

INDUSTRY STANDARD FOR
ISO END SUCTION CENTRIFUGAL
MOTOR PUMPS

WSA 131—2011

First Edition



**WATER SERVICES ASSOCIATION
OF AUSTRALIA**

PREFACE

The objective of this Standard is to provide design, manufacturing and performance requirements for manufacturers of ISO end suction centrifugal motor pumps.

The first edition of this Standard has been solely based on Water Corporation Strategic Product Specification SPS 501 Version 1 Revision 0 dated February 2010.

While the initial cost of a pump is important, manufacturers should be aware that with increasingly onerous legislative requirements – both in terms of demonstrating fiscal prudence and managing public health and environmental risk – Water Agencies are increasingly focused on reducing total life cycle costs of asset management of network infrastructure.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

This Standard may exclude specific requirements that should apply to a particular project or application. In such cases, the project designer is required to document the supplementary project specific requirements in the appropriate Clause of the ‘Project Specific Requirements’ schedule given in Appendix C of the Standard.

The text of this Standard should not be directly modified. In the event that a text variation is considered necessary to accommodate the needs of a particular project or application, the text modification should be documented in the appropriate Clause of a ‘Project Specific Requirements’ schedule given in Appendix C of the Standard.

Deviation from the requirements of a Standard on a particular project is permissible only in special circumstances subject to consultation with and express acceptance by the appropriate representative of the Asset Owner.

All enquiries relating to the technical content of this Standard should be directed to info@wsaa.asn.au.

Your participation, as a user of the Standard, in its ongoing review is invited with the intent of improving its value to your work and to that of other users. All formal requests for its improvement or change should be forwarded to info@wsaa.asn.au.

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WSAA Standard

ISO End Suction Centrifugal Pumps

1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the design, manufacture, inspection and testing, packaging, transportation and delivery of bare shaft ISO end suction centrifugal pumps to be direct coupled to the driver. The Standard is intended to apply to pumps that:

- (a) incorporate suction and discharge flange sizes up to and including DN 200 and DN 150 respectively, and conform to the designation, nominal duty points and dimensions of ISO 2858;
- (b) will be used for pumping standard or corrosive waters in accordance with Table 2.1.

NOTE: Reference should be made to the requirements of Clause 2.3 for pumps that are required to handle highly corrosive water or chemicals.

For larger flange sizes the designation, duty points and dimensions should be to the Manufacturer's standard; however, the pump design shall comply with the technical requirements of this Standard.

The Standard also details the means by which compliance with the Standard shall be demonstrated and the criteria for acceptance of product.

NOTE: For bare shaft ISO end suction centrifugal pumps the reader should refer to WSA 130.

This standard may be used for supply of multiple pumps.

Reference to the Asset Owner shall be understood to refer to the Asset Owner representative or project manager.

1.2 REFERENCED DOCUMENTS

The documents referred to in this Standard are listed in Appendix A.

1.3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 2417 and those below apply:

1.3.1 Allowable operating pressure (AOP)

The allowable internal pressure, excluding surge, a component can safely withstand in service.

1.3.2 Asset Owner

An agency, authority, board, company, corporation, council, department, individual, utility or other legal entity who is the owner of the asset and/or who will have ultimate responsibility for the asset.

NOTE: The Asset Owner in many instances will not be the Purchaser of the submersible pump.

1.3.3 Best efficiency capacity (BEC)

The flow rate at which a pump exhibits a maximum efficiency (the gradient of the efficiency-flow curve is zero), for a particular impeller diameter and speed.

1.3.4 Coating

A corrosion-inhibiting medium applied to the surface of a component.

1.3.5 Coating defect

A detectable weakness or discontinuity in a coating which renders suspect its ability to protect component substrates from corrosion during normal service life.

1.3.6 Certificate

A formal certificate defined in SAA HB 18.2 and operated in accordance with SAA HB 18.22 that, as an outcome of Product Certification, attests Product conformity with the nominated product and test standards and authorizes the use of a Certification Mark.

1.3.7 Certification mark

A trademark or other mark of product conformity with a specified standard defined in SAA HB 18.2 and applied in accordance with SAA HB 18.23 that is issued under the rules of a Certification Scheme.

1.3.8 Certification scheme

A product certification program or system which is operated in accordance with JAS-ANZ Procedure 15 – General requirements for bodies operating product certification systems and in accordance with the general rules of SAA HB 18.28 and System No. 5 as defined in ISO/ITC publication - Certification - Principles and practice.

NOTE: The effect of this is to require maintenance by the Manufacturer of effective production control planning in addition to full type testing from independently sampled production and subsequent verification of conformity with specified standards.

1.3.9 Compliant product

Product that has been assessed, by means of Product Appraisal, as conforming with standards and specifications that are nominated by the Asset Owner.

1.3.10 Conformity assessment body

An independent (or third party) organisation duly accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ) to operate Certification Schemes.

1.3.11 Manufacturer

An entity or combination of entities that is responsible for selection, processing and control of Product constituent materials or compounds and for the processing equipment that collectively result in the manufactured product.

1.3.12 Maximum allowable operating pressure (MAOP)

The maximum rated operating pressure of the pump.

1.3.13 Nominal size (DN)

An alphanumeric designation of size for components of a pipework system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections.

1.3.14 Net positive suction head (NPSH)

NPSH: (Net Positive Suction Head) is the absolute inlet total head above the head equivalent to the vapour pressure relative to the suction eye of the pump impeller:

$$\text{NPSH} = H_1 - Z_D + (p_{\text{amb}} - p_v)/\rho_1 g$$

where—

H_1 = inlet head

Z_D = difference between NPSH datum plane and reference plane

p_{amb} = atmospheric pressure

p_v = vapour pressure

ρ_1 = specific gravity

$g = 9.81 \text{ m/s}^2$

NPSHA: (Available NPSH) is the NPSH available as determined by the conditions for a specific flow rate in a particular.

NPSHR: (Required NPSH) is the minimum NPSH performance provided by the Manufacturer for a pump achieving a specified performance at a specified flow rate, speed and pumped liquid (e.g. the occurrence of visible cavitation, increase of noise and vibration due to cavitation, producing a head or efficiency drop of a given amount, limitation of cavitation erosion).

NPSH3: NPSH required for a drop of the total head of the first stage of the pump as a standard basis for use in performance curves.

The definition of the term NPSHR is further covered in Clause 3.3.2 of this Standard to include a minimum value of NPSHR relative to NPSH3.

1.3.15 Pressure class (PN)

A classification of pressure by PN number, based on the allowable operating pressure (AOP) expressed in Megapascals ($PN = 10 \times AOP$).

1.3.16 Product

A single unit or multiple units of manufactured end product or an assembly of manufactured component products, materials or equipment. This Standard and accompanying Purchasing Schedule define the nature and details of Product to be supplied.

NOTES:

- 1 An end product is most commonly an output of manufacturing processes that result in finished end products having the same features and characteristics and can be the result of a single or multiple production batches.
- 2 Manufactured equipment and assemblies of Product components or materials are commonly procured for mechanical, electrical and civil infrastructure applications.

1.3.17 Product appraisal

A formal process whereby Product, including product design, is subjected to systematic engineering assessment to determine Product fitness for prescribed end uses and to evaluate the extent of Product and production systems conformity with nominated standards and specifications. Product Appraisal includes verification of the extent of compliance in accordance with the requirements of a relevant 'Technical Compliance Schedule' of Appendix C.

