

Dubai Electricity & Water Authority (DEWA)

Project Name: Hatta Pumped Storage Hydro Power Plant

DEWA Purchase Order No.: PO 3091900054, PO 3091900055

DEVIATION REQUEST NOTIFICATION		Document Reference No.:	PO3091900054-0-38-M-Y-00152 , PO3091900054-0-38-M-Y-00227
		Rev. No.:	A
		Date:	13/07/2023
FROM:		TO:	
NAFFCO		Employer / Engineer	
REQUESTED BY Contractor			
Deviation Request Submitted vide ref no.:		Issue Date:	
		13/07/2023	
Deviation from Specifications:		Reference Details:	
VOLUME II , PAST P 204 , STR- FIRE FIGHTING SYSTEM - WORKING DOCUMENTS CALUSE 4.8.3 , 132 KV AND 400 KV SUBSTATION FIRE PROTECTION SYSTEM 1.5.1.9.0.08-REV.12 CLAUSE 6.1.1 TO 6.1.18			
Proj. Dwg. / Document No.& Revision:		ISSUE:	
VOLUME II , PAST P 204 , STR- FIRE FIGHTING SYSTEM - WORKING DOCUMENTS CALUSE 4.8.3 , 132 KV AND		As noted below	
Subject: FIRE PUMP SET			
Specification Requirements:			
VOLUME II , PAST P 204 , STR- FIRE FIGHTING SYSTEM - WORKING DOCUMENTS CALUSE 4.8.3 , 132 KV AND 400 KV SUBSTATION FIRE PROTECTION SYSTEM 1.5.1.9.0.08-REV.12 CLAUSE 6.1.1 TO 6.1.18			
Reason / Cause for Deviation:			
<p>1. As per specification P 204 clause 4.8 horizontal split case pumps are required however , Proposed is vertical turbine pump for " POWER HOUSE" as the water tank is underground.</p> <p>2. As per specification P 204 clause 4.8 Pressure accumulator with compressure is required however. Kindly note that as per NFPA/UL/FM approval fire pump set pressure vessel is not required, since a jockey pump is provided to maintain minor pressure losses. However, we will provide 1 No pressure accumulator (500 liter) supplied separately.</p> <p>Please note as a fire fighting specialist we are not recommending pressure accumulators for the listed fire pump set and we will not provide a single source responsible for the entire fire pump set.</p> <p>3. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.1 para 248 a dry run protection is required however , Dry run protection is N/A as per NFPA20, Shutting down of the pump due to low water level is not permitted by NFPA20. We can provide additional auxiliary contact and the main contractor has to be installed a low-water level sensor that has to be connected to our control panel. So we can monitor if the water level is low in our fire pump control panel to protect dry run.</p> <p>4. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.3 para 255 a selector switch is required for electric fire pump controller however as per our proposal selector switch is N/A for electric fire pump controllers as . Manual start/stop push buttons are provided and auto mode is programmable.</p> <p>5. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.3 par 256 and 255 , a power failure indication is required for electric fire pump however our proposal is power failure indication N/A as Phase loss indication is provided</p> <p>6. . As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.5 para 276 battery chargers need to get electrical supply from electrical controllers , however as per NFPA 20 dedicated UL & FM approved diesel engine controller is provided for providing the electrical supply to the battery chargers</p> <p>7. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.4 par 267 semi rotary hand pump is required for filling the diesel , please note that this is not in the scope of NAFFCO , hence its N/A</p> <p>8. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.8 para 289 external reset is required for jockey pump controller , our proposal is an external isolator is already provided for resetting purpose hence a dedicated external reset is excluded.</p> <p>9. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.1 para 243, horizontal split case pumps are required , Proposed is vertical turbine pump for " POWER HOUSE" as the water tank is underground.</p> <p>10. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 250 drip rim base is required , please note that our proposed VT Pump will be directly mounted in the rigid concrete foundation</p> <p>11. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 251 and 252 material of construction is required as per split case pumps however , Proposed vertical turbine pumps has CT discharge head , SS impeller , SS shaft and sleeves with bronze wear rings for VT pump, Proposed is stainless steel shaft with Stainless steel sleeves for VT.</p> <p>12. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 253 casing relief valve to be provided , please note that casing relief valve is not applicable.</p> <p>13. As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 253 isolation pads to be provided for concrete block , please note that as per NFPA 20 isolation pads is not required as the fire pumps are to be mounted on rigid foundation. pump</p> <p>14. NOTE : Please refer to the compliance statement for detailed proposal</p>			
Nature & Description of Deviation:			
Please refer to the details a noted above and the compliance statement provided in section 3 of the technical submittals.			
Commercial Implication, None			
General Remarks: Please refer to the attached compliance statement in section 3 of the submittals for further details		Enclosures: Please refer to section 3	
Main Contractor:			
Signature:		Signature:	
Date : Stamp:		Date : Stamp:	
To be Completed by the Consultant:			
Employer / Engineer Decision (Tick Box):			
Accepted <input type="checkbox"/> Rejected <input type="checkbox"/>		Accepted Comments <input type="checkbox"/>	
Commercial Impact:			
Remarks:			
Name:			
Signature:		Date: Stamp:	

