Assets Planning and Delivery Group
Engineering

Strategic Product Specification

SPS 506

Vertical Multi-Stage Electric Centrifugal Pumps

VERSION 1
REVISION 1

MAY 2022

FOREWORD

Each Strategic Product Specification has been prepared to inform Water Corporation staff, consultants, contractors and land developers of the requirements for selecting and acquiring a manufactured product to be used in strategic Corporation infrastructure. The definition of 'Product' includes items that comprise assembled components, equipment or plant for mechanical, electrical and civil infrastructure applications.

The objective of a Strategic Product Specification is to specify fit-for-purpose Product which will contribute to the provision of effective water services at least whole-of-life cost and with least risk to service standards and safety. A Strategic Product Specification also provides uniform standards for compatibility of new water infrastructure with existing water assets.

Many Strategic Product Specifications have drawn on the design, asset management and operational experience of Product performance in live service gained by the Corporation over time. Some Strategic Product Specifications have drawn on the experience of the water industry nationally by referencing Australian or WSAA standards.

Strategic Product Specifications are intended for reference and use in the following typical procurement scenarios:

- Capital funded infrastructure design and construction work;
- Private developer funded subdivision infrastructure for takeover by the Corporation;
- Operationally funded infrastructure design and construction work;
- Corporation period contracts for Product purchases;
- Product purchases for stock or for miscellaneous minor work.

A published Strategic Product Specification will, in some cases, comprise technical content that is typical of a range of products of the same type (type specification) but 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' Appendix of the Specification.

The text of a published Specification 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' Appendix.

Enquiries relating to the technical content of this Specification should be directed to the Senior Principal Engineer, Mechanical, Engineering to whom all enquiries relating to the technical content of the Specification should be directed. Future Specification changes, if any, will be issued to registered Specification users as and when published.

Head of Engineering

This document is prepared without the assumption of a duty of care by the Water Corporation. The document is not intended to be nor should it be relied on as a substitute for professional engineering design expertise or any other professional advice.

It is the responsibility of the user to ensure they are using the current version of this document.

REVISION STATUS

The revision status of this specification is shown section by section below:

REVISION STATUS						
SECT.	**VER./ REV.**	**DATE**	**PAGES REVISED**	**REVISION DESCRIPTION (Section, Clause, Sub-Clause)**	**RVWD.**	**APRV.**
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Strategic Product Specification

SPS 506

Vertical Multi-Stage Electric Centrifugal Pumps

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1 Scope and General

1.1 Scope

This Specification sets out requirements for the manufacture, testing, supply, handling and delivery of non self-priming, vertical, multi-stage, electric centrifugal pumps with in-line flanged suction and delivery ports, and as further described in the following.

The pumps will be used in Corporation water supply systems for general pumping and pressure boosting of raw water, treated water and clear effluent.

1.2 Referenced Documents

The Specification makes reference to the following current standards:

AS

1111.1	ISO metric hexagon bolts and screws – Product grade C - Bolts
1112.3	ISO metric hexagon nuts - Product grade C
1275	Metric screw threads for fasteners
1359	Rotating electrical machines – General requirements
1359.109	Rotating electrical machines – General requirements Noise
1565	Copper and copper alloys – Ingots and castings
1627	Metal-finishing – Preparation and pretreatment of surfaces – Method of selection guide
1646.1	Elastomeric seals for waterworks purposes – General requirements
1646.2	Elastomeric seals for waterworks purposes – Material requirements for pipe joint seals used in water and wastewater applications – Specifies by prescription formula
1646.3	Elastomeric seals for waterworks purposes – Material requirements for pipe joint seals used in water and wastewater applications with the exception of natural rubber and polyisoprene compounds
1830	Grey cast iron
1831	Ductile cast iron
2074	Steel castings
2345	Dezincification resistance of copper alloys
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 r/min and 15,000 r/min when measured in situ
2738	Copper and copper alloys – Compositions and designations of refinery products, wrought products, ingots and castings

