

WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION M-01-01

CENTRIFUGAL PUMPS

Revision Date: 28 July 2010

CONTENTS

CENTRIFUGAL PUMPS

		<u>Page</u>
1.	Design	1
2.	Duties and Characteristics	1
3.	Horizontal Pumpsets	2
4.	Vertical Pumpsets	2
5.	Pump Tests	2 - 3
6.	Materials of Construction	3 - 4
7.	Pump Casing	4
8.	Pump Impeller	4
9.	Pump Shaft	4
10.	Mechanical Seals	4
11.	Bearings	5
12.	Gauges	5

WATER SUPPLIES DEPARTMENT
STANDARD SPECIFICATION M-01-01
CENTRIFUGAL PUMPS

1. **DESIGN**

The pump shall be of centrifugal type and of robust construction with all rotating parts carefully balanced to prevent undue vibration. The pump should have the maximum efficiency at the specified pump duty point.

Pumps with one or two stages shall have axially split casings with the suction and delivery flanges cast into the fixed half to allow full accessibility to all internal parts without disturbing the alignment of the pumpset or breaking the pipe joints. The design of coupling shall allow the pump to be removed without disturbing the motor. Multistage pumps can be of the axially split casing or cellular design.

The pump shall be designed so that no thrust is transmitted to the driving motor and multistage pumps are to be provided with a balance disc/device to reduce the thrust on the pump bearings.

The pumpset vibration level shall be within the limits specified in ISO 10816 of appropriate support class and zone boundary. For pumps having a duty output of 20 litres/second or more, the maximum pump speed shall not exceed 1500 rpm.

The pump shall be free from unacceptable noise. The limiting sound pressure level of the pumpset with the motor coupled up at the pump closed valve head shall not exceed 94 dBA measured to BS EN ISO 1680 at any point 1 m from the pumpset.

2. **DUTIES AND CHARACTERISTICS**

The pump shall have a stable characteristic and be capable of continuous operation at the specified range of flow rate. The closed valve head of the pump shall be not less than 120% of the pumping head at its duty point.

The rated output power of the driving motor for salt water and fresh water/raw water pumpset shall be not less than 115% and 120% respectively of the maximum power absorbed by the pump over the whole operating range specified.

For calculating the available net positive suction head (NPSH) at the pump for any operating condition, the minimum atmospheric pressure shall be taken as 10 m of water and the maximum vapour pressure of water as 0.3 m of water. The curve of NPSH required by the pump shall be submitted with tender for assessment.

3. **HORIZONTAL PUMPSETS**

Unless otherwise specified, the pump supplied shall be complete with motor, coupling, and foundation bolts and shall be mounted on a common bedplate with the motor.

The bedplate shall be of a robust and rigid design to ensure that there is no vibration of the plant, and designed so as to allow suitable cable access to the motor cable box. All rotating parts shall be provided with suitable guards.

4. **VERTICAL PUMPSETS**

Unless otherwise specified, the pump supplied shall be complete with motor.

When the motor is coupled to the pump by an extension shaft, the motor shall be mounted on a stool and a soleplate suitable for mounting on the floor. Unless otherwise specified, an adjustable extension shaft complete with universal joints and couplings for power transmission shall be supplied. Each pumpset shall be supplied with an appropriate fixture for supporting and securing the extension shaft when the motor is decoupled for maintenance. Where specified in the Particular Specification, an intermediate bearing shall be supplied. Plummer block bearing housing or flanged bearing housing of grease lubricating type shall be fitted with a grease nipple for relubrication.

When the motor is coupled directly to the pump, the pump motor shall be supported on its own steel stand and soleplate over the pump. The motor stand shall be so designed that full access to the pump is maintained to facilitate maintenance, and suitable working platform for access to the top of the motor shall be provided. The motor stand shall be free from undue vibration when the motor / pumpset is operating.

All rotating parts, including the intermediate shafting shall be provided with suitable guards. Foundation bolts are to be supplied for the motor stool, stand, soleplate and for the pump. Means must be provided to enable the pump rotating element to be withdrawn without difficulty, and without disturbing the motor. A water thrower shall be provided to protect the lower bearing except the water lubricated type.

5. **PUMP TESTS**

The pump casing shall be hydraulically tested to 1.5 times the maximum attainable pressure in the system, or to a value as specified in the Particular Specification, which shall take into account the maximum suction head, closed valve head and the effects of system surge. During the hydraulic test, the test pressure shall be sustained for a period of not less than 10 minutes.

The pump shall then be coupled to the motor to be supplied and tested at the pump manufacturer's works to BS EN ISO 9906 Grade 1 over the full range of its capabilities to determine pump output, power absorbed and efficiency.

All tests are to be carried out in the presence of representatives of an Independent Inspection Body (IIB). The qualification and experience of IIB's representatives and the requirements associated with the inspection and testing of the pumpset and reporting thereon by IIB shall comply with the requirements stipulated in Water Supplies Department Standard Specification EM-00-01.