Project/ Location Name
Project / Location:
Employer:
Engineer:

HATTA PUMPED STORAGE HYDRO POWER PLANT
DUBAI
DUBAI ELECTRICITY AND WATER AUTHORITY
EDF

S.No	DEVIATION REQUEST DESCRIPTION	PROJECT SPECIFICATION	CODES / STANDARDS/ REQUIREMENT	Approved detailed design layout	REMARKS/ REASONS
1	Proposed is Vertical turbine fire pump instead of HSC pump	As per specification P 204 clause 4.8 horizontal split case pumps are required	As per site conditions	As per the IFC drawing Vertical turbine pump is required	Proposed is vertical turbine pump for " POWER HOUSE" as the water tank is underground.
2	Pressure accumulator with compressor	As per specification P 204 clause 4.8 Pressure accumulator is required	NFPA 20 verison 2019 clause 4.27.1 TO 4.27.4 (please refer to the attached extract from NFPA 20 at enclosure no.1)	NFPA 20 verison 2019 clause 4.27.1 TO 4.27.4 (please refer to the attached extract from NFPA 20 at enclosure no.1)	Kindly note that as per NFPA/UL/FM approval fire pump set pressure vessel is not required, since a jockey pump is provided to maintain minor pressure losses. However, we will provide 1 No pressure accumulator (500 liter) supplied separately. Please note as a fire fighting specialist we are not recommending pressure accumulators for the listed fire pump set and we will not provide a single source responsible for the entire fire pump set.
3	Dry Run Protection is not applicable.	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.1 para 248 a dry run protection is required	NFPA 20 verison 2019 clause 4.16.9 (please refer to the attached extract from NFPA 20 at enclosure no.1)	Not specified details in IFC drawing	Please note that the dry-run protection is not applicable as per NFPA20. We can provide additional auxiliary contact and the main contractor has to be installed a low-water level sensor that has to be connected to our control panel. So we can monitor if the water level is low in our fire pump control panel to protect dry run.
4	Selector switch is not available	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.3 para 255 a selector switch is required for electric fire pump controller	OEM recommendation	Not specified details in IFC drawing	Proposed is advanced UL & FM approved fire pump controller where the auto mode is programmable and manual start/stop push buttons are provided along with emergency start/stop lever, also Selector switch is not provided in the main fire pump controller to avoid any SELECTOR SWITCH MIS SET CONDITION.
5	Individual phase loss indication is provided instead of power failure	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.3 para 256 and 255 , a power failure indication	OEM recommendation	Not specified details in IFC drawing	Power on indication is provided in the controller that can be connected to BMS/Any other system in case of power failure the indication will be turned off.
6	Battery chargers are provided in the diesel engine controller and will take the supply from the diesel engine controller and not from electrical fire pump controller	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.5 para 276 battery chargers need to get electrical supply from electrical controllers	NFPA 20 verison 2019 clause 4.7.5 (please refer to the attached extract from NFPA 20 at enclosure no.1)	Not specified details in IFC drawing	Please note that as per NFPA 20 a dedicated fire pump controller is to be provided for each fire pump hence a dedicated UL & FM approved diesel engine controller is provided with in built battery chargers that take the supply from the diesel engine controller.
7	Not part of our scope	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.4 para 267 semi rotary hand pump is required for filling the diesel	As per site conditions	Not specified details in IFC drawing	Semi rotary pump for filling the diesel fuel is not in the scope of NAFFCO works.
8	External isolator is used for external resetting purpose instead of a separate external reset.	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.8 para 289 external reset is required for jockey pump controller	OEM recommendation	Not specified details in IFC drawing	Please note that an External isolator is used for external resetting purpose instead of a separate external reset.
9	Proposed is Vertical turbine fire pump instead of HSC pump	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.1 para 243, horizontal split case pumps are required	As per site conditions	As per the IFC drawing Vertical turbine pump is required	Proposed is vertical turbine pump for " POWER HOUSE" as the water tank is underground.
10	Drip rim base is not applicable	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 250 drip rim base is required	OEM recommendation	Not specified details in IFC drawing	proposed VT Pump will be directly mounted in the rigid concrete foundation and not on any base frame
11	Material of construction is as per the requirements of submerged vertical turbine fire pump and not as per HSC pumps	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 251 and 252 material of construction is required as per split case pumps	OEM recommendation	As per the IFC drawing Vertical turbine pump is required	Proposed vertical turbine pumps has 1" discharge head , SS impeller , SS shaft and sleeves with bronze wear rings for VT pump, Proposed is stainless steel shaft with Stainless steel sleeves for VT.
12	Casing relief valve is not applicable for vertical turbine pumps that are submerged in the water tank	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 253 casing relief valve to be provided	NFPA 20 verison 2019 clause 4.13.1.2 (please refer to the attached extract from NFPA 20 at enclosure no.1)	Not specified details in IFC drawing	Casing relief valve is not applicable for vertical turbine pumps that are submerged in the water tank , hence NFPA 20 does not specify this a requirement in any part of their standard
13	Isolation pads are not recommended and applicable as per NFPA 20.	As per specification 1.5.1.9.0.08 - rev.12 clause 6.1.2 para 253 isolation pads to be provided for concrete block	NFPA 20 verison 2019 clause 6.4.4 (please refer to the attached extract from NFPA 20 at enclosure no.1)	Not specified details in IFC drawing	please note that as per NFPA 20 isolation pads is not required as the fire pumps are to be mounted on rigid foundation. pump