2738.2	Wrought products
3709	Vibration and shock – Balance quality of rotating rigid bodies
4087	Metallic flanges for waterworks purposes
60947.8	Low-voltage switchgear and controlgear – Control units for built-in thermal protection (PTC) for rotating electrical machines
60529	Degrees of protection provided by enclosures (IP Code)

AS/NZS

1567	Copper and copper alloys – Wrought rods, bars and sections
1568	Copper and copper alloys- Forging stock and forgings
4020	Testing of products for use in contact with drinking water

AS/NZS ISO

9001	Quality management systems – requirements
9906	Rotodynamic pumps – Hydraulic performance acceptance tests – Grades 1, 2 and 3

ASTM

A240M	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and strip for Pressure Vessels and for General Applications
A276	Standard Specification for Stainless Steel Bars and Shapes
A313M	Standard Specification for Stainless Steel Spring Wire
351M	Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems
A 480 M	Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
B127	Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet and Strip
B163	Standard Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes
B164	Standard Specification for Seamless Nickel-Copper Alloy Rod, Bar and Wire
B165	Standard Specification for Nickel-Copper Alloy (UNS N04400)* Seamless Pipe and Tube

Corporation Technical Specifications

PA	Protective Coating on Steel and/or Cast Iron
PS	IZS.AT-80/80 – Inorganic Zinc Silicate Primed, Two Pack Acrylic Coating on Steel or Cast Iron

DS

26-06	Corporation Design Standard: Type Specifications – Electrical Type Specification for Standard Cage Induction Motors

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 specifications
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

MP 52 Manual of authorization procedures for plumbing and drainage products

1.3 Definitions and Notation

1.3.1 Allowable Operating Pressure (AOP)

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

1.3.2 Certification 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.

In the case of a non-strategic plumbing Product, a Certification Body means an organisation approved by Standards Australia to administer the National Certification of Plumbing and Drainage Products (NCPDP) Scheme in accordance with SAA MP 52.

1.3.3 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.

1.3.4 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. In the case of a non-strategic plumbing Product, a Certification Scheme means the NCPDP Scheme.

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.

1.3.5 Compliant Product

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

1.3.6 Corporation

The Water Corporation of Western Australia.

1.3.7 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.

1.3.8 Nominal Size

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.

1.3.9 Notation

Statements expressed by use of the word 'shall' are mandatory or 'normative' requirements of the Specification. Statements expressed by use of the words 'should' or 'may' are 'informative' but not mandatory and are provided only for information and guidance. Notes in Specification text are informative. Notes that form part of Specification Tables are normative. An Appendix to the Specification that is designated 'normative' contains mandatory requirements. An Appendix that is designated 'informative' is provided for information and guidance only. The term 'specified' includes requirements of the Specification and requirements stated or referenced in other project documentation.

1.3.10 Officer

A duly authorised representative or appointed agent of the Corporation.

1.3.11 Pressure Class (PN)

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

1.3.12 Product

A single unit or multiple units of manufactured end product or an assembly of manufactured component products, materials or equipment. This Specification and accompanying Purchasing Schedule define the nature and details of Product to be supplied. In this Specification the Product shall refer to a vertical multi-stage in-line centrifugal pump (or pumps).

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.

1.3.13 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' Appendix.

1.3.14 Product Assessor

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

1.3.15 Product Certification

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

1.3.16 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 Corporation.

1.3.17 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 Corporation 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.

1.3.18 Pumpset

Pumpset shall refer to the combined motor and pump unit.

1.3.19 Purchasing Schedule

A Corporation 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.

NOTE: The Purchasing Schedule of this Specification is contained in Table 11.1.

1.3.20 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.

1.3.21 Strategic Product

An essential product whose performance is critical in eliminating risk to the safe and effective provision of water services, which are functions of the Corporation under the Water Corporation Act as licensed under the Water Services Coordination Act.

NOTES:

1 Strategic product is most commonly an element of permanent Corporation infrastructure. Ancillary operational and safety equipment, not intended to form part of this infrastructure, may be considered strategic by virtue of enhanced operational performance or personnel safety.