1.3.18 Product assessor

An organization, representative or other person who, having demonstrated specialist product knowledge and competence acceptable to the Asset Owner, is nominated by the Asset Owner, subjects Product to Product Appraisal and issues one or more Product Verification Reports.

1.3.19 Product certification

A formal process whereby the production and management systems for the manufacture of Product, are assessed by a Conformity Assessment Body to evaluate compliance of these systems with prescribed product standards and tests, under Certification Scheme rules.

1.3.20 Product verification report

A formal report wherein a Product Assessor evaluates the extent of Product compliance with the nominated product standards and specifications.

NOTE: Verification may be on a project-by-project basis or at agreed intervals, as appropriate to the scope of a Purchasing Schedule and Product end use, subject to determination by the Asset Owner.

1.3.21 Product warranty

A formal express undertaking by a Supplier or Manufacturer that Product is:

- (a) In conformity with the nominated product specification and referenced standards;
- (b) Fit for the nominated Product end use or application;
- (c) Designed for sustained operation at the nominated service performance levels for the specified design life;
- (d) Adequately packaged for intended transportation, handling and storage conditions;
- (e) Supported by English language installation, operating and servicing instructions;
- (f) Adequately supported by Supplier capacity to provide technical Product support.

NOTE: Where required, a Product Warranty should indemnify the Asset Owner against claims made or losses suffered as a result of breach of the Warranty by means of Public and Products Liability Insurances as specified in the undertaking.

1.3.22 Pump

The term pump (or pumps) referred to in this Standard shall mean an ISO end suction motor centrifugal pump (or pumps).

1.3.23 Pumpset

A pump, electric motor and other ancillary items.

1.3.24 Purchasing schedule

A Asset Owner purchase order, tender, schedule of prices, bill of quantities, or specification that details the nature, quantity and other characteristics of Product to be supplied, purchased or installed. Table C.1 of this Standard shall constitute part of the Purchasing Schedule.

1.3.25 Quality system

A management system that establishes, documents, implements and maintains organizational structures, resources, responsibilities, processes and procedures for the manufacture of Product and provision of Product related services in accordance with the requirements of AS/NZS ISO 9001.

1.3.26 Supplier

An entity or combination of entities that is responsible for the supply of Product.

NOTE: A Supplier may be a Product Manufacturer, owner, producer, distributor or vendor or an agent, tenderer or contractor for supply of Product or Product related service.

1.3.27 Testing

The determination of Product characteristics by inspection and by the application of specified test procedures.

1.4 DESIGNATION OF SIZE

This Standard generally covers pump discharge flanges to DN 200 and pressure classes to PN 16 and flow capacities up to and including 250 L/s.

2 MATERIALS AND COMPONENTS

2.1 WATER CLASSIFICATION

The materials and components used in the manufacture of pumps shall be selected on the basis of the type of water being pumped.

The classification of waters given in Table 2.1 shall apply for the purposes of this Standard.

TABLE 2.1
CLASSIFICATION AND WATER CORROSIVITY

Water classification	Water type	pH	Chlorides mg/L	Alkalinity mg/L	Free chlorine mg/L	Average temperature °C
Standard	Water or effluent	6 - 9	≤500	≥20	≤5	≤25
Corrosive	Water or effluent	5 - 9	>500≤3000	<20	≤2	≤35

2.2 MATERIALS OF CONSTRUCTION

Each pump shall be constructed from materials detailed in Table 2.2 for the type of water stated in the Purchasing Schedule. Other materials may be used, provided they are equivalent in performance, particularly with respect to strength, corrosion resistance, pump operation and durability. See Appendix B for alternative materials.

NOTE: Material equivalence will be considered by a ruling committee of Asset Owners and suppliers selected by the Water Services Association of Australia, (WSAA).

2.3 HIGHLY CORROSIVE WATER AND CHEMICALS

Pump materials and components required to handle highly corrosive water or chemicals shall be subject to agreement between Asset Owner and the Manufacturer. For these applications the Manufacturer shall recommend materials and components (e.g. mechanical seal and flush type such as external flushing) appropriate for the pumped fluid, its physical and chemical properties and related temperature, as specified in the Purchasing Schedule.

NOTES:

- 1 Highly corrosive waters may include saline water, seawater or brine;
- 2 For highly aggressive or exotic chemicals a purpose-built chemical pump may be a more appropriate solution.

2.4 CONTACT WITH DRINKING AND RECYCLED WATER

Pumps that come into contact with drinking and recycled water shall comply with AS/NZS 4020. A scaling factor of 0.01 shall be applied.

2.5 DEZINCIFICATION-RESISTANT MATERIALS

Copper alloy pump components shall be dezincification resistant and shall comply with AS 2345.

TABLE 2.2
MATERIALS OF CONSTRUCTION

Pump Component	Standard Waters		Corrosive Waters	
	Material	Standard: Grade	Material	Standard: Grade
Casing volute and back cover	Grey iron	AS 1830: ISO 85/JL/250	Stainless steel	AS 2074: H6C
Motor adaptor housing	Grey iron	AS 1830: ISO 85/JL/250	Grey iron	AS 1830: ISO 85/JL/250
Impeller	Phosphor bronze	AS 1565: C90250	Stainless steel	AS 2074: H6C
Impeller wear rings	Phosphor bronze	AS 1565: C90250	Duplex stainless steel	AS 2074: H3C
Casing wear rings	Leaded tin bronze	AS 1565: C93500	Stainless steel	AS 2074: H6B
Shaft extension	Stainless steel	ASTM A276: 431	Duplex stainless steel	EN 10088-3 1.4462
Shaft sleeves (as applicable)	Stainless steel	ASTM A276: 316	Stainless steel	ASTM A276: 316
Impeller key	Stainless steel	ASTM A276: 431	Duplex stainless steel	EN 10088-3 1.4401
Coupling key	Stainless steel	ASTM A276: 431	Stainless steel	ASTM A276: 431
Impeller nut	Stainless steel	ASTM A276: 431 or 316	Stainless steel	ASTM A276: 431 or 316
Impeller washer	Stainless steel	ASTM A276: 316	Stainless steel	ASTM A276: 316
Mechanical seal:				
Seal plate	Stainless steel	ASTM A276: 316	Stainless steel	ASTM A276: 316
Rotating face	Carbon	N/A	Carbon	N/A
Stationary faces	Solid silicon carbide	N/A	Solid silicon carbide	N/A
Drive keys	Stainless steel	ASTM A276: 431	Stainless steel	ASTM A276: 316
Spring(s)	Hastelloy C®	N/A	Hastelloy C®	N/A
Studs, setscrews, capscrews, bolts, pins, nuts	Stainless steel	ASTM A276: 431 or 316	Stainless steel	ASTM A276: 431 or 316
O-rings and seals	Synthetic elastomer	WSA 109: EPDM or NBR	Synthetic elastomer	WSA 109: EPDM or NBR
Plugs (drain, vent)	Stainless steel	ASTM A276: 316 or 431	Stainless steel	ASTM A276: 316 or 431

2.6 STAINLESS STEEL

2.6.1 Welding, heat treatment and passivation

Stainless steel castings, plate and bar subjected to welding, including repair welding, during the manufacture of any component shall be a low carbon or stabilized grade. Stainless steel castings shall be heat treated in accordance with AS 2074. All stainless steel components except for fasteners shall be passivated in accordance with ASTM A380.