4.24.2.2 The test pressure shall not be less than one and one-half times the sum of the pump's shutoff head plus its maximum allowable suction head, but in no case shall it be less than 250 psi (17.24 bar).

4.24.2.3 Pump casings shall be essentially tight at the test pressure.

4.24.2.4 During the test, no objectionable leakage shall occur at any joint.

4.24.2.5 In the case of vertical turbine-type pumps, both the discharge casting and pump bowl assembly shall be tested.

4.25* Pump Shaft Rotation. Pump shaft rotation shall be determined and correctly specified when fire pumps and equipment involving that rotation are ordered.

4.26* Other Signals. Where required by other sections of this standard, signals shall call attention to improper conditions in the fire pump equipment.

4.27* Pressure Maintenance (Jockey or Make-Up) Pumps.

4.27.1 For pressure-actuated fire pumps, a means to maintain the pressure in the fire protection system shall be provided in accordance with one of the following:

- (1) A pressure maintenance (jockey) pump
- (2) A water mist positive displacement pumping unit in accordance with 8.5.7.2
- (3) Another approved means that is not the main fire pump

4.27.2 Pressure maintenance pumps shall not be required to be listed. Pressure maintenance pumps shall be approved.

4.27.2.1* The pressure maintenance pump shall be sized to replenish the fire protection system pressure due to allowable leakage and normal drops in pressure.

4.27.3 Pressure maintenance pumps shall have rated capacities not less than any normal leakage rate.

4.27.4 Pressure maintenance pumps shall have discharge pressure sufficient to maintain the desired fire protection system pressure.

4.27.5* Excess Pressure.

4.27.5.1 Where a centrifugal-type pressure maintenance pump has a total discharge pressure with the pump operating at shut-off exceeding the working pressure rating of the fire protection equipment, or where a turbine vane (peripheral) type of pump is used, a relief valve sized to prevent overpressuring of the system shall be installed on the pump discharge to prevent damage to the fire protection system.