2 Plumbing products (end-of-line water service fittings DN 32 or smaller) used in strategic services may, by virtue of statutory and regulatory requirements, be considered strategic in Corporation applications.

1.3.22 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.

1.3.23 Testing

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

1.3.24 Pump

The term pump (or pumps) referred to in this Specification shall mean a vertical multi-stage in-line centrifugal pumpset (or pumpsets).

1.3.25 WSAA

The Water Services Association of Australia of which the Water Corporation is a corporate member.

1.4 Designation of Size

This Specification generally covers pump flange sizes from DN 25 to DN 150, operating heads to 300 m and flow capacities to 120 m^3/h (33.3 L/s).

2 Materials and Components

2.1 General

Each pump shall be constructed from the materials detailed in Table 2.1 below, which constitutes the basic or minimum requirements. Materials of equivalent or superior quality may be acceptable subject to being authorised for use by the Corporation.

Table 2.1 – Vertical Multi-stage Centrifugal Pump Material Requirements

Component		Material	Standard	Designation
Motor adaptor flange, motor pedestal and shaft coupling, baseplate (if relevant), backing flanges		Cast iron	AS 1830	250
		Ductile cast iron	AS 1831	ISO 1083/JS/500-7/U;
				ISO 1083/JS/400-15/U
Coupling guard		Stainless steel	ASTM A480M	304
Mechanical seal faces	Rotating	Wear resistant material	N/A	Solid silicon carbide
	Stationary	Wear resistant material	N/A	Solid carbon
Mechanical seal springs		Stainless steel	N/A	Hastelloy C®
			ASTM A313M	316
Pump head		Stainless steel	ASTM A 351M	CF8M-316
Top sealing plate (if relevant)		Stainless steel	ASTM A 480M	316
O-rings and seals		Synthetic elastomer	AS 1646.1,.2,.3	EPDM, NBR
Pump shaft, drive keys, seal flange, stay bolts, internal fasteners, drain and priming plugs		Stainless steel	ASTM A276	431, 316
Pump shaft bearing sleeve or bush, inlet bearing bush (if relevant)		Tungsten carbide	N/A	N/A
Pump inter-stage bearing bush		Tungsten carbide	N/A	N/A
		Ceramic	N/A	N/A
		Carbon graphite filled PTFE	N/A	N/A
Impellers, diffusers, and inner and outer chamber sleeves		Stainless steel	ASTM A240M	316
Casing wear rings (or neck rings)		PTFE, carbon filled PTFE	N/A	N/A
		Technopolymer PPS	N/A	N/A
Pump inlet/outlet casing		Stainless steel	ASTM A 480M	316
			ASTM A 351M	CF8M-316
External fasteners		Stainless steel	ASTM A 276	304, 316

2.2 Contamination of Water

Components in contact with drinking water shall comply with the requirements of AS/NZS 4020.

2.3 Corrosion Resistant Materials

The following materials are considered to be corrosion resistant for the purpose of this Standard.

(a) Copper alloys – AS 1565, AS/NZS 1567, AS/NZS 1568.

(b) Austenitic stainless steels – ASTM A276 grade 316.

(c) Phosphor bronze – AS 2738.2 Alloy 518.

(d) Nickel-copper-iron alloys – AS 2738.2 Alloy 713; ASTM B127; ASTM B163; ASTM B164; ASTM B165.

(e) Copper nickel alloy – AS 2738 Alloy 706; AS 2738 Alloy 715.

2.4 Stainless Steel

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

Graphite greases, graphite packing and graphite compounds shall not be used in contact with stainless steel. Protective or decorative coatings shall not be applied to stainless steel when exposed to moist or corrosive environments.

2.5 Dezincification-Resistant Materials

Copper alloy materials shall be dezincification-resistant and shall comply with AS 2345.

