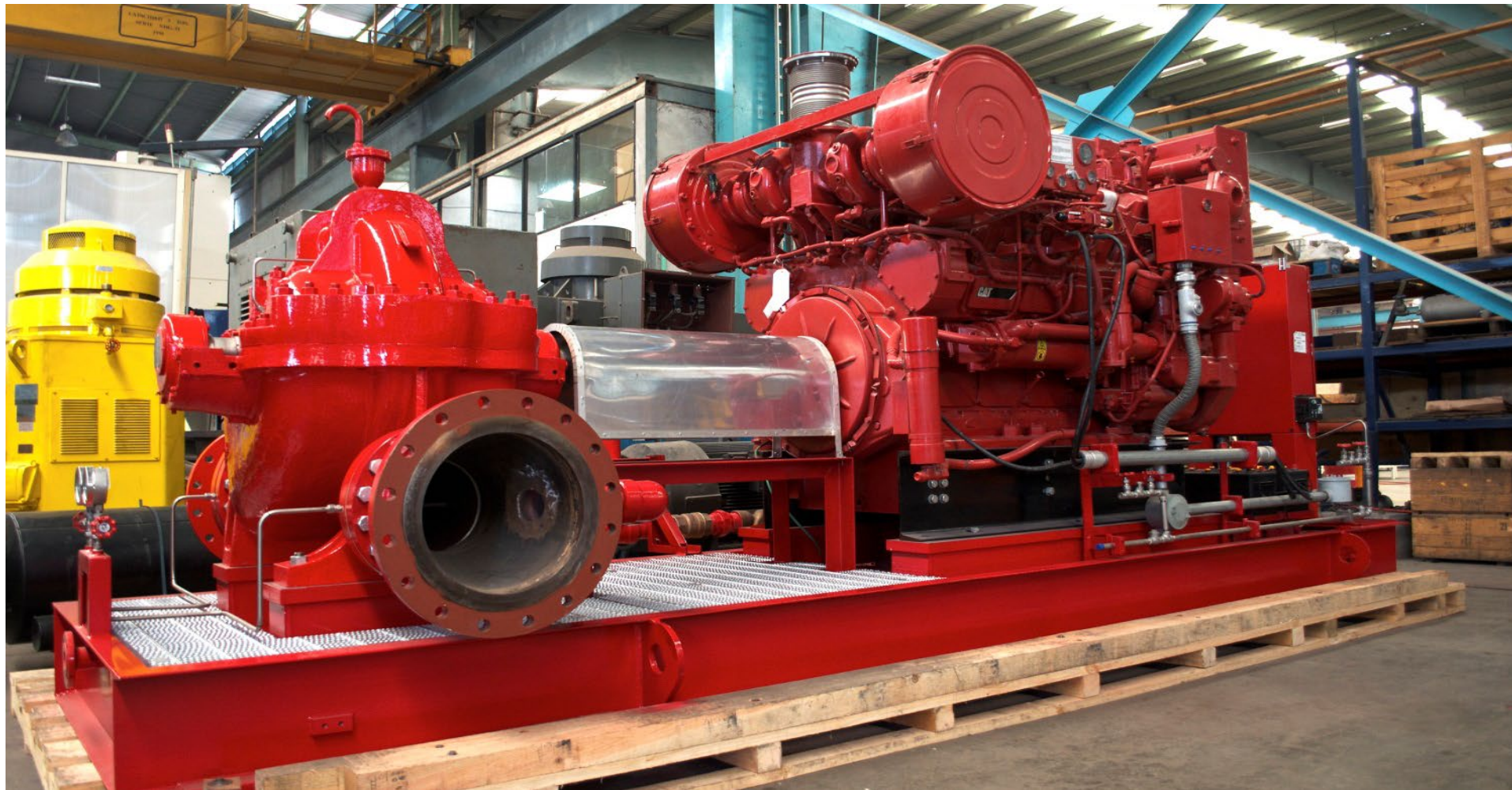
ENPPI – CAIRO REFINERY- EGYPT



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





IBERDOLA ENERGÍA ESCOBEDO

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



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





ALUAR ALUMINIO ARGENTINO

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