4.27.5.2 Running period timers shall not be used where jockey pumps are utilized that have the capability of exceeding the working pressure of the fire protection systems.

4.27.6 Piping and Components for Pressure Maintenance Pumps.

4.27.6.1 Steel pipe shall be used for suction and discharge piping on pressure maintenance pumps, which includes packaged prefabricated systems.

4.27.6.2 Valves and components for the pressure maintenance pump shall not be required to be listed.

4.27.6.3 An isolation valve shall be installed on the suction side of the pressure maintenance pump to isolate the pump for repair.

4.27.6.4 A check valve and isolation valve shall be installed in the discharge pipe.

4.27.6.5* Indicating valves shall be installed in such places as needed to make the pump, check valve, and miscellaneous fittings accessible for repair.

4.27.6.6 The pressure sensing line for the pressure maintenance pump shall be in accordance with Section 4.32.

4.27.6.7 The isolation valves serving the pressure maintenance pump shall not be required to be supervised.

4.27.7 Except as permitted in Chapter 8, the primary or standby fire pump shall not be used as a pressure maintenance pump.

4.27.8 The controller for a pressure maintenance pump shall be listed but shall not be required to be listed for fire pump service.

4.27.9 The pressure maintenance pump shall not be required to have alternate or standby power.

4.28 Summary of Centrifugal Fire Pump Data. The sizes indicated in Table 4.28(a) and Table 4.28(b) shall be used as a minimum.

4.29 Backflow Preventers and Check Valves.

4.29.1 Check valves and backflow prevention devices and assemblies shall be listed for fire protection service.

4.29.2 Relief Valve Drainage.

4.29.2.1 Where the backflow prevention device or assembly incorporates a relief valve, the relief valve shall discharge to a drain appropriately sized for the maximum anticipated flow from the relief valve.

4.29.2.2 An air gap shall be provided in accordance with the manufacturer's recommendations.

4.29.2.3 Water discharge from the relief valve shall be readily visible or easily detectable.

4.29.2.4 Performance of the requirements in 4.29.2.1 through 4.29.2.3 shall be documented by engineering calculations and tests.

4.29.3 Devices in Suction Piping. Where located in the suction pipe of the pump, check valves and backflow prevention devices or assemblies shall be located a minimum of 10 pipe diameters from the pump suction flange.

4.29.3.1 Where a backflow preventer with butterfly control valves is installed in the suction pipe, the backflow preventer is required to be at least 50 ft (15.2 m) from the pump suction flange (as measured along the route of pipe) in accordance with 4.16.5.4.

4.29.4 Evaluation.

4.29.4.1 Backflow Prevention Device.

4.29.4.1.1 Where a backflow prevention device or assembly is installed in connection with the pump, special consideration shall be given to the increased pressure loss resulting from the installation.

N 4.16.5.3 Automated Valves.

N 4.16.5.3.1 A listed indicating valve with automated controls shall be permitted.

N 4.16.5.3.2 The automated water control valve assembly shall meet the following criteria:

- (1) Include a reliable position indication
- (2) Include a valve supervisory switch and be connected to a remote supervisory station
- (3) Operate manually as well as automatically

4.16.5.4 No control valve other than a listed OS&Y valve and the devices as permitted in 4.29.3 shall be installed in the suction pipe within 50 ft (15.3 m) of the pump suction flange.

4.16.6* Installation.

4.16.6.1 General. Suction pipe shall be laid carefully to avoid air leaks and air pockets, either of which can seriously affect the operation of the pump.

4.16.6.2 Freeze Protection.

4.16.6.2.1 Suction pipe shall be installed below the frost line or in frostproof casings.

4.16.6.2.2 Where pipe enters streams, ponds, or reservoirs, special attention shall be given to prevent freezing either underground or underwater.

4.16.6.3 Elbows and Tees.

4.16.6.3.1 Unless the requirements of 4.16.6.3.2 are met, elbows and tees with a centerline plane parallel to a horizontal split-case pump shaft shall not be permitted. (See Figure A.4.16.6.)

4.16.6.3.2 The requirements of 4.16.6.3.1 shall not apply to elbows and tees with a centerline plane parallel to a horizontal split-case pump shaft where the distance between the flanges of the pump suction intake and the elbow and tee is greater than 10 times the suction pipe diameter.

