

WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION M-01-05

MULTISTAGE CENTRIFUGAL PUMP AND

ASSOCIATED EQUIPMENT

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ASSOCIATED EQUIPMENT

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**MULTISTAGE CENTRIFUGAL PUMP AND
ASSOCIATED EQUIPMENT**

1. DESIGN

This specification covers multistage centrifugal pump for fresh water application with driving motor output power not exceeding 40 kW. The operating speed of the pump shall not exceed 3,000 r.p.m. or as specified in the Particular Specification.

The pump shall be of robust construction with all rotating parts carefully balanced to prevent undue vibration. The pumpset shall be designed for installation in horizontal or vertical position as specified in the Particular Specification. General descriptions of pump of these two designs are set out in Clause 3 and 4 of this Standard Specification respectively. For both of the installation arrangements, no thrust load shall be transmitted to the driving motor.

Unless otherwise specified in the Particular Specification, the pump shall be supplied with its driving motor. Other necessary accessories, including pressure gauges, flexible coupling, safety guards for rotating parts, mounting bracket or bedplate together with foundation bolts shall be provided. The pump shall be suitable for starting with delivery valve fully opened and reflux valve fully closed.

2. DUTIES AND CHARACTERISTICS

The pump shall have stable characteristics and shall be capable for continuous operation at any flow rate over the specified operating range. The operating range together with the duty flow rate and head of the pump shall be as specified in the Particular Specification.

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 head of water and the maximum vapour pressure of water as 0.3 m head of water. The curve of NPSH required by the pump shall be submitted for assessment after award of contract.

3. HORIZONTAL PUMPSET

The pump assembly and the driving motor shall be mounted horizontally on a common bedplate and shall be properly aligned and coupled through a suitable coupling. The bedplate shall be of robust construction so that no excessive vibration shall be induced during operation of the pump. Suitable cable access shall be provided on the bedplate to the motor cable box.

4. VERTICAL PUMPSET

The pump shall be vertically mounted with a flange type driving motor mounted onto the motor stool. The motor shall be properly aligned and coupled to the pump shaft through a suitable coupling. The pump shall be properly designed so that no excessive vibration shall be induced during the operation of the pump.

5. PUMP TESTS

All pump components subject to pressure shall be hydraulically tested to a pressure of not less than 1.5 times the sum of the maximum suction head plus the zero flow head of the pump supplied. The test shall be sustained for a period of not less than 10 minutes, so as to provide a safety margin against possible surge pressure.

On completion of assembly at the Manufacturer's works, the pump shall be coupled with its driving motor or if not to a slave motor supplied, and tested to BS EN ISO 9906 Grade 2B over the full range of its capabilities to determine pump output, power absorbed and efficiency. For pump with shaft input power in excess of 10 kW, the tests shall be carried out in the presence of a representative of an Independent Inspection Body (IIB) unless otherwise stated in the Particular Specification.

Noise measurement shall be made on the pumpset with its own motor or a slave motor coupled up at the Manufacturer's works at closed valve head. The limiting sound pressure level for the pumpset shall not exceed 94 dBA at any point 1 m from the pumpset. Noise measurement shall be conducted in accordance with BS EN ISO 1680.

The tolerance factors to be applied to pump test at the duty flow and head conditions and the corresponding pump efficiency shall comply with the following requirements:

Testing Parameters	Shaft Input Power of the Pump	
	≤ 10 kW	> 10 kW
Flow rate, head and pump efficiency	According to Clause 4.4.2 of BS EN ISO 9906	According to Grade 2B in Clause 4.4.1 of BS EN ISO 9906
Witnessed test requirements	Pump type test certificate in lieu of works test certificate issued by an Independent Inspection Body (IIB) shall also be acceptable provided the contractor can guarantee that the performance of the pump shall not be inferior to that indicated in the type test certificate, and the pump	Pump test, including noise level test as required under this Clause, shall be carried out in the presence of a representative of an Independent Inspection Body (IIB) unless otherwise stated in the Particular Specification