2.6 Non-Metallic Materials

Non-metallic materials used in the components of the Product shall be fit for the intended purpose and shall exhibit dimensional stability when exposed to weather, sunlight and where relevant after extended periods of immersion.

2.7 O-Rings

O-rings shall be made of elastomer that is not injuriously affected by the fluid, temperature or environmental conditions to which O-rings will be subjected in service.

3 Design and Manufacture

3.1 General

Pumps shall be of the vertical, multi-stage, close-coupled, electric motor driven, centrifugal type. The electric motor shall be capable of being removed without disturbing the pump rotating element. The pump impellers shall be capable of being removed without disturbing the suction and discharge pipework. Bosses shall be provided for all tappings.

The design criteria of the pumps shall be based on a minimum life expectancy of 20 years.

3.2 Pump Inlet/Outlet Casing

The pipework connection ports shall be in-line with circular flanges complying with AS 4087. The pump casing shall be fitted with drain plugs to facilitate drainage of the inlet and outlet chambers. The casing shall incorporate an integral or separate baseplate with four foundation bolt holes.

3.3 Pump Head

The pump head shall be fitted with a priming plug located such that the mechanical seal will be completely flooded and all air expelled from the discharge chamber after priming. The pump head design shall prevent accumulation of air in the critical area surrounding the mechanical seal.

3.4 Stage Casings

Each pump stage casing (comprising the impeller and diffuser) shall be designed to efficiently convert radial flow from the impeller via the diffuser to axial discharge flow.

3.5 Impellers

The impellers shall be of the closed centrifugal type with integral neck accurately manufactured and balanced. The impellers shall be secured to prevent circumferential and axial movement via an impeller key and locknuts or by use of locking collets.

3.6 Diffusers

Each diffuser shall accommodate a replaceable casing wear ring (neck ring). Diffuser waterways shall be smooth, and optimally sized and shaped. Diffusers shall incorporate a bearing housing to accommodate a shaft bearing bush (where required).

3.7 Pump Shaft

3.7.1 Orientation and Construction

The shaft shall be vertically oriented and common for all stage casings. It shall be a ground finish throughout its entire length with a high degree of finish at the bearing surfaces. Steps shall be radiused to minimize stress raisers.

3.7.2 Size and Deflection

The pump shaft shall of ample size to transmit the full driven output. The total deflection of the shaft at the maximum operating head, with the maximum diameter impeller, shall be less than the minimum diametral clearance at the impeller neck rings.

3.7.3 Critical Speed

The pump shaft shall be of rigid construction. The shaft first lateral critical speed shall be calculated for the maximum diameter impeller without consideration of any support from the

casing or impeller neck rings or seals. The shaft first lateral critical speed shall be greater than 120% of the rated motor speed.

3.8 Shaft Bearings

Water lubricated pump shaft journal bearings shall be provided as required in the diffuser bearing housing. For pump sizes larger than DN 50 a journal bearing shall be provided at the bottom end of the shaft.

3.9 Mechanical Seal

Mechanical seal component materials shall comply with Table 2.1. For pump sizes greater than DN 50 a balanced cartridge type mechanical seal shall be provided.

3.10 Fasteners

Each pump shall be supplied with all fasteners, washers and gaskets required for its installation. Fastener threads shall conform to 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.

Stainless steel fasteners shall either be designed to prevent galling or treated with anti-galling compounds prior to assembly.

3.11 Immersed Components

All continuously immersed components shall be manufactured from corrosion-resistant materials.

3.12 Defects

The pumpset shall comply with the following requirements:

(a) Components shall be free from defects.

(b) All castings shall be sound and free from laps, blowholes and pitting. Casting internal and external surfaces shall be free from sand.

(c) The internal and external surfaces of components shall be free from burrs, fins and sharp edges. The minimum radius of edges to be protective coated shall be 3 mm.

3.13 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-faces for bolt head, nut and washer. Match machined and balanced assemblies shall be match-marked.