4.16.6.3.3 Elbows and tees with a centerline plane perpendicular to the horizontal split-case pump shaft shall be permitted at any location in the pump suction intake.

4.16.6.4 Eccentric Tapered Reducer or Increaser. Where the suction pipe and pump suction flange are not of the same size, they shall be connected with an eccentric tapered reducer or increaser installed in such a way as to avoid air pockets.

4.16.6.5 Strain Relief. Where the pump and its suction supply are on separate foundations with rigid interconnecting pipe, the pipe shall be provided with strain relief. [See Figure A.6.3.1(a).]

4.16.7 Multiple Pumps. Where a single suction pipe supplies more than one pump, the suction pipe layout at the pumps shall be arranged so that each pump will receive its proportional supply.

4.16.8* Suction Screening.

4.16.8.1 Where the water supply is obtained from an open source such as a pond or wet pit, the passage of materials that might clog the pump shall be obstructed.

4.16.8.2 Double intake screens shall be provided at the suction intake.

4.16.8.3 Screens shall be removable, or an in situ cleaning shall be provided.

4.16.8.4 Below minimum water level, these screens shall have an effective net area of opening of 1 in.² for each 1 gpm (170 mm² for each 1 L/min) at 150 percent of rated pump capacity.

4.16.8.5 Screens shall be so arranged that they can be cleaned or repaired without disturbing the suction pipe.

4.16.8.6 Mesh screens shall be brass, copper, Monel, stainless steel, or other equivalent corrosion-resistant metallic material wire screen of 0.50 in. (12.7 mm) maximum mesh and No. 10 B&S gauge.

4.16.8.7 Where flat panel mesh screens are used, the wire shall be secured to a metal frame sliding vertically at the entrance to the intake.

4.16.8.8 Where the screens are located in a sump or depression, they shall be equipped with a debris-lifting rake.

4.16.8.9 Periodically, the system shall be test pumped, the screens shall be removed for inspection, and accumulated debris shall be removed.

4.16.8.10 Continuous slot screens shall be brass, copper, Monel, stainless steel, or other equivalent corrosion-resistant metallic material of 0.125 in. (3.2 mm) maximum slot and profile wire construction.

4.16.8.11 Screens shall have at least 62.5 percent open area.

4.16.8.12 Where zebra mussel infestation is present or reasonably anticipated at the site, the screens shall be constructed of a material with demonstrated resistance to zebra mussel attachment or coated with a material with demonstrated resistance to zebra mussel attachment at low velocities.

4.16.8.13 The overall area of the screen shall be 1.6 times the net screen opening area. (See screen details in Figure A.7.2.2.2.)

4.16.9* Devices in Suction Piping.

4.16.9.1 No device or assembly, unless identified in 4.16.9.2, that will stop, restrict the starting of, or restrict the discharge of a fire pump or pump driver shall be installed in the suction piping.

4.16.9.2 The following devices shall be permitted in the suction piping where the following requirements are met:

- (1) Check valves and backflow prevention devices and assemblies shall be permitted where required by other NFPA standards or the authority having jurisdiction and **installed** in accordance with Section 4.29.
- (2) Where the authority having jurisdiction requires positive pressure to be maintained on the suction piping, a pressure sensing line for a low suction pressure control, specifically listed for fire pump service, shall be permitted to be connected to the suction piping.
- (3) Devices shall be permitted to be installed in the suction supply piping or stored water supply and arranged to activate a signal if the pump suction pressure or water level falls below a predetermined minimum.
- (4) Suction strainers shall be permitted to be installed in the suction piping where required by other sections of this standard.

4.6.3 Level. The minimum water level of a well or wet pit shall be determined by pumping at not less than 150 percent of the fire pump rated capacity.

4.6.4* Stored Supply.

4.6.4.1 A stored supply plus reliable automatic refill shall be sufficient to meet the demand placed upon it for the design duration.

4.6.4.2 A reliable method of replenishing the supply shall be provided.

4.6.5 Head.

4.6.5.1 Except as provided in 4.6.5.2, the head available from a water supply shall be figured on the basis of a flow of 150 percent of rated capacity of the fire pump.