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





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



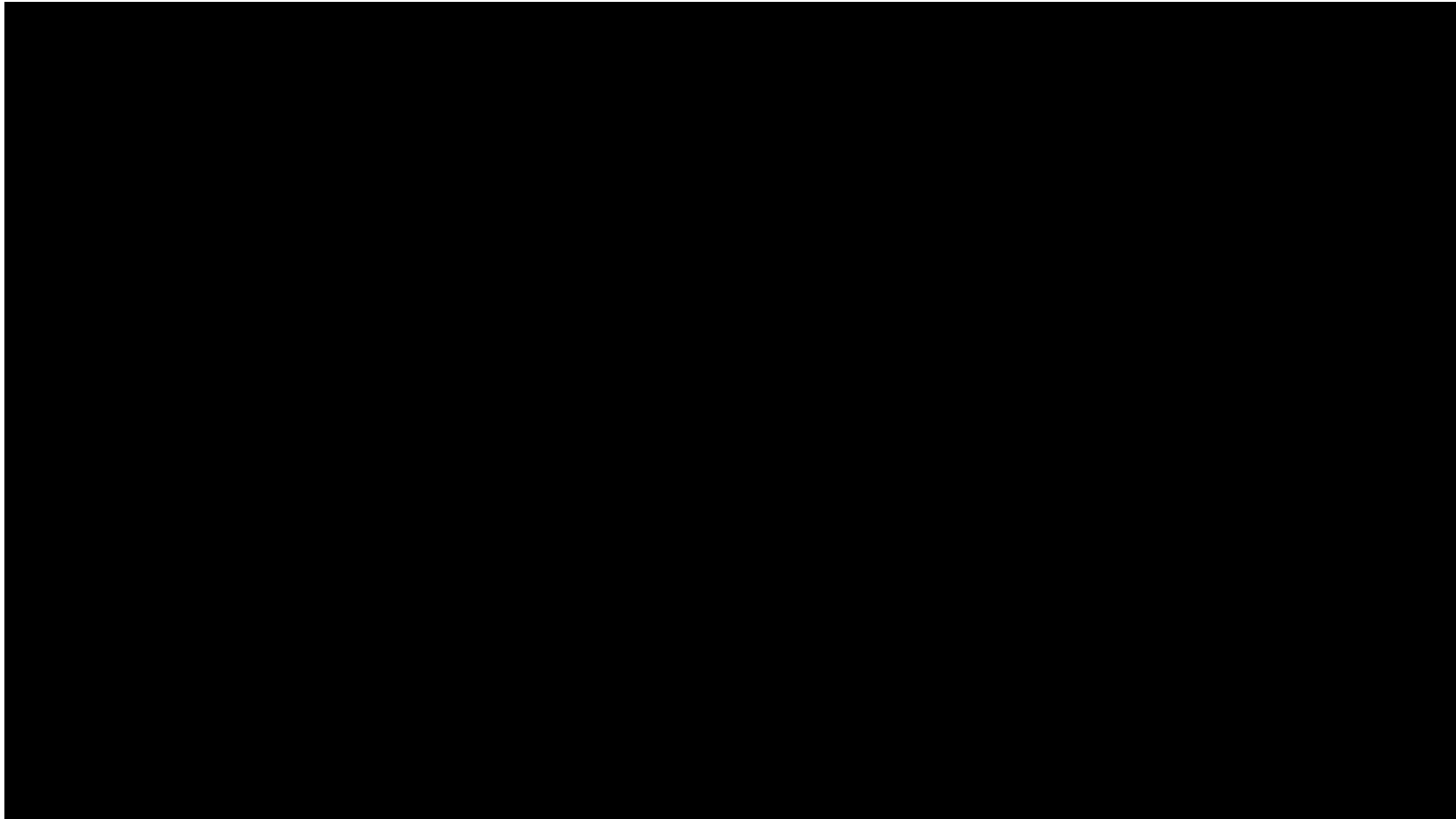


ENPRI

PETROBEL

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







Modularised Package





Coming Attractions 😊

“Summer Break”

We are taking a break during the summer holiday period.