Testing Parameters	Shaft Input Power of the Pump	
	≤ 10 kW	> 10 kW
	<p>components have undergone pressure test of not less than 150% of the maximum pressure to be sustained by the pump.</p> <p>If noise level of pump is not indicated in the type test certificate or no other relevant document can be produced by the pump manufacturer to substantiate its compliance with the requirement as set out in this Clause, the pump shall be subject to noise level measurement at site after its installation. All costs associated with the measurements, and all necessary measures to limit the pump noise to the acceptable level, if required, shall be borne by the Contractor.</p>	

6. MATERIALS OF CONSTRUCTION

The pump shall be manufactured from the following materials or other equivalent or superior suitable materials:-

Components	Material Specification
Pump casing, including motor stool (if applicable), suction, discharge and stage casings	High Quality Grey Cast Iron to BS EN 1561 EN-GJL-250
Impellers	Stainless Steel to BS EN 10088 Designation 1.4408 / 1.4401
Diffusers	Stainless Steel to BS EN 10088 Designation 1.4408
Wear Rings	Lead-free alloy or other materials of suitable grades
Pump Shaft	Stainless Steel to BS EN 10088 Designation 1.4021 / 1.4401 / 1.4057
Shaft Sleeves	Stainless Steel to BS EN 10088 Designation 1.4021 / 1.4401

7. PUMP CASING

Unless otherwise specified in the Particular Specification, the pump casing shall be fitted with replaceable wear rings. Except for in-line vertical pump, radially drilled and tapped bosses adjacent to the respective suction and delivery flanges of the pump shall be provided for installation of pressure gauges. Air release cocks, which shall be fitted at the highest point of the first and last stage chambers, and drain valve shall be provided for the pump.

8. PUMP IMPELLERS

The impellers shall be designed with sufficient strength at the boss to withstand all possible stresses imposed by the drive. The impellers shall be machined to close limits inside the pump casing and dynamically balanced.

9. PUMP SHAFT AND SHAFT SEAL

The pump shaft shall be protected from wear by replaceable sleeves as appropriate. The pump shall be fitted with mechanical seals suitable for use with a pressure greater than the sum of the closed valve head of the pump and the maximum suction head.

10. BEARINGS

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

11. PRESSURE GAUGES

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

The gauge complete with isolating cock shall be mounted at the tappings adjacent to the pump suction and delivery flanges. Static head correction is not required and the scale diameter shall not be less than 150 mm.

An additional tee connection, with a separate isolating cock shall be provided between the gauge and pump branch for connection of portable instruments.

If vertical in-line multistage pump is specified in the Particular Specification, the aforesaid suction and delivery pressure gauges and the associated isolation cock shall be

supplied with the pump as loose items.

12. MOTOR

Unless otherwise specified in the Particular Specification, the motor, if it is to be supplied with the pump, shall be in compliance with Water Supplies Department Standard Specification E-51-04 for Squirrel Cage Induction Motors below 40 kW.

13. INFORMATION TO BE PROVIDED IN THE PARTICULAR SPECIFICATION

The following information shall be provided in the Particular Specification.

Clause in this Standard Specification	Requirement to be specified in the Particular Specification.
Clause 1 Design	To specify whether the pumpset shall be horizontally or vertically mounted. For vertically mounted design, to specify whether in-line vertical multistage pump (i.e. suction and delivery are at same level) shall be supplied.
Clause 2 Duties and Characteristics	The operating range together with the duty flow rate and head of the pump.

The following information, if specified in the Particular Specification, shall take precedence over the respective requirements stated in this Standard Specification.

Clause in this Standard Specification	Alternative requirements that can be specified in the Particular Specification.
Clause 1 Design	The operating speed of the pumpset in excess of 3,000 r.p.m.
	The driving motor shall be provided by WSD.
Clause 5 Pump Tests	Waiving of the requirement to have the pumpset tested in the presence of a representative of an Independent Inspection Body (IIB).
Clause 7 Pump Casing	Waiving of the requirement to have replaceable wear rings fitted in the pump casing.