4.6.5.2 Where the water supply cannot provide a flow of 150 percent of the rated flow of the pump but the water supply can provide the greater of 100 percent of the rated flow or the flow demand of the fire protection system(s), the head available from the water supply shall be permitted to be calculated on the basis of the maximum flow available as allowed by 4.6.2.3.1.

4.6.5.3 The head described in 4.6.5.1 and 4.6.5.2 shall be as indicated by a flow test.

4.7 Pumps, Drivers, and Controllers.

4.7.1* Fire pumps shall be dedicated to and listed for fire protection service.

4.7.2 Acceptable drivers for pumps at a single installation shall be electric motors, diesel engines, steam turbines, or a combination thereof.

4.7.3* A pump shall not be equipped with more than one driver.

4.7.4 Each fire pump shall have its own dedicated driver unless otherwise permitted in 8.6.3.1.

4.7.5 Each driver or water mist positive displacement pumping unit shall have its own dedicated controller.

4.7.6* The driver shall be selected in accordance with 9.5.2 (electric motors), 11.2.2 (diesel engines), or 13.1.2 (steam turbines) to provide the required power to operate the pump at rated speed and maximum pump load under any flow condition.

4.7.7* Maximum Pressure for Centrifugal Pumps.

4.7.7.1 The net pump shutoff (churn) pressure plus the maximum static suction pressure, adjusted for elevation, shall not exceed the pressure for which the system components are rated.

4.7.7.2* Pressure relief valves and pressure regulating devices in the fire pump installation shall not be used as a means to meet the requirements of 4.7.7.1.

4.7.7.3 Variable Speed Pressure Limiting Control.

4.7.7.3.1 Variable speed pressure limiting control drivers, as defined in this standard, shall be acceptable to limit system pressure.

4.7.7.3.2* The set pressure plus the maximum pressure variance of the variable speed pressure limiting controlled

systems during variable speed operation and adjusted for elevation shall not exceed the pressure rating of any system component.

4.8 Multistage Multiport Pump.

4.8.1 Multistage multiport fire pumps shall be installed in accordance with this standard.

4.8.2 A shutoff valve shall not be required between the impellers of a multistage multiport pump.

4.9* Centrifugal Fire Pump Capacities.

4.9.1 A centrifugal fire pump for fire protection shall be selected so that the greatest single demand for any fire protection system connected to the pump is less than or equal to 150 percent of the rated capacity (flow) of the pump.

4.9.2* Centrifugal fire pumps shall have one of the rated capacities in gpm (L/min) identified in Table 4.9.2 and shall be rated at net pressures of 40 psi (2.7 bar) or more.

4.9.3 Centrifugal fire pumps with ratings over 5000 gpm (18,925 L/min) shall be subject to individual review by either the authority having jurisdiction or a listing laboratory.

4.10 Nameplate.

4.10.1 Pumps shall be provided with a nameplate.

4.10.2 The name plate shall be made of and attached using corrosion resistant material.

4.11 Pressure Gauges.

4.11.1 Discharge.

4.11.1.1 A pressure gauge having a dial not less than 3.5 in. (89 mm) in diameter shall be connected near the discharge casting with a nominal 0.25 in. (6 mm) gauge valve.

4.11.1.2 The dial shall indicate pressure to at least twice the rated working pressure of the pump but not less than 200 psi (13.8 bar).

4.11.1.3 The face of the dial shall read in bar, pounds per square inch, or both with the manufacturer's standard graduations.

4.11.2* Suction.

4.11.2.1 Unless the requirements of 4.11.2.4 are met, a gauge having a dial not less than 3.5 in. (89 mm) in diameter shall be

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		

6.3 Fittings.

6.3.1* Where necessary, the following fittings for the pump shall be provided by the pump manufacturer or an authorized representative:

- (1) Automatic air release valve
- (2) Circulation relief valve
- (3) Pressure gauges

6.3.2 Where necessary, the following fittings shall be provided:

- (1) Eccentric tapered reducer at suction inlet
- (2) Hose valve manifold with hose valves
- (3) Flow measuring device
- (4) Relief valve and discharge cone
- (5) Pipeline strainer

6.3.3 Automatic Air Release.

6.3.3.1 Unless the requirements of 6.3.3.2 are met, pumps that are automatically controlled shall be provided with a listed float-operated air release valve having a nominal 0.50 in. (12.7 mm) minimum diameter discharged to atmosphere.