We will be back with more Short Courses at the beginning of September

Future subjects in preparation include:

- Double Case Pumps (Barrel Pumps – BB5)
- Sump Pumps
- Wastewater Pumps



Specialist for Pumping Technology

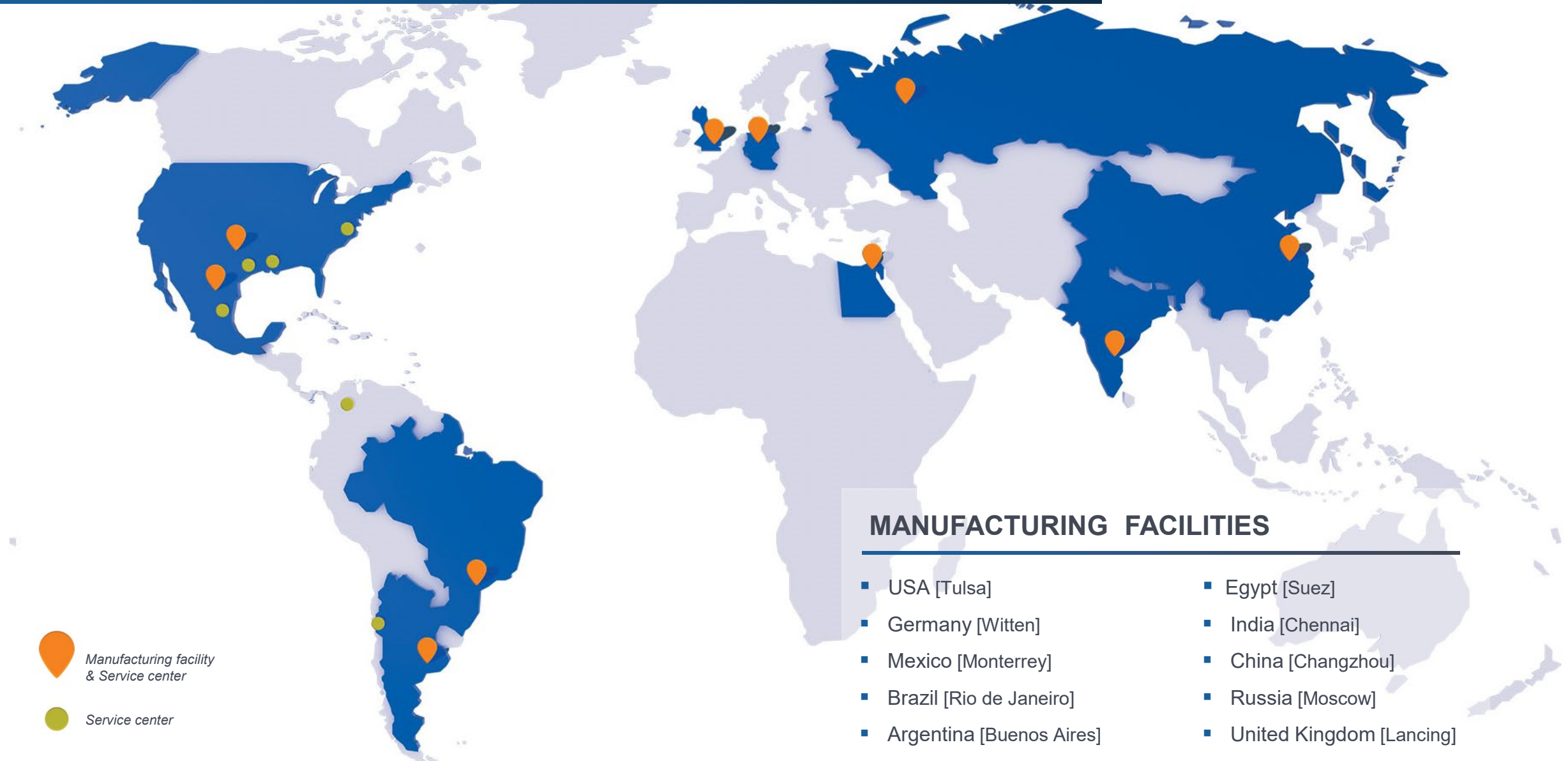
Q & A

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www.ruhrpumpen.com

marketing@ruhrpumpen.com

A GLOBAL COMPANY



RUHRPUMPEN AT A GLANCE

**VERTICAL
INTEGRATION**

**SALES
OFFICES IN
+35 COUNTRIES**

**MANUFACTURING
FACILITIES
IN 10 COUNTRIES**

**+70 YEARS
OF EXPERIENCE**

**+2,000
EMPLOYEES**

**15 SERVICE
CENTERS**

+70,000 PUMPING SOLUTIONS INSTALLED WORLDWIDE

MARKETS WE SERVE

Our commitment to create innovations that offer reliable solutions to our customers allow us to provide a complete range of pump systems to support **core markets** as:





OUR PUMP LINES

Ruhrpumpen offers a broad range of highly engineered and standard pumping products that meet and exceed the requirements of the most demanding quality specifications and industry standards.