2.6.2 Graphite compounds

Graphite greases, graphite packing and graphite compounds shall not be used in contact with stainless steel.

2.6.3 Galling

Components and fasteners that may be susceptible to galling shall embody mitigating features such as:

- (a) Selection of stainless steel grades with at least 50 HB hardness difference e.g. grade 431 stainless steel bolts (285 ± 10 HB) fitted with grade 316 stainless steel nuts (215 ± 10 HB);
- (b) Use of nickel food grade ant-seize lubricant (grease) when fitting stainless steel fasteners;
- (c) Provision of surfaces that do not promote galling e.g. rolled stainless steel threads in lieu of machined threads;
- (d) Selection of close tolerance bolts and nuts;
- (e) Eliminating contaminants (grit) during fitting and operation of susceptible components; and/or
- (f) Adopting material design loads which are below those that would produce galling.

2.7 NON-METALLIC MATERIALS

Non-metallic materials used in the components of the pump shall be fit for the intended purpose and shall exhibit dimensional stability when exposed to weather, sunlight and, where relevant, immersion in water of the appropriate classification.

2.8 IMMERSED COMPONENTS

All continuously immersed components shall be manufactured from corrosion-resistant materials except for cast iron pump casings which shall be coated in accordance with Clause 3.10. Components in contact with each other shall be designed so as to minimise galvanic corrosion via insulation or optimal selection.

2.9 ELASTOMERIC MATERIALS

Elastomeric material shall not be injuriously affected by the fluid, temperature or environmental conditions to which it will be subjected in service.

2.10 PROTECTIVE COATINGS

2.10.1 General

The external and internal surfaces of cast iron pumps and appurtenant fittings shall be prepared and coated in accordance with relevant clauses below. Prior to coating all sharp edges, burrs, slag and other sharp surface irregularities shall be removed. The minimum radius of edges to be protective coated shall be 3 mm. Surfaces to be coated, which will become inaccessible after assembly or installation, shall be cleaned and coated before becoming inaccessible.

2.10.2 Pump internal coating

The internal wetted surfaces of cast iron pumps shall be coated with Belzona® 1341 Super Metal Glide, or Chesterton® ARC 855, or Epigen 1311 in accordance with the respective coating Manufacturer's recommendations, including surface preparation.

The pump Manufacturer shall comply with the coating Manufacturer's specified requirements for:

- (a) Minimum number of coats;
- (b) Dry film thickness; and
- (c) Testing and third-party certification.

The pump design shall be such that the coating system specified for internal surfaces shall be fully effective for all internally wetted surfaces. All surfaces that cannot be coated shall be of corrosion resistant materials. This shall particularly apply to internal galleries, tapping, drain, vent and flushing waterways which would otherwise be subject to corrosion (refer Note).

NOTE: Immersed cast iron surfaces will corrode and form iron corrosion products (iron tubercles) that will block waterways if they are not effectively coated, or sleeved with a corrosion resistant material.

Alternatively, in lieu of internally coated cast iron, the pump wetted components may be constructed from corrosion resistant materials complying with Table 2.2.

2.10.3 Pump external coating

The external surfaces of cast iron pump components shall be prepared for coating in accordance with AS 1627.2 followed by coating in accordance with the Manufacturer's standard coating system with a finish colour of AS 2700 Jade. The total dry film thickness shall be 250 microns minimum.

2.10.4 Baseplate and coupling guard

The baseplate shall be hot-dip galvanized in accordance with AS/NZS 4680.

Fasteners, holding down bolts and foundation bolts shall be hot-dip galvanized in accordance with AS 1214.

3 DESIGN AND MANUFACTURE

3.1 GENERAL

The pump shall be horizontal, end suction, single stage centrifugal type complying with ISO 2858 except that the dimensions shall apply to the pump volute only. The pump rotating element including back cover and bearing housing shall be capable of being removed without disturbing the suction and discharge pipework or disturbing alignment of the pump with its driver. The pumpset shall be suitable for continuous operation outdoors.

The design criteria for the pumps shall be based on a minimum life expectancy of 25 years.

3.2 OPERATING CONDITIONS

3.2.1 Standard parameters

The pump shall be selected to operate in accordance with the following conditions:

- (a) Environment - Non-aggressive and non-flammable;
- (b) Ambient temperature range of -5°C to 60°C;
- (c) Altitude - 0 to 1500 m;
- (d) Pumped liquid:
 - (i) Clean water (minimal solid particles) in accordance with Table 2.1;
 - (ii) Water temperature range of 5°C to 40°C.

For deviations from the above parameters refer to Clause 3.2.2.

3.2.2 Special parameters

Conditions that have parameters that fall outside the standard parameters above will be specified in the Purchasing Schedule including relevant pumped liquid properties e.g. viscosity and density of the pumped fluid. Accordingly the Manufacturer shall base the selection of the pump in terms of performance, materials and component design on the special parameters specified in the Purchasing Schedule.

3.3 PERFORMANCE

3.3.1 Pump selection

Pumps shall meet the duty requirements contained in the Purchasing Schedule.

Pump shall be selected to so that:

- (a) The primary guarantee point stated in the Purchasing Schedule is at, or close to, the BEC of the pumps;
- (b) Secondary guarantee points stated in the Purchasing Schedule are met at the same speed and with the same impeller diameter as the primary guarantee point (the secondary guarantee points are used to define the shape of the pump curve);
- (c) No continuous operating duty point is greater than 115%, or less than 70%, of the BEC for the operating speed;
- (d) No intermittent operating duty point is greater than 120%, or less than 50%, of the BEC for the operating speed; and
- (e) The H-Q curve is continuously rising for the operating range specified in the Purchasing Schedule.

The pump shall have proven performance characteristics i.e. not estimated.

3.3.2 NPSH

The pump shall be selected to have an NPSHR less than the system NPSHA specified in the Purchasing Schedule under all operating conditions.

NOTE: The NPSHR shall include both the Manufacturer's and site margins as required to ensure satisfactory operation.

The NPSHR shall be the numerical sum of NPSH3 value at BEC provided by the Manufacturer and the NPSH margin, The NPSH margin shall be a minimum of one 1 m head.

3.3.3 Performance curves

The Manufacturer shall provide the following performance curves and related information for the pump:

- (a) Head-flow, efficiency and absorbed power curves for the pumps fitted with the impeller diameter and speed to meet the primary and secondary guaranteed point(s). As part of the selection process the Manufacturer shall superimpose the pump head-flow characteristic curves supplied onto the minimum and maximum system resistance curves or operating envelope;
- (b) Head-flow, efficiency and absorbed power curves for the maximum diameter impeller able to be fitted to the pump;
- (c) NPSH3 curves for the duty and maximum diameter impellers, and superimposed curves for NPSHR and NPSHA.

3.3.4 Driver

The pump shall be close-coupled to a conventional electric motor. The motor shall be foot and flange mounted with a horizontal shaft, complying with the Asset Owner's requirements.

3.4 PUMP DESIGN

3.4.1 Pressure rating

Pumps shall be designed and manufactured for the Pressure Class (PN) stated in the Purchasing Schedule and in accordance with Table 3.1.