6.3.3.2 The requirements of 6.3.3.1 shall not apply to overhung impeller-type pumps with top centerline discharge or that are vertically mounted to naturally vent the air.

6.4 Foundation and Setting.

6.4.1* Overhung impeller and impeller between bearings design pumps and driver shall be mounted on a common grouted base plate.

6.4.2 Pumps of the overhung impeller close coupled in-line type [see Figure A.6.1.1(c)] shall be permitted to be mounted on a base attached to the pump mounting base plate.

6.4.3 The base plate shall be securely attached to a solid foundation in such a way that pump and driver shaft alignment is ensured.

6.4.4* The foundation shall be sufficiently substantial to form a permanent and rigid support for the base plate.

6.4.5 The base plate, with pump and driver mounted on it, shall be set level on the foundation.

6.5* Connection to Driver and Alignment.

6.5.1 Coupling Type.

6.5.1.1 Separately coupled-type pumps with electric motor or diesel engine drivers shall be connected by a flexible coupling or flexible connecting shaft.

6.5.1.2* Flexible couplings and flexible connecting shafts shall be listed for fire pump service and installed in accordance with the listing.

6.5.2 Pumps and drivers on separately coupled-type pumps shall be aligned in accordance with the coupling and pump manufacturers' specifications and the ANSI/HI 1.4, *Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation and Maintenance*. (See A.6.5.)

Chapter 7 Vertical Shaft Turbine-Type Pumps

7.1* General.

7.1.1* Application. Where the water supply is located below the discharge flange centerline and the water supply pressure is insufficient to deliver the water to the fire pump, a vertical shaft turbine-type pump shall be used.

7.1.2 Factory and Field Performance.

7.1.2.1 Pumps shall furnish not less than 150 percent of rated capacity at a total head of not less than 65 percent of the total rated head. (See Figure A.6.2.)

7.1.2.2 The total shutoff head shall not exceed 140 percent of the total rated head on vertical turbine pumps. (See Figure A.6.2.)

7.1.2.3 The vertical turbine-type pump shall be designed to operate in a vertical position with all parts in correct alignment.

7.2 Water Supply.

7.2.1 Source.

7.2.1.1* The water supply shall be adequate, dependable, and acceptable to the authority having jurisdiction.

7.2.1.2* The acceptance of a well as a water supply source shall be dependent upon satisfactory development of the well and establishment of satisfactory aquifer characteristics.

7.2.2 Pump Submergence.

7.2.2.1* Well Installations.

7.2.2.1.1 Submergence of the pump bowls shall be provided for reliable operation of the fire pump unit.

7.2.2.1.2 Submergence of the second impeller from the bottom of the pump bowl assembly shall be not less than 10 ft (3.2 m) below the pumping water level at 150 percent of rated capacity. (See Figure A.7.2.2.1.)

7.2.2.1.3* The submergence shall be increased by 1 ft (0.3 m) for each 1000 ft (305 m) of elevation above sea level.

7.2.2.2* Wet Pit Installations.

7.2.2.2.1 To provide submergence for priming, the elevation of the second impeller from the bottom of the pump bowl assembly shall be such that it is below the lowest pumping water level in the open body of water supplying the pit.

7.2.2.2.2 For pumps with rated capacities of 2000 gpm (7570 L/min) or greater, additional submergence is required to prevent the formation of vortices and to provide required net positive suction head (NPSH) in order to prevent excessive cavitation.

7.2.2.2.3 The required submergence shall be obtained from the pump manufacturer.

7.2.2.2.4 The distance between the bottom of the strainer and the bottom of the wet pit shall be at least one-half of the pump bowl diameter but not less than 12 in. (305 mm).

7.2.3 Well Construction.

7.2.3.1 It shall be the responsibility of the groundwater supply contractor to perform the necessary groundwater investigation

N 4.8.24 The maximum operating frequency shall not exceed line frequency.

