



# Standard Specification CENTRIFUGAL PUMPS FOR WATER TRANSMISSION

TET/SS/5057  
Issue Date: 09/09/2019  
Version : 1.0

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## DOCUMENT HISTORY

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## 1. SCOPE

This specification sets the minimum acceptable requirements for supply Centrifugal pumps for potable water transmission to PAW Directorates of operations, projects and Stores, here in after referred as Water transmission pumps. The pumps are considered high energy if the Power consumption exceed 600kW and required standards of manufacturing shall offered by manufacture as per API 610.

Transmission pumps shall be manufactured inspected and tested in accordance with the applicable codes and standards and shall be capable of withstanding design conditions of the operating systems. The manufacturer of the pumps shall be certified to ISO 9001:2008.

This specification covers Water Transmission pump for potable water application with driving motor output power not exceeding 2 MW with PN 25, PN 50. The operating speed of the pump shall not exceed 3,000 rpm.

In case of difference between this specification and the relevant current specified international standards then the most stringent requirements shall prevail.

## 2. DEFINITIONS & NOTATIONS

|       |                                                   |
|-------|---------------------------------------------------|
| API   | American Petroleum Institute                      |
| ASME  | American Society of Mechanical Engineers          |
| ASTM  | American Society for Testing and Materials        |
| BS EN | British Standards adopted with European Standards |
| DIN   | Deutsches Institut für Normung                    |
| DE    | Driving End (Pump / Motor)                        |
| IEC   | International Electro-Technical Commission        |
| IEE   | Institution of Electrical Engineers               |
| ISO   | International Standard Organization               |
| JIS   | Japanese Industrial standards                     |
| NSF   | Public Health & Safety Organization US            |
| NDE   | Non-Driving End (Pump / Motor)                    |
| OHS   | Occupational Health & Safety                      |
| Rcl   | Residual chlorine                                 |
| SPM   | Suspended Particle Matter                         |
| WRAS  | Water Regulations Advisory Scheme                 |

## 3. APPLICABLE STANDARDS AND CODES

The following Table – 01 summarized the design and manufacturing standards, which are widely used in manufacturing pumps for water applications. However, manufacturers following different standards that are more stringent or equal can accepted after reviewing such standards on submission by PAM unit, PAW.

Table – 01 Applicable Standards and codes

| SN | Reference of Code | Description / Title                                                                                          |
|----|-------------------|--------------------------------------------------------------------------------------------------------------|
| 1  | API 610           | Pumps with duty point greater than 25 bar with a flow of 500 m <sup>3</sup> /h, high-pressure standard pumps |
|    | API Standard 682  | Pumps Shaft Sealing Systems for Centrifugal and Rotary Pumps.                                                |
|    | ASTM A48          | Standard Specification for Gray Iron Castings                                                                |

|    |                   |                                                                                                                                |
|----|-------------------|--------------------------------------------------------------------------------------------------------------------------------|
|    | ISO 185:1988      | Grey cast iron — Classification                                                                                                |
| 2  | ISO 9001          | International standard that specifies requirements for a quality management system (QMS)                                       |
|    | ISO 3506:1979     | Corrosion-resistant stainless steel fasteners                                                                                  |
| 3  | ISO 14001:2015    | Environmental Management System                                                                                                |
|    | DIN EN 12639      | Noise test code for pumps & pump units                                                                                         |
| 4  | OHSAS 18001       | Occupational Health & safety                                                                                                   |
| 5  | ISO 76:1987       | Rolling bearings — Static load ratings.                                                                                        |
| 6  | ISO 281:1990,     | Rolling bearings — Dynamic load ratings and rating life.                                                                       |
| 7  | ISO 1940-1:1986   | Mechanical vibration — Balance quality requirements of rigid rotors — Part 1: Determination of permissible residual unbalance. |
| 8  | ISO 7005-1:1992   | Metallic flanges — Part 1: Steel flanges.                                                                                      |
| 9  | ISO 7005-2:1988   | Metallic flanges — Part 2: Cast iron flanges.                                                                                  |
| 10 | NSF / WRAS / ACS  | Health and safety for drinking water applications                                                                              |
| 11 | ISO 9906          | Rotor Dynamic pumps – Hydraulic performance acceptance test Grade 1 , 2 and 3                                                  |
| 12 | NSF ANSI 61 / 372 | Certification for Drinking Water System Components Health Effects + Lead                                                       |

#### 4. WATER QUALITY & CLIMATIC DATA

The drinking water quality is as per OS 8 / 2012

Some of the water quality parameters for different applications are in the Table – 02

Table – 02 Water Quality parameters

| SN | Description                 | Potable water | Ground water | Brackish water | Sea water |
|----|-----------------------------|---------------|--------------|----------------|-----------|
| 1  | Turbidity ( NTU )           | 1             | < 1.0        | < 3            | < 3       |
| 2  | pH                          | 6.5 – 8.5     | 6.5 – 8.0    | 7.1 – 7.9      |           |
| 3  | Conductivity ( $\mu$ S/cm ) |               | 800-2500     | 16,000-20,000  | 57,000    |
| 4  | Temperature ( C )           |               | 25           | 25             | 35        |
| 5  | TDS ( ppm)                  | 120-600       | <1000        | <12,000        |           |
| 6  | Rcl ( ppm)                  | 0.2 – 0.5     | -            | -              | -         |

The climatic conditions of the Sultanate of Oman shall be taken into account in Material selection and coatings of the products used in PAW. Following data provided is for the guidance only.

- Maximum ambient temperature: 55 °C
- Black bulb temperature 80 °C
- Maximum humidity: can reach 100%
- Maximum temperature of supply water: 40 °C
- SPM subject to dust storms.
- PM<sub>10</sub> Particulate matter 10 micrometres or less in diameter
- Rainfall: 100 mm per year

The pumps and associated equipment shall be designed and suitable for operation in the climatic conditions of the Sultanate of Oman.

The pumps shall be suitable for pumping potable water, seawater, well water and/or brackish water unless specifically mentioned otherwise, taking into due consideration of temperature of well water.

## **5. DESIGN CONSIDERATIONS**

### **5.1 General:**

This specification only consider pumps, which are used for pumping potable water in distribution & transmission schemes, mainly pumps are to operate for water transmission and pressure booster purpose. Pumps considered herein are of centrifugal pumps of, Vertical & Horizontal installations,

- End suction
- Split casing (Single stage, Multi stage)
- Horizontal multistage ring section pumps

The speed of pumps shall not exceed 3000 rpm. The pump shall be of robust construction with all rotating parts carefully balanced to prevent undue vibration. The pump and motor is refer as pumpset, which shall be installed on a suitably designed common bedplate with good engineering practices.

The pumpset shall be designed for installation in horizontal or vertical position. For both of the installation arrangements, no forces, and thrust loads shall be transmitted to either to the pump casing or to the driving motor.

Unless otherwise specified, the pump shall be supplied with its driving motor. Other necessary accessories, including pressure gauges, protection sensors, flexible coupling, and safety guards for rotating parts, mounting bracket or bedplate together with foundation bolts shall be provided. The operation and maintenance access to all parts of the pump and motor shall be a part of the accessories unless otherwise installed permanent. The pump shall be suitable for starting with delivery valve fully opened and reflux valve fully closed.

The sound & Noise level of the pump without the prime mover shall be not more than 87 dB (A) at one-meter distance from the pump.

### **5.2 Castings:**

All high stressed components such as pump casing shall be furnace stress relieved free of surface voids and cavities subject to applicable standards.

### **5.3 Impeller:**

Impeller shall be stainless steel preferably with PREN number not less than 25.

Min. material requirement of Pump's shaft:

- Drinking water : stainless steel 316
- Brackish water : stainless steel 904L
- Sea water : Super duplex Stainless Steel of 904L.

### **5.4 Balancing & Vibration:**

All major rotating components shall be balanced. Unfiltered vibration shall not exceed the vibration severity limits as given in the Table - ...when measured on the manufacturers test bench. The measurements shall be comply with the relevant class of vibration as per the ISO 1941-1 most recent edition.

## **6. MANUFACTURING REQUIREMENTS**

### **6.1 General**

The manufacture of the pump and motor shall fulfil the following minimum requirements for proving the high quality of manufacturing, level of R & D, quality of support services and after sales services.

- I. All major components of the pump shall be produced in-house foundry facility of the manufacture.
- II. Process. Machining and assembling supported with ISO 9004 quality management system.
- III. Manufacturers test bench, Pump testing facility as per hydraulic performance characteristics are guaranteed as conforming to standard UNI/ISO 9906 Grade 3B.
- IV. Not less than 20 years of manufacturing history of the pump model offered for approval with market share in water industry for the pump offered / products.
- V. Registered company as the Local vender with own workshop facilities and skilled labour for after sales services with sufficient stock of fast moving spares.
- VI. Spares for the pump model to be approve shall guaranteed of availability for not less than 10 years.
- VII. Direction of rotation of the pump shall be printed on the pump casing.

## 6.2 Casing

The casing shall be of monolithically casted in virgin raw material to the approved grade of Steel. With process to obtain best quality steel, machined, finished, and shall be capable of withstanding all pressures that may be produced due to operating pressure surges.