On completion of all tests, the pump shall be cleaned thoroughly with clean water and the motor shall be refitted with the rotor locking device before packing for shipment in accordance with Water Supplies Department Standard Specifications M-00-03 and EM-00-01.

6. MATERIALS of CONSTRUCTION

The pump shall be manufactured from the following materials or from materials superior to the following:

Item	Raw Water and Treated Water	Salt Water
Casing	High Quality Grey Cast Iron BS EN 1561, Designation EN-GJL-250	Duplex Stainless Steel ASTM A995 CD4MCuN
Pump Bearing House	High Quality Grey Cast Iron BS EN 1561, Designation EN-GJL-250	High Quality Grey Cast Iron BS EN 1561, Designation EN-GJL-250 Duplex Stainless Steel (Compatible Grade) (for vertical pumps lower bearing house)
Casing Wear Rings (Neck Rings)	Leaded Bronze BS EN 1982 Designation CC495K	Duplex Stainless Steel (Compatible Grade)
Impeller	Leaded Gunmetal BS EN 1982 Designation CC491K	Duplex Stainless Steel ASTM A995 CD4MCuN
Impeller Wear Rings (Eye Rings)	Copper Alloy BS EN 1982 (Compatible Grade)	Duplex Stainless Steel (Compatible Grade)
Pump Shaft and keys for securing impeller and half coupling	Stainless Steel BS 970 Grade 431S29	Duplex Stainless Steel ASTM A276 S32760

Shaft Sleeves	Leaded Gunmetal BS EN 1982 Designation CC491K	Duplex Stainless Steel ASTM A995 CD4MCuN
Bolts, nuts, studs, Dowels, washers, jacket cover etc.	---	Suitable grades of Stainless Steel

7. **PUMP CASING**

The pump casing shall be fitted with renewable wear rings (neck rings). The suction and delivery flanges of the pump casing shall be faced and drilled to BS EN 1092 and positioned as detailed in the Particular Specification.

Bosses, radially drilled and tapped to receive the pressure gauge connections, shall be provided on the suction and delivery sides adjacent to the flanges. Means shall be provided to drain the casing and an air release cock of adequate size shall be fitted at the uppermost point on each stage.

Painting and final colours of the pump casings shall comply with the requirements stipulated in Water Supplies Department Standard Specification M-00-03. Surface painting is not required on the duplex stainless steel pump casings.

8. **PUMP IMPELLER**

The impeller should be designed with sufficient strength at the boss to withstand all possible stresses imposed by the drive. The impeller shall be machined to close limits, hand finished and dynamically balanced. It shall be fitted with wear rings or allowed with sufficient materials and strength at the wearing surface of the impeller eye for future machining and/or fitting the impeller wear rings during the service life of the impeller.

9. **PUMP SHAFT**

The pump shaft shall be protected by renewable sleeves where in contact with water.

10. **MECHANICAL SEALS**

The pump shall be fitted with mechanical seals suitable for use with a pressure of at least the closed valve head of the pump plus the maximum static suction head. For vertical pumpset, the mechanical seals shall be of split type.

All metallic parts of mechanical seal of salt water pumps shall be of 316 stainless steel. The mechanical seal flushing water shall be taken from the pump casing and the flushing system shall be fitted with cyclone separators, sight

flow indicators, flow switches and isolating valves to protect the seals from damage caused by suspended debris in the water. The sight flow indicator shall be equipped with a manual internal wiper operated externally for cleaning of the flow indicator. An additional tee connection with an isolating valve for connecting to an alternative flushing water supply shall be provided. The small bore pipework and isolating valves shall be of 316 stainless steel.

11. **BEARINGS**

Ball and roller type bearing shall be sealed, grease lubricated and protected from the ingress of dust and water. These bearings shall conform to BS, ISO or other equivalent standards and shall be readily obtainable. Special bearings and imperial bearings are not acceptable.

Oil lubricated plain bearings may be used where necessary. Each bearing shall be fitted with an oil level sight glass.

Each pump bearing shall be provided with resistance temperature detectors (RTD) and a monitoring unit for temperature indication and contacts for a two-level separate alarm and tripping initiation. The monitoring units shall be installed in the pumpset instrument panel.

For vertical pumpsets, the lower bearings can be of the water lubricated rubber type. Such bearings shall be supplied with a flushing water system in which water shall be taken from the pump casing, and cyclone separators, sight flow indicators, flow switches and isolating valves shall be included. The sight flow indicator shall be equipped with a manual internal wiper operated externally for cleaning of the flow indicator. The small bore pipework and isolating valves shall be of 316 stainless steel.

12. **GAUGES**

Bourdon tube suction and delivery pressure gauges of suitable range and graduated in both kPa and metres head of water shall be provided.

The gauges complete with isolating cocks shall be mounted at the branches to which they apply. Static head correction is not required and the scale diameter shall not be less than 150 mm.

An additional tee connection, with an isolating cock is to be provided between each gauge and pump branch.