TABLE 3.1
PRESSURE CLASSIFICATIONS

Pressure class PN	MAOP kPa	Hydrostatic test pressure kPa
10	1000	1500
14	1400	2100
16	1600	2400

3.4.2 Casing

The pump casing volute and back cover shall be designed and manufactured to provide a hydraulically smooth volute flow passage with a surface finish equal or better than Roughness Grade N8 to AS 2382.

The casing shall incorporate a footplate for horizontal orientation. The footplate shall be provided with holes to accommodate holding down bolts.

The pump casing shall:

- (a) Be self-venting;
- (b) Have an allowable operating pressure rating the same or less than the suction and discharge flanges;
- (c) Incorporate suction and discharge ports with integral flat faced flanges of the same pressure rating in accordance with AS 4087 (default); or flanges complying with either AS/NZS 4331.1 or AS/NZS 4331.2 depending on the flange material;
- (d) Withstand static and dynamic forces transmitted from the installed suction and discharge pipework;
- (e) Incorporate an integral anti-swirl vane in the suction port;
- (f) Incorporate bosses for all tapping points;
- (g) Be provided with forcing screw to facilitate dismantling;
- (h) Incorporate eyebolts, lugs or cast holes for lifting the pump. Eyebolts shall comply with AS 2317; and
- (i) Be fitted with the following tapping points:
 - (i) Pressure: One 15 mm nominal BSP tapping point for pressure gauge connection on the suction and discharge flanges;
 - (ii) Drain: A 20 mm nominal BSP tapping point on the casing low point fitted with a stainless steel plug;
 - (iii) Seal flushing: A 10 mm nominal tapping point for seal flushing.

Internal waterways for cast iron pumps shall be effectively coated or treated in accordance with Clause 2.10.

3.4.3 Impeller

The impeller shall be:

- (a) Double shrouded, one piece (excluding wear rings), radial flow type;
- (b) Precision cast, accurately machined, with the waterways dressed to a smooth finish;
- (c) Secured to the shaft in a manner that prevents circumferential and axial movement;
- (d) Hydro-dynamically balanced; and
- (e) Direction of rotation shall be clockwise when viewed from the driven end.

3.4.4 Shaft extension

The pump shaft extension shall be:

- (a) Sized in order to transmit the full driven output;
- (b) Of sufficient stiffness to provide trouble free seal performance and meet the dynamic deflection requirements detailed Clause 4.4.5.
- (c) Concentric, with runout tolerance not exceeding the seal Manufacturer's requirements;
- (d) Manufactured in one piece, machined throughout its entire length with a high degree of finish at the mechanical seal and bearing surfaces;
- (e) Stepped for ease of assembly of components with correctly radiused at all section changes to minimize stress raisers. No sharp corners or undercutting shall be permitted; and
- (f) Where neck bushes are fitted they shall be manufactured with bearing clearances to provide lateral support to the shaft in lieu of the packed glands;

3.4.5 Rotating element dynamics

The first lateral critical speed of the rotating assembly shall be calculated for the maximum diameter impeller without consideration of any support from the casing or impeller neck rings or seals. The first lateral critical speed shall be greater than 120% of the maximum pump speed.

The total dynamic shaft deflection, at maximum pump speed with maximum impeller at maximum duty head shall be half the diametric clearance at the sealing rings. Bearing support by the neck bush shall not be considered when determining shaft deflection.

3.4.6 Wear rings

The pump shall be fitted with replaceable casing and impeller wear rings that are mechanically secured to prevent loosening and rotation. Wear ring materials shall be selected so as to avoid galling.

NOTE: Casing wear rings manufactured from AS 1565 grade C93500 leaded tin bronze should not be used where chlorine is injected upstream and within close proximity of the pump, because of the material's susceptibility to chlorine attack.

3.4.7 Pump to motor adaptor

The pump to motor adaptor or bell housing shall be of rigid cast iron construction. The adaptor shall incorporate end spigots which shall provide accurate and concentric alignment with the motor flange and pump volute. A hand hole shall be provided on either side of the adaptor to permit access to the coupling area. The adaptor shall be provided with a drain hole in the stuffing box area of the housing to allow removal and capture of product leakage.

3.4.8 Mechanical seal

The pump shall be fitted with either:

- (a) A single inside-mounted mechanical seal (Manufacturer's standard), or
- (b) A single cartridge type balanced mechanical seal,

as specified in the Purchasing Schedule.

Where fitted the cartridge mechanical seal shall be retained by a flange with provision for a flushing water connection.

3.4.9 Seal flushing

The type of mechanical seal flushing required will depend on whether the water being pumped is clean or dirty (as specified in the Purchasing Schedule) and accordingly shall comply with either of the following:

- (a) For clear water applications an internal discharge recirculation flushing passage connected to the stuffing box, or an externally piped flushing system complying with API Plan 11, shall be provided; or
- (b) For waters containing solids such as sand and grit an externally piped cyclone separator connected upstream of the mechanical seal complying with API Plan 31 shall be provided.

3.4.10 Transmission coupling

The transmission coupling shall:

- (a) Be a rigid type;
- (b) Incorporate a spigot connection with the pump shaft extension or be integral;
- (c) Be capable of transmitting 150% of the full starting torque of the driver;
- (d) Be secured against circumferential and axial movement relative to the shafts via a shear key and double locked grubscrews or equivalent system; and
- (e) Be balanced with all components together which shall be permanently marked to facilitate correct assembly, and to the same balance quality grade as the pump impeller.

3.4.11 Fasteners

The pump shall be supplied with all fasteners, washers and gaskets. Fastener threads shall comply with AS 1275 and bolts and studs shall be sized so that excessive threads do not protrude past the nut after assembly. Bolts and nuts shall comply with AS 1111.1 and AS 1112.3, respectively.

3.5 MANUFACTURE

3.5.1 Castings

Castings shall exhibit a close, uniform and homogenous grain that is free from blowholes, porosity, shrinkage, cracks and other injurious defects. Castings shall be properly cleaned and fettled with all lumps, fins and rough areas smoothed. No repairs shall be permitted on structural defects however minor defects in steel casings may be repaired providing approval is obtained from the Asset Owner's representative in accordance with Clause 9.3.2 relating to Manufacturing Repairs.

3.5.2 Machining

Machining shall be concentric, square to line and true. All sharp edges and burrs shall be removed. Bolt holes shall be drilled and spot-faced for bolt heads, nuts and washers. Mating and balanced assemblies shall be match marked.

3.5.3 Balancing of rotating elements

Balancing shall be in accordance with ISO 1940/1. Prior to assembly of the rotating elements, impellers shall be statically and dynamically balanced to achieve balance grade G6.3 at the maximum pump operating speed. Material removed from the impeller shall be near the periphery of the impeller. The material removal process shall maintain a smooth overall surface finish.

The assembled rotating element shall then be dynamically (two-plane) balanced to achieve a balance grade G2.5 at the maximum operating speed of the pump with the material removed from the area immediately around the wear rings (not the impeller periphery).

The assembled rotating element shall then have the coupling half fitted and balanced to grade G2.5 with material removed from the coupling half.

3.5.4 Vibration

Vibration limits for pumpsets shall comply with AS 2625.1 and AS 2625.4. The pumpset maximum vibration severity level shall not exceed 2.8 mm/s (rms) in accordance with Table A2 of AS 2625.4:2003 for Group 2, rigid support class (commissioning classification), or 4.5 mm/s (rms) for flexible support class (factory test classification).