- Pump casings minimum corrosion allowance shall be consider (3mm or more).
- The casing shall be provided with vent and drain connections, screwed type and fitted with removable corks.

All material in contact with water shall not adversely effect the water quality requirement of Regulation & Supervision Bureau Regulation, which refers to WHO. The completed pump shall bear certification of WRAS or equivalent accepted certification for use in drinking water well.

## 6.3 Rotating elements

All rotary parts shall dynamically balance during manufacturing. The standards for the rotors vibration and balancing shall follow ISO 10876 and ISO 7919 in terms of vibration, and from ISO 1940-1 in terms of permissible residual balance.

Impellers shall manufactured of stainless steel ASTM A487 CA6NM or superior steel grade. The impellers shall tested and factory certified for smooth, well finished, free from blowholes and imperfections.

Impellers shall be securely fitted to pump spindles in such a manner that they do not loosen or become detached when the pump is in operation, or when it is rotating in the wrong direction by reverse flow or reversed motor connections.

## 6.4 Shaft and sleeves

The pump shaft shall protected from wear by replaceable sleeves as appropriate. Shafts and sleeves shall manufactured from best quality stainless steel.

## 6.5 Bearings

The bearings (ball / thrust) shall be manufactured in best quality stainless steel. The bearing life of operating hours at most sever conditions shall be of the range 20,000 – 25,000 hour.

## 6.6 Accessories

Each Pump set shall be comprise the following accessories:

- Pump lifting I bolt.
- Pump venting valves, plug valves etc.; if any
- Suction and discharge pressure gauges with isolation ball clock valves.
- NDE/DE Bearings Vibration
- NDE/DE Bearings temperature monitoring
- Dismantling tools if any

## 6.7 Motor

The motor of 50Hz power supply, rated output (kW) shall be selected considering VFD operations of the pump and the worst-case scenario of running out flow of the pump curve. The motor shall have the class of insulation – H with IP54 protection, shall be with a service factor of 1.15.

Motor shall withstand number of four (04) starts per hour for large capacity motors, above 1.5 MW and fifteen (15) starts per hour for all other motor capacities.

## 6.8 Protective Coatings:

### Internal coatings:

Pump casing internal surfaces shall be coated with Belzona or 2 layers of epoxy of 350 microns thickness or equivalent approved protection/efficiency enhancing coating.

Only those substances and products which meet the requirements of Regulations 25 and 26 of the Water Supply (Water Quality) Regulations 1989, Statutory Instrument No 1147, (with subsequent amendments) as published by the UK Drinking Water Inspectorate (DWI) (website: [www.dwi.gov.uk](http://www.dwi.gov.uk)), or approved by NSF/ANSI 61 or the American Food and Drug Association, or approval of an equivalent internationally recognized body, shall be used.

The Manufacturer shall produce material test certificates for all components making up the pump in accordance with ISO 10474 3.1 certificate.

### External Coatings:

The external coating of the pump shall comprise 2 pack epoxy resin to a minimum dry film thickness of 300 microns . The finish colour shall be BS4800 18 E 53, or equivalent.

All coatings, substances and products used in the Works shall not contain any matter, which could impart taste, odour, colour or toxicity to the environment or otherwise be objectionable on health grounds.

## **7. WARRANTY**

The manufacturer shall propose 1-year minimum including parts and labour for the pump, motor and accessories.

## **8. INSPECTION AND TESTING**

The manufacturer shall have own pump test bench for characteristics performance testing for the pump model required for approval. The Factory Inspection of the pump and acceptance test shall be tolerances of Grade 1E of BS EN ISO 9906. Pump performance test shall include NPSH test.

## **9. SPARE PARTS**

Two years replaceable set of spares for the Pump and motor units of the following as recommended by manufacturer.

- I. Wearing rings,
- II. Shaft sleeves
- III. Bearings.
- IV. Set of gaskets & O- rings
- V. Set of Mechanical seal

The following minimum identification data must be present and permanently marked on the pump and the motor. All markings on the pump shall be in English and shall be clear and legible.

- The manufacturer's name or mark and place of manufacturing
- Identification of the year/month of manufacture
- Label with serial number or equivalent traceability system
- Country of origin "MADE IN XXX"
- Bearing numbers
- Impeller details
- Designed flow , head and efficiency
- Operating voltage, frequency
- Rated current of the motor

The manufacturing details of the pump could be incorporated in the form of a bar code and provide along with the pump, which shall include all the details above mentioned.

## **10. WARRANTY**

The Pump and motor unit with base plate and couplings shall have a minimum warranty period of 24 months from date of successful commissioning.

## **11. PACKING AND DELIVERY**

The MANUFACTURER shall provide packing and shipping at his discretion so that goods delivered shall not deteriorated while in handling, transporting, shipping and delivering to PAW stores.