4.9 Multistage Multiport Pump.

4.9.1 Multistage multiport fire pumps shall be installed in accordance with this standard.

4.9.2 A shutoff valve shall not be required between the impellers of a multistage multiport pump.

4.10* Centrifugal Fire Pump Capacities.

4.10.1 A centrifugal fire pump for fire protection shall be selected so that the greatest single demand for any fire protection system connected to the pump is less than or equal to 150 percent of the rated capacity (flow) of the pump.

4.10.2* Centrifugal fire pumps shall have one of the rated capacities in gpm (L/min) identified in Table 4.10.2 and shall be rated at net pressures of 40 psi (2.7 bar) or more.

4.10.3 Centrifugal fire pumps with ratings over 5000 gpm (18,925 L/min) shall be subject to individual review by either the authority having jurisdiction or a listing laboratory.

4.11 Nameplate.

4.11.1 Pumps shall be provided with a nameplate.

4.11.2 The name plate shall be made of and attached using corrosion resistant material.

N 4.11.3 The nameplate shall indicate the maximum pump horsepower demand required to power the pump at any flow, including flows beyond 150 percent of the rated capacity.

4.12 Pressure Gauges.

4.12.1 Discharge.

4.12.1.1 A pressure gauge having a dial not less than 3.5 in. (89 mm) in diameter shall be connected near the discharge casting with a nominal 0.25 in. (6 mm) gauge valve.

4.12.1.2 The dial shall indicate pressure to at least twice the rated working pressure of the pump but not less than 200 psi (13.8 bar).

4.12.1.3 The face of the dial shall read in bar, pounds per square inch, or both with the manufacturer's standard graduations.

Table 4.10.2 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		

4.12.2* Suction.

4.12.2.1 Unless the requirements of 4.12.2.4 are met, a gauge having a dial not less than 3.5 in. (89 mm) in diameter shall be connected to the suction pipe near the pump with a nominal 0.25 in. (6 mm) gauge valve.

4.12.2.1.1 Where the minimum pump suction pressure is below 20 psi (1.3 bar) under any flow condition, the suction gauge shall be a compound pressure and vacuum gauge.

4.12.2.2 The face of the dial shall read in inches of mercury (millimeters of mercury) or psi (bar) for the suction range.

4.12.2.3 The gauge shall have a pressure range two times the rated maximum suction pressure of the pump.

4.12.2.4 The requirements of 4.12.2 shall not apply to vertical shaft turbine-type pumps taking suction from a well or open wet pit.

4.13 Circulation Relief Valve.

4.13.1 General Requirements.

4.13.1.1* Where an electric variable speed pump is installed, the automatic circulation relief valve shall open at the minimum speed.

4.13.1.2 Unless the requirements of 4.13.1.8 are met, each pump(s) shall have an automatic relief valve listed for the fire pump service installed and set below the shutoff pressure at minimum expected suction pressure.

4.13.1.3 The valve shall be installed on the discharge side of the pump before the discharge check valve.

4.13.1.3.1 For multistage multiport pumps, the automatic circulation relief valve shall be installed before the discharge check valve for the last port and set below the churn pressure of the first port.

4.13.1.4 The valve shall provide sufficient water flow to prevent the pump from overheating when operating with no discharge.

4.13.1.5 Provisions shall be made for discharge to a drain.

4.13.1.6 Circulation relief valves shall not be tied in with the packing box or drip rim drains.

4.13.1.7 The automatic relief valve shall have a nominal size of 0.75 in. (19 mm) for pumps with a rated capacity not exceeding 2500 gpm (9462 L/min) and have a nominal size of 1 in. (25 mm) for pumps with a rated capacity of 3000 gpm to 5000 gpm (11,355 L/min to 18,925 L/min).

4.13.1.8 The requirements of 4.13.1 shall not apply to engine-driven pumps for which engine cooling water is taken from the pump discharge.

4.14* Equipment Protection.

4.14.1* General Requirements. The fire pump, driver, controller, water supply, and power supply shall be protected against possible interruption of service through damage caused by explosion, fire, flood, earthquake, rodents, insects, wind-storm, freezing, vandalism, and other adverse conditions.

4.14.1.1* Indoor Fire Pump Units.

4.14.1.1.1 Except as permitted in 4.14.1.1.3, fire pump units serving high-rise buildings shall be protected from surrounding