3.6 BASEPLATE

Each pump shall be mounted on a baseplate which shall:

- (a) Be fabricated from standard rolled steel sections and plate;
- (b) Be rigidly constructed and braced to prevent misalignment and flexing under load;
- (c) Be fully seal-welded with welding in accordance with AS/NZS 1554.1 weld category GP;
- (d) Incorporate foundation bolt holes and access holes to facilitate grouting and concrete filling;
- (e) Accommodate a flexible coupling guard;
- (f) Incorporate individual mounting pads which shall be machined after hot-dip galvanizing of the baseplate;
- (g) Incorporate 4 jacking screws per driver for direct-coupled electric motors exceeding 15 kW rating to facilitate driver alignment laterally and longitudinally; and
- (h) Incorporate specifically designed lifting lugs.

4 PERFORMANCE REQUIREMENTS

4.1 GENERAL

Product shall be tested in accordance with the test requirements of this Standard. Testing shall be deemed acceptable when test results have been formally verified by a Conformity Assessment Body or witnessed by a representative of the Asset Owner. Product for which a test requirement has not been met shall be classified as non-compliant Product.

NOTES:

- 1 Testing should be carried out by an organisation accredited by NATA or in accordance with ISO/IEC 17025.
- 2 The Asset Owner's representative should have specialist knowledge of, and/or training in, product or materials testing appropriate to the Product characteristics to be tested.
- 3 The Asset Owner should be notified in writing of each formal test proposal at least seven (7) days prior to the preparation of Product for testing except where a specified test has been the subject of a current valid Certificate issued by a Conformity Assessment Body. This notification is required to enable the Asset Owner to make all necessary arrangements including appointment of a suitable representative in a timely manner.
- 4 The Asset Owner's representative should be afforded access, at all reasonable times, to all places of manufacture of Product or product components and should be authorised to arrange or undertake such testing there as the Asset Owner deems appropriate to the testing regime specified.

4.2 PUMP PRODUCTION TESTS

4.2.1 Coating test

Pump internal coating shall be tested in accordance with AS 3894.1 and AS 3894.3 for continuity and dry film thickness, respectively.

4.2.2 Hydrostatic test

Each pump casing shall withstand the hydrostatic test pressure appropriate to its pressure class in accordance with Table 4.1, for a period of 5 minutes without any leakage or permanent distortion.

4.2.3 Pump performance tests

Unless otherwise stated in the Purchasing Schedule each pump shall be tested at the Contractor's premises in accordance with AS 2417 Grade 2. The tests shall confirm the guaranteed performance values for the specified duty(s) for:

- (a) Rate of flow;
- (b) Total head;
- (c) Efficiency;
- (d) Speed of rotation; and
- (e) Power input.

Tests shall be carried out from the lower head limit of the pump guaranteed performance curve progressively moving towards the shut off head. At least six points along the characteristic curve shall be taken.

All instrumentation used in acceptance testing to AS 2417 shall be certified by the National Association of Testing Authorities Australia (NATA), or an approved equivalent body in an overseas country, as complying with the required measurement tolerance for that instrumentation as stipulated in AS 2417.

Tolerances as specified in AS 2417 are allowable within the guaranteed range.

Additional tests relating to NPSH3, vibration and noise may be required as specified in the Purchasing Schedule.

4.2.4 Pump test report

For the purpose of acceptance the Manufacturer shall provide a Test Report in accordance with AS 2417 which shall also include as a minimum the following additional documents:

- (a) A pump Test Sheet in accordance with Appendix J of AS 2417:2001;
- (b) Pump test curves
- (c) Test results relating to NPSH3, vibration, noise and coating tests (as applicable).

Each Test Report shall show the relevant pump serial number. The Pump Test Report shall certify that the Product has complied with the specified test requirements.

NOTE: Three copies of the Pump Test Report should be supplied to the Asset Owner representative for acceptance as detailed below.

4.2.5 Acceptance

Product shall not be dispatched from the Manufacturer's works until acceptance of the Pump Test Report by the Asset Owner representative, or the appointed testing and inspecting authority. Acceptance will be conditional on the Product complying with the test requirements and guaranteed performance.

NOTE: Three copies of each approved Pump Test Report should be provided to the Asset Owner representative.

5 MARKING, LABELLING AND PACKAGING

5.1 MARKING

5.1.1 Pump markings

Each pump shall have the following information clearly marked by casting on the body, or displayed by stamping or engraving on a corrosion resistant plate which shall be permanently secured to the pump using corrosion resistant fasteners:

- (a) Manufacturer's name;
- (b) Model/type;
- (c) Inlet and outlet connection size, DN;
- (d) Serial number;
- (e) Duty rate of flow, L/s;
- (f) Duty total head, m;
- (g) Speed of rotation, rev/min;
- (h) Impeller diameter, mm;
- (i) Seal make and model;
- (j) NPSH3 at duty point, m;
- (k) Duty power input (kW);
- (l) Year of manufacture.

The pump casing hydrostatic test pressure and serial number shall be stamped on the casing. The direction of rotation of the pump shall be clearly indicated by an arrow cast on the casting (preferably on the front of the volute with ROTATION above the arrow). Cast lettering shall be as large as practicable.

5.1.2 Motor markings

The electric motor shall have nameplate information in accordance with the requirements of the Asset Owner.

5.2 PACKAGING

5.2.1 General

Product shall be packaged with appropriate protection to prevent damage or defects as a result of handling, storage or transportation. Flexible packaging material shall have a minimum expected life in outside storage conditions of 12 months from the date of delivery.

The suction and discharge ports shall have durable covers fitted to their flanges to prevent entry of foreign matter into the pump casing.

5.2.2 Identification tag

Wherever requested in the Purchasing Schedule each Product item shall be identified using a weatherproof marking pen on a corrosion resistant metal identification tag securely wired to the Product in a conspicuous position using a galvanized tie wire with the following information:

- (a) Material Master Record (MMR) number;

- (b) Contract number;
- (c) Purchase order number.

5.2.3 Marking of packaging

Where requested in the purchasing schedule the Product shall be identified by marking on the outside of any protective packaging the same information as shown on the identification tag.

5.2.4 Warning labels

The Manufacturer shall attach a warning label to alert the Purchaser that the pump has to be primed with water prior to operation otherwise damage to the mechanical seal will occur.

6 MANUALS

6.1 FORMAT AND LANGUAGE

Where required, Product shall be supplied complete with appropriate installation, operation and maintenance instructions or manuals, in clear diagrammatic and text format, in English.

6.2 CONTENT

The manuals shall contain all the relevant information required to commission and maintain the Product in operational service, including, but not limited to, the following:

- (a) Details of Product features;
- (b) Operational adjustments;
- (c) Installation and commissioning instructions;
- (d) Preventative maintenance requirements and intervals;
- (e) Testing procedures;
- (f) Trouble shooting guidelines;
- (g) Complete list of parts and associated exploded views or sectional diagrams and reference part numbers.

7 SPARE PARTS AND SPECIAL TOOLS

7.1 SPARE PARTS

All spare parts shall be interchangeable for a Manufacturer's Product of the same size and model.

NOTE: Spare parts and servicing facilities should be readily available to meet the needs of the Asset Owner.

7.2 SPECIAL TOOLS

Any special tools required for the dismantling, servicing and re-assembly of the pump unit shall be supplied.