The following documents shall be included in suitable wrapping and shall be enclosed with the shipment:

- Packing list
- General arrangement and catalogues



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- Operation and maintenance manual as applicable
- Installation instructions

## **12. DOCUMENTATION**

The delivery packages shall include the following documents as a minimum as below:

- TPI witnessed and certified Test reports.
- Certified report for Material of Construction.
- Catalogues/Brochures
- Cross section drawings with detailed parts list, as applicable
- Detailed material specifications
- Complete Technical description

Dimensioned general arrangement



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## 13. DATA SHEET

|                                                |                                         |                                                                                                                                                                                            |                                                 |                               |
|------------------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------|
| Name of the Company<br>.....<br>.....<br>..... |                                         | <b>Pump Data Sheet</b>                                                                                                                                                                     |                                                 | Pump model / Models:<br>..... |
|                                                |                                         |                                                                                                                                                                                            |                                                 | Revision & Date:<br>.....     |
| Name & registration of Local agent :           |                                         | .....<br>.....                                                                                                                                                                             |                                                 |                               |
| Address of the local Office & workshop :       |                                         | .....<br>.....                                                                                                                                                                             |                                                 |                               |
| <b>A</b>                                       | <b>Pump</b>                             | Type of pumps: End suction, split casing, Ring section, Axial flow pumps<br>Vertical and Horizontal assemblies<br>Note : The following details are to be submitted for all models offered. |                                                 |                               |
| 1                                              | Pump Type & Size :                      |                                                                                                                                                                                            |                                                 |                               |
| 2                                              | Pump Type test report :                 |                                                                                                                                                                                            |                                                 |                               |
| 3                                              | Sectional Drawing of the Pump:          |                                                                                                                                                                                            |                                                 |                               |
| 4                                              | Drawing of the shaft Seal               |                                                                                                                                                                                            |                                                 |                               |
| 5                                              | Country of origin                       |                                                                                                                                                                                            |                                                 |                               |
| 6                                              | Place of manufacturing :                |                                                                                                                                                                                            |                                                 |                               |
| 7                                              | Pump efficiency ( Minimum)              |                                                                                                                                                                                            |                                                 |                               |
| 8                                              | Quality Management system               |                                                                                                                                                                                            |                                                 |                               |
| 9                                              | Foundry details : Location and capacity |                                                                                                                                                                                            |                                                 |                               |
| 10                                             | WRAS / NSF/ANSI 61                      |                                                                                                                                                                                            |                                                 |                               |
| <b>B</b>                                       | <b>Motor</b>                            | <b>Affiliated brand</b>                                                                                                                                                                    | <b>Optional brand</b>                           |                               |
| 1                                              | Motor manufacturer                      |                                                                                                                                                                                            |                                                 |                               |
| 2                                              | Motor class of insulation:              |                                                                                                                                                                                            |                                                 |                               |
| 3                                              | Motor IP rating :                       |                                                                                                                                                                                            |                                                 |                               |
| 4                                              | Type Sectional Drawing of Motor:        |                                                                                                                                                                                            |                                                 |                               |
| 5                                              | Motor efficiency :                      |                                                                                                                                                                                            |                                                 |                               |
| 6                                              | Country of origin                       |                                                                                                                                                                                            |                                                 |                               |
| 7                                              | Place of manufacturing :                |                                                                                                                                                                                            |                                                 |                               |
| 8                                              | Quality Management system               | -                                                                                                                                                                                          |                                                 |                               |
| 9                                              | NEMA /IEE standard & Class              |                                                                                                                                                                                            |                                                 |                               |
| <b>C</b>                                       | <b>Accessories</b>                      | <b>Brand name</b>                                                                                                                                                                          | <b>Country of origin</b>                        |                               |
| 1                                              | Pressure gauges                         |                                                                                                                                                                                            |                                                 |                               |
| 2                                              | Bearing Vibration Probes                | -                                                                                                                                                                                          |                                                 |                               |
| 3                                              | Bearing temperature Probes              |                                                                                                                                                                                            |                                                 |                               |
| 4                                              | Pump lifting I bolt                     |                                                                                                                                                                                            |                                                 |                               |
| 5                                              | Special Dismantling tools if any        |                                                                                                                                                                                            |                                                 |                               |
| <b>D</b>                                       | <b>Company Stamp</b>                    | <b>Manufacturer</b>                                                                                                                                                                        | <b>Manufacturer approved<br/>Local Supplier</b> |                               |
| 1.                                             |                                         |                                                                                                                                                                                            |                                                 |                               |

Note:

Please attach updated and stamped respective technical catalogues with certifications. Use one data sheet per model.