3.14 Balance of Rotating Elements

Individual components of the rotating element shall be first statically and dynamically balanced to a grade of G6.3 in accordance with AS 3709 at the maximum pump operating speed with the material being removed from, or near, the periphery of the component. The assembled rotating element rotating element shall be dynamically (two-plane) balanced to achieve a balance grade of G2.5 at the maximum operating speed of the pump with the material being removed from the area immediately around the seal rings.

3.15 Vibration

Vibration limits for the pumpsets shall comply with AS 2625.1 and AS 2625.4 and the following. The pumpset maximum vibration severity level shall not exceed 2.3 mm/s (r.m.s) when commissioning under full operating conditions.

3.16 Noise

The noise emitted by the pumpset shall comply with the sound power levels specified in AS 1359.109.

3.17 Electric Motor

The electric motor shall be flange mounted directly above the pump. The pumpset electric motor shall comply with the requirements of Corporation Electrical Type Specification DS 26-06 with the exception of Clauses 16, 21, 22 and 23, which either do not apply, or are covered elsewhere in this Specification.

4 Protective Coatings

4.1 General

All immersed components are required to be manufactured from non corrosive materials and therefore do not require coating. Pumpset components not subject to immersion e.g. electric motor, cast or ductile iron motor adaptor flange, motor pedestal, shaft coupling, pump head, baseplate and backing flanges (as relevant) shall be prepared and coated in accordance with the following clauses.

4.2 Preparation

Prior to coating all sharp edges, burrs, slag, and other sharp surface irregularities shall be removed. The external surfaces of cast or ductile iron components shall be prepared for coating in accordance with the relevant parts of AS 1627. Surfaces to be coated which will become inaccessible after assembly shall be prepared and coated before assembly.

4.3 Coating

The components shall be coated in accordance with Technical Specifications PA and PS.

5 Performance Tests

5.1 General

Product shall be tested in accordance with the test requirements of this Specification. Testing shall be deemed acceptable when test outcomes have been formally verified by a Certification Body or witnessed by a testing Officer. 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. A testing Officer should normally be an Officer who has specialist knowledge of or training in product or materials testing appropriate to the Product characteristics to be tested.

5.2 Notification of Testing

The Corporation shall 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 Certification Body. This notification is required to enable the Corporation to make all necessary arrangements including appointment of a testing Officer in a timely manner.

5.3 Access to the Place of Manufacture

The testing Officer shall be afforded access, at all reasonable times, to all places of manufacture of Product or product components and shall be authorised to arrange or undertake such testing there as the Corporation deems appropriate to the testing regime specified.

5.4 Place of Manufacture other than WA

Where any Product or product component is being manufactured other than in Western Australia the Corporation may appoint a local inspecting Officer to undertake inspections and witnessed testing as required. The testing Officer shall be provided with all due authority and permits required to carry out testing at the place of manufacture.

NOTE: The cost of witnessed testing arranged by the Corporation will normally be borne by the Corporation unless otherwise negotiated.

5.5 Production Tests

5.5.1 Pump Tests

Pumps shall be tested in accordance with ISO 9906, Grade 2B and shall confirm the guaranteed performance values for duty flow, head, efficiency and NPSHr.

5.5.2 Electric Motor Tests

Electrical motor tests shall comply with the testing requirements contained in Corporation Electrical Type Specification DS 26-06, Clause 28 Tests.

5.6 Test Certificates

For the purposes of acceptance, each test certificate shall, as a minimum, bear the relevant Product item serial number and shall certify that the Product item has complied with the specified test requirements. A set of test certificates shall be supplied with each valve.

6 Marking and Packaging

Each Product shall be marked and packaged in accordance with the following.

6.1 Nameplate Marking

Each pump shall have a nameplate fixed with corrosion resistant fasteners located in an easily readable position which is permanently and indelibly marked with at least the following:

6.1.1 Pump

(b) Manufacturer's name.

(c) Model and series number.

(d) Year of manufacture.

(e) Serial number.

(f) Duty head, m.

(g) Duty flow, m^3/h.

(h) Number of impellers.

(i) Inlet and outlet connection