8 TRANSPORTATION, HANDLING AND STORAGE

8.1 GENERAL

Transportation, handling and storage facilities shall be designed to prevent Product damage or defects and to maintain Product free of deleterious matter.

8.2 PRESERVATION OF PRODUCT IN STORAGE

Product shall be stored in original Product packaging in accordance with the published requirements of the Manufacturer, prior to installation. Sensitive component materials shall be protected from extended exposure to direct sunlight and high temperatures e.g. elastomeric components shall be stored in accordance with the general principles of AS 1646. Designated Product storage areas shall be of sufficient size to accommodate Product deliveries and shall be flat, reasonably level and free of combustible vegetation, sharp stones or projections that could cause Product damage or defects.

9 QUALITY ASSURANCE

9.1 CERTIFICATION

9.1.1 Certification of Product

Wherever this Standard requires compliance with nominated Product and test Standards, conformance shall be certified by means of an ISO Type 5 Certification Scheme, conducted by a Conformity Assessment Body. Each Certificate shall expressly attest compliance of all Product items with the nominated Standards. Wherever specified, Certificates shall be submitted to the Asset Owner representative nominated for this purpose. Product shall be marked in accordance with the requirements of the Conformity Assessment Body.

NOTE: Compliance of Product including related accessories and services with nominated Standards and specified requirements may be verified by means of a Product Verification Report provided by a Product Assessor. The Product Verification Report should identify all relevant Certificates of Product compliance, duly issued in accordance with Certification Scheme rules.

9.1.2 Quality System

The processes for manufacture, testing, supply, transportation, handling, delivery and storage of Product to be supplied in accordance with this Standard shall form part of a documented Quality System. The System shall be certified by a Conformity Assessment Body as complying with the requirements of AS/NZS ISO 9001 and shall provide for identification and traceability, control of production and delivery to the specified destination, customer verification and control of documents and records.

9.1.3 Product Re-verification

Product compliance with the Standard shall be subject to re-verification by a Product Assessor when, during the agreed Product supply period, there occurs any:

- (a) Substantive change in Product design, material formulation or performance
- (b) Product failure to perform in operational service to the nominated performance standard or specification.

Re-verification shall require the issue of a new or supplementary Product Verification Report. Product components and test outcomes that are not significantly affected by the Product change or failure may be excluded from the scope of re-verification, provided that these outcomes have already been reported in a current valid Product Verification Report that is acceptable to the Asset Owner.

Wherever the requirements of the Standard apply to a Product supply period in excess of three years, continuing acceptance of Product shall be subject to re-verification. The purpose of re-verification shall be to confirm the continuing compliance of Product quality and production control processes with the requirements of the Standard.

9.2 COMPLIANCE AND ACCEPTANCE

9.2.1 Means of Demonstrating Compliance

Compliance with this Standard shall be demonstrated by means of Product Appraisal and issue by a Product Assessor of a Product Verification Report that confirms compliance. Otherwise, Product shall be deemed non-compliant and ineligible for registration as Product authorized for use in the Asset Owner's infrastructure.

NOTES:

- 1 Where a project includes design work including Product design, Product Appraisal may form part of the project design review process and the Product Assessor may be a member of the project design review team.
- 2 A Product Verification Report should verify the extent of compliance with the Standard including all relevant 'Technical Compliance Schedule' Appendices and the currency of a Certificate where relevant to the Product.

9.2.2 Acceptance Criteria

For acceptance, Product shall be supplied as specified in the Purchasing Schedule.

Prior to the implementation of any arrangement to supply Product, the Supplier shall, in accordance with specified requirements:

- (a) nominate applicable Product Warranty terms; and
- (b) provide documentary verification in the form of a current valid Certificate or Product Verification Report as appropriate to the Product; and
- (c) detail each element of Product that does not comply with the specified requirements together with the extent of non-compliance.

NOTE: Where the Standard includes Technical Compliance Schedules, the nature and extent of all non-compliances should be provided in accordance with the appropriate Schedules.

9.3 NON-COMPLIANT PRODUCT

9.3.1 General

Product whose design, workmanship or performance fails to conform to the specified requirements shall be clearly tagged and quarantined by the Supplier as non-compliant and shall be subject to rejection for return to and replacement by the Supplier.

Where the Standard includes a 'Technical Compliance Schedule', Product shall be deemed non-compliant except where a Supplier has demonstrated compliance in accordance with the requirements of the 'Technical Compliance Schedule' Appendices of the Standard.

9.3.2 Manufacturing Repairs (In-process)

Welding, the use of fillers and other repairs shall generally not be permissible on "off the shelf" Product which is in the course of production.

Repairs to custom-built Products such as axially-split pumps and large valves may be considered only if determined by the Asset Owner to be minor casting repair work in non-strategic locations. Accordingly, details of any defect which the Manufacturer considers can be repaired; together with details of proposed repair procedures shall be submitted in writing for determination by the Asset Owner.

For acceptance, a proposal for repair or remedy of Product defects shall not void or otherwise diminish the provisions of the Product Warranty.

The Manufacturer shall make provision in its production Quality System and in the appropriate ITPs for sufficient hold points whenever casting defects are encountered. Production work on non-compliant components shall cease and repair work shall not commence until the following details have been confirmed by the Asset Owner in writing that:

- (a) Repair of the non-compliant components in lieu of their replacement is acceptable;
- (b) Proposed repair procedures are acceptable; and
- (c) Any proposal to extend the terms of the original Product Warranty as a consequence of the in-process repair is acceptable.

9.3.3 Product Warranty

The Supplier shall replace non-compliant Product with Product that conforms to the acceptance criteria or shall repair or rectify all faults, damage or losses caused by defective Product. Except as may otherwise be specified, the Product Warranty shall indemnify and keep indemnified the Asset Owner against all losses suffered by the Asset Owner as a result of non-compliant Product for a period no less than 24 months after Product delivery or 12 months after Product installation, whichever period elapses first.

All reasonable proposals for repair or remedy of defects will be considered, provided that each such proposal is accompanied by a methodology statement that accords with the performance objectives of this Standard, as determined by the Asset Owner. For acceptance, a proposal for repair or remedy of Product defects shall not void or otherwise diminish the provisions of the Product Warranty.