Our pumps can handle head requirements as high as 13,000 ft (4,000 m) and capacities up to 300,000 gpm (68,000 m³/hr).

Moreover, our pump designs cover temperatures from cryogenic temperatures of -310 °F (-196 °C) up to 752 °F (400 °C).

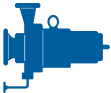
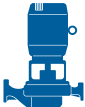
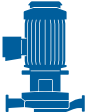


Products include:

- Single Stage Overhung Pumps
- Between Bearings Pumps
- Horizontal Multi-Stage Pumps
- Vertical Multi-Stage Pumps
- Vertical Mixed Flow & Axial Flow Pumps
- Positive Displacement Pumps
- Full Range of Industrial Pumps
- Submersible Pumps
- Magnetic Drive Pumps
- Decoking Systems
- Packaged Systems
- Fire Systems



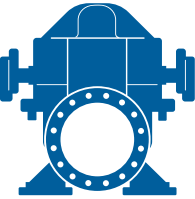
OVERHUNG PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Sealless Magnetic Drive Pumps	CRP-M / CRP-M-CC	ISO 2858 & 15783 HI design (OH11)	
	SCE-M	API 685	
Foot Mounted OH1 and General End Suction Pumps	IPP	HI design (OH1)	
	CPP / CPP-L	HI design (OH1) ANSI B73.1	
	CPO / CPO-L	HI design (OH1) ANSI B73.1	
	CRP	HI design (OH1) ISO 2858 & 5199	
	GSD	HI design (OH0)	
	SHD / ESK / SK / SKO SKV / ST / STV	HI design (OH1)	
	SWP	HI design (OH3A)	
Centerline Mounted	SCE	API 610 (OH2)	
Vertical In-Line Pumps	SPI	API 610 (OH3)	
	IVP / IVP-CC	HI design (OH4 / OH5)	
	IIL	HI design (OH5) Dimensionally compliant with ANSI B73.2	
	SPN	API 610 (OH5)	





BETWEEN BEARING PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
1 and 2 stage	Axially split	HSC / HSD / HSL HSR / ZW	HI design (BB1)	
		HSM	HI design (BB3)	
		ZM / ZMS ZLM / ZME	API design (BB1)	
	Radially split	HVN / J	API design (BB2)	
		RON / RON-D	API design (BB2)	
Multi-stage	Axially split	SM / SM-I	API design (BB3)	
		JTN	API design (BB3)	
	Radially split <i>single casing</i>	GP	API design (BB4)	
	Radially split <i>double casing</i>	A LINE	API design (BB5)	





VERTICAL PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
Single casing	Diffuser	VTP	HI & API 610 (VS1)	
		VCT	HI & API 610 (VS1)	
		HQ	HI & API 610 (VS1)	
		VLT	HI & API 610 (VS1)	
	Volute	DSV / DX	HI & API 610 (VS2)	
	Discharge through column – Axial flow	VAF	HI & API 610 (VS3)	
Double casing	Separate discharge line	VSP / VSP-Chem	HI & API 610 (VS4)	
	Diffuser	VLT / VMT	HI & API 610 (VS6)	
	Volute	DSV / DX	HI & API 610 (VS7)	
Submersible pumps		SMF	HI design (OH8A)	
		VLT-Sub / VTP-Sub	HI design (VS0)	





SPECIAL SERVICE PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Pitot tube pumps	COMBITUBE	HI design	
Reciprocating pumps	RDP	API 674 ISO 13710	
Vertical turbine generator	VTG	HI design (VS6)	
Barge	LS BARGE	HI design	
Floating dock pumps	ZVZ	HI design	
	LVZ	HI design	
Cryogenic pumps	SVNV	-	
	VTG Cryogenic	-	
	VLT Cryogenic VLTV	-	
Pre-packaged fire pump systems	Fire systems incorporate pumps, drivers, control systems and pipework in a single container. They can be skid mounted, with or without enclosure and supplied with electric motor or diesel engine.		 NFPA-20-850 UL and FM approved components