APPENDIX B REFERENCED DOCUMENTS

(Normative)

AS

1111.1	ISO metric hexagon bolts and screws Product grade C - Bolts
1112.3	ISO metric hexagon nuts – Product grade C
1214	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
1275	Metric screw threads for Plain washers for metric bolts, screws and nuts for fasteners general purposes - General plan
1554.1	Structural steel welding – Welding of steel structures
1565	Copper and copper alloys Plain washers for metric bolts, screws and nuts for – Ingots and castings general purposes - Tolerances
1627.2	Metal finishing – Preparation and pre-treatment of surfaces – Power tool cleaning
1646	Elastomeric seals for waterworks purposes
1830	Grey cast iron
2074	Steel castings
2317	Collared eyebolts
2345	Dezincification resistance of copper alloys
2382	Surface roughness comparison specimens
2417	Rotodynamic pumps – Hydraulic performance acceptance tests- Grades 1 and 2
2550.1	Cranes, hoists and winches – Safe use - General
2550.3	Cranes, hoists and winches – Bridge, gantry and portal (including container cranes), jib and monorail cranes
2550.5	Cranes, hoists and winches - mobile
2550.11	Cranes hoists and winches – Vehicle loading cranes
2625.1	Mechanical vibration – Evaluation of machine vibration by measurements on non-rotating parts – General guidelines
2625.4	Mechanical vibration – Evaluation of machine vibration by measurements on non-rotating parts – Industrial machines with nominal power above 15 kW and nominal speeds between 120 rev/min and 15,000 rev/min when measured in situ
2700	Colour standards for general purposes - Swatches
2729	Rolling bearings – Dynamic load ratings and rating life
3894.1	Site testing of protective coating – Non-conductive coatings – Continuity test – High voltage (“brush”) method
3894.3	Site testing of protective coatings – Determination of dry film thickness

AS

4087 Metallic flanges for waterworks purposes

AS/NZS

1594 Hot-rolled steel flat products

4020 Testing of products in contact with drinking water

4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

4331.1 Metallic flanges – Steel flanges

4331.2 Metallic flanges – Cast iron flanges

AS/NZS ISO

9001 Quality management systems - Requirements

ASTM

A276 Standard Specification for Stainless Steel Bars and Shapes

A380 Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems

ISO

1940/1 Mechanical vibration – Balance quality requirements for rotors in constant (rigid) state Part 1: Specification and verification of balance tolerances

2858 End-suction centrifugal pumps (rating 16 bar) – Designation, nominal duty point and dimensions

ISO/IEC

17025 General requirements for the competence of testing and calibration laboratories

SAA Guides

HB 18 Guidelines for third-party certification and accreditation

HB 18.2 Guide 2 – General terms and their definitions concerning standardization and related activities

HB 18.22 Guide 22 – Information on manufacturer's declaration of conformity with standards and other technical specification

HB 18.23 Guide 23 – Methods of indicating conformity with standards for third-party certification systems

HB 18.28 Guide 28 – General rules for model third-party certification system for products

WSA

109 Flange Gaskets and O-Rings

APPENDIX C ALTERNATIVE MATERIAL REQUIREMENTS
(Normative)

Pump Component	Standard Waters		Corrosive Waters	
	Material	Standard: Grade	Material	Standard: Grade
Casing volute and back cover				
Bearing housing				
Impeller				
Impeller wear rings				
Casing wear rings				
Shaft				
Shaft sleeves (as applicable)				
Impeller key				
Coupling key				
Impeller nut				
Impeller washer				
Mounting foot				
Mechanical seal:				
Seal plate				
Rotating face				
Stationary faces				
Drive keys				
Spring(s)				
Studs, setscrews, capscrews, bolts, pins, nuts				
O-rings and seals				
Plugs (drain, vent)				
Water thrower				

APPENDIX D PROJECT SPECIFIC REQUIREMENTS (Normative)

D1 GENERAL

Project requirements and clarification of options contained in this Standard are detailed in Table C.1. The Asset Owner (or Purchaser on behalf of the Asset Owner) is required to complete the table, which will form part of the Purchasing Schedule and is intended to assist the Supplier in meeting the Asset Owner's requirements.

D2 TECHNICAL REQUIREMENTS

Notwithstanding the content of Sections 1 to 9 of this Standard, the following specific requirements shall apply.

**TABLE C.1
SCHEDULE OF PROJECT TECHNICAL REQUIREMENTS**

Clause	Project Requirements	Specified Item/Option
N/A	Number of pumpsets required:	
2.1	Water classification e.g. standard or corrosive:	
2.2 & Appendix B	Acceptable alternative materials	
2.3	Details of highly corrosive water or chemicals e.g. properties including temperature and concentration ¹	
2.4	Compliance with AS/NZS 4020	Yes/No
2.10	Pump internal coating product ² :	
3.2.2	Special operating parameters ³	
3.3.1	Duty(s):	
	Primary duty rate of flow:	L/s
	Primary duty total head:	m
	Secondary duty rate of flow (if required):	L/s
3.3.2	Secondary duty total head (if required):	m
	NPSHA	m
3.4.1	Pressure class:	PN
3.4.2	Suction and discharge port flange standard ⁴ :	
	Suction and discharge port diameters:	/ mm
3.4.6	Pump will be subjected to high chlorine dosing upstream e.g. >2 mg/L	Yes/No
3.4.9	Standard or cartridge seal required	
3.4.10	Seal flushing ⁵ clear water (internal recirculation or API Plan 11); or dirty water (API Plan 31)	Clear water/dirty water
4.1	Performance testing ⁶ e.g. certified or witness testing:	
4.2.3	Special or additional test requirements ⁷ :	
4.2.4	No of copies of Pump Test Report required	

Clause	Project Requirements	Specified Item/Option
5.2.2	Identification tag e.g. required or not required:	
	MMR catalogue numbers	
5.2.3	Marking of packaging e.g. required or not required:	
6.1	Number of Manuals required ⁸ :	
9.1.1	Submission of Certificates required	Yes/No
	Acceptance of a Product Verification Report in lieu of Type 5 Certification by Conformity Assessment Body	Yes/No
9.2.1	Notification of testing	
	Access to place of manufacture	

NOTES:

- 1 This requirement would only be applicable for pumps requiring special materials in lieu of the materials specified in Table 2.2.
- 2 Generally any of the three internal coating products referred to in this Standard would be acceptable.
- 3 Normally would be N/A unless there were changes in the Standard Parameters referred to in Clause 3.2.1.
- 4 Normally AS 4087 flanges; however, there may be occasions where AS/NZS 4331.1 (steel) or AS/NZS 4331.2 (cast iron) might be specified e.g. desalination plants.
- 5 Specify whether the application is for clean water or dirty water.
- 6 Generally certified Test Reports would be acceptable.
- 7 Grade 1 in lieu of Grade 2 testing (default) or additional tests may be specified for special circumstances.
- 8 The Asset Owner should be consulted to provide this information.

APPENDIX E TECHNICAL COMPLIANCE SCHEDULES

(Normative)

E1 COMPLIANCE SCHEDULES

Suppliers shall demonstrate Product compliance with the Standard by completing Technical Compliance Schedules in Tables D1 and D2 on an item by item basis.

Each scheduled item in Table D1 nominates a Standard Clause number with which the extent of Product compliance shall be demonstrated. For acceptance, the extent of scheduled technical item compliance shall be supported by verifiable documentary evidence.

The Supplier shall denote compliance of an item by ticking the unshaded 'Yes' column appropriate to that item. Where Product does not comply with specified requirements, the Supplier shall tick the 'No' column and shall detail the reasons for non-conformance and any proposed alternatives in the 'Comments' column. The Supplier shall denote acceptance and understanding of a Standard clause by ticking the corresponding 'Noted' column wherever unshaded.

NOTE: Failure to notify the Asset Owner of all non-compliant Product components, including the extent of non-compliance, may void an accepted offer to supply or may result in rectification of all non compliant Product elements, at the Supplier's cost.

TABLE D1
TECHNICAL COMPLIANCE SCHEDULE 1

ISO End Suction Centrifugal Pumps – Supplier Clause-by-Clause Response					
Section/Clause		Noted	Compliance		Comments
			Yes	No	
1. SCOPE AND GENERAL					
1.1	Scope				
1.2	Referenced Documents				
1.3	Definitions and Notation				
1.4	Designation of Size				
2. MATERIALS AND COMPONENTS					
2.1	Water Classification				
2.2	Materials of Construction				
2.3	Highly Corrosive Water and Chemicals				
2.4	Contamination of Drinking Water				
2.5	Dezincification-resistant Materials				
2.6.1	Welding, Heat Treatment and Passivation				
2.6.2	Graphite Compounds				
2.6.3	Galling				
2.7	Non-metallic Materials				
2.8	Immersed Components				
2.9	Elastomeric Materials				
2.10.1	Coatings - General				
2.10.2	Pump Internal Coating				
2.10.3	Pump External Coating				
2.10.4	Baseplate and Coupling Guard				
3. DESIGN AND MANUFACTURE					
3.1	General				
3.2.1	Standard Parameters				
3.2.2	Special Parameters				
3.3.1	Pump Selection				
3.3.2	NPSH				
3.3.3	Performance Curves				
3.3.4	Driver Selection				
3.4.1	Pressure Rating				
3.4.2	Casing				

3. DESIGN & MANUFACTURE					
3.4.3	Impeller				
3.4.4	Shaft Extension				
3.4.5	Rotating Element Dynamics				
3.4.6	Wear Rings				
3.4.7	Pump to Motor Adaptor				
3.4.8	Mechanical Seal				
3.4.9	Seal Flushing				
3.4.10	Transmission Coupling				
3.4.11	Fasteners				
3.5.1	Castings				
3.5.2	Machining				
3.5.3	Balancing of Rotating Elements				
3.5.4	Vibration				
3.6.1	Flexible Coupling				
3.6.2	Baseplate				
4. PERFORMANCE TESTS					
4.1	General				
4.5.1	Coating test				
4.5.2	Hydrostatic Test				
4.5.3	Pump Performance Tests				
4.5.4	Pump Test Report				
4.5.5	Acceptance				
5. MARKING AND PACKAGING					
5.1.1	Pump Markings				
5.1.2	Motor Markings				
5.2.1	General				
5.2.2	Identification Tag				
5.2.3	Marking of Packaging				
5.2.4	Warning Labels				
6. MANUALS					
6.1	Format and Language				
6.2	Content				
7. SPARE PARTS AND SPECIAL TOOLS					
7.1.1	Interchangeability				
7.1.2	Availability				
7.2	Special Tools				
8. TRANSPORTATION, HANDLING AND STORAGE					
8.1	General				
8.2	Preservation of Product in Storage				
9. QUALITY ASSURANCE					
9.1.1	Certification of Product				
9.1.2	Quality System				
9.1.3	Product Re-verification				
9.2.1	Means of Demonstrating Compliance				
9.2.2	Acceptance Criteria				
9.3.1	General				
9.3.2	Manufacturing Repairs (In-process)				
9.3.3	Product Warranty				

Name of Supplier:

Signature:

Date:

The Supplier shall provide the information required by Technical Compliance Schedule 2 as shown in Table D.2.

TABLE D.2
TECHNICAL COMPLIANCE SCHEDULE 2

ISO End Suction Centrifugal Pumps		
1. SUPPLIER'S REPRESENTATIVE		
1.1	Full name	
1.2	Postal address	
1.3	Facsimile number	
1.4	Email address	
1.5	Phone number	
1.6	Mobile phone number	
2. QUALITY ASSURANCE		
2.1	Extent of third party accreditation of Supplier	
2.2	Extent of third party accreditation of Manufacturer	
2.3	Details of certificates and verification reports attached	(Yes/No)
3. TECHNICAL INFORMATION		
3.1	Performance curves supplied for specified duty points	(Yes/No)
3.2	Performance curves supplied for maximum diameter impeller	(Yes/No)
3.3	General arrangement and cross sectional drawings supplied	(Yes/No)
3.4	Technical data and dimensions supplied.	(Yes/No)
3.5	Details of servicing facilities in Perth supplied.	(Yes/No)
4. PUMP DESIGN AND MANUFACTURE		
4.1	Manufacturer's name	
4.2	Place of manufacture	
4.3	Pump model	
4.4	Pump type e.g. ISO end suction motor pump	
4.5	Designation e.g. 150/200 - 400	
4.6	Suitable for continuous operation outdoors	(Yes/No)
4.7	Performance Guarantees:	Primary Duty Secondary Duty
	• Rate of flow, L/s	
	• Total head, m	
	• Efficiency, %	
	• Speed of rotation, rev/min	
	• Power input, kW	
4.8	NPSHR, m	
4.9	NPSH margin recommended by the Manufacturer, m	
4.10	NOL or Maximum Power, kW	
4.11	Shut off head, m	
4.12	Vibration severity, mm/s rms	
4.13	Maximum sound power, dB(A)	
4.14	Rotating element balance standard and grade	
4.15	Moment of inertia of rotating element including rotor, kgm ²	
4.16	Pump casing:	
	• Radially split	(Yes)/(No)
	• Suction flange diameter, mm	
	• Discharge flange diameter, mm	
	• Flange standard and class	
	• Method of fixing casing wear rings	
	• Back pull out	(Yes)/(No)

4. PUMP DESIGN AND MANUFACTURE				
4.17	Impeller:			
	• Type e.g. one piece closed, open			
	• Diameter, mm			
	• Maximum diameter for casing, mm			
	• Method of fixing to shaft			
	• Method of fixing impeller wear ring			
	• Impeller static diametral clearance			
	• Direction of rotation - viewed from the driven end			
4.18	Shaft			
	• First critical speed with max. dia. impeller, rev/min			
	• Dynamic deflection at maximum head, mm			
4.19	Tapping points:			
	• Gauge points – size and location			
	• Casing drain – size and location			
4.20	Method of taking impeller thrust			
4.21	Internal coating product details and thickness, µm			
4.22	Mass of pumpset, kg			
5.0 PUMP MATERIALS		MATERIAL	STANDARD	GRADE
5.1	Casing volute and back cover			
5.2	Motor to pump adaptor housing			
5.3	Impeller			
5.4	Impeller wear rings			
5.5	Casing wear rings			
5.6	Extension Shaft			
5.7	Impeller key			
5.8	Coupling key			
5.9	Impeller nut			
5.10	External spindle tube			
5.11	Studs, setscrews, capscrews, bolts, pins, nuts			
5.12	O-rings and seals			
5.13	Plugs (drain, vent)			
6.0 MECHANICAL SEAL				
6.1	Brand			
6.2	Model/Type			
6.3	Materials:			
	• Stationary face			
	• Rotating face			
	• Drive keys			
	• O-rings			
	• Flange			
6.4	Flushing type or API Plan number			

7.0	TRANSMISSION COUPLING	
7.1	Type e.g. rigid	
7.2	Spigot or integral with extension shaft	
7.3	Maximum power rating at duty speed, kW	
7.4	Method of securing axially and circumferentially	
8.0	COATINGS	
9.1	Pump internal coating product details and thickness, µm/.....
9.2	Pump external coating type and thickness, µm/.....
10.0	TESTING	
10.1	Coating test	(Yes/No)
10.2	Hydrostatic test pressure, kPa	
10.3	Pump test code/class/.....
10.4	NPSHR testing (if requested)	(Yes/No)
10.5	Sound testing (if requested)	(Yes/No)
10.6	Vibration testing (if requested)	(Yes/No)
10.7	Location of tests	

Name of Supplier:

Signature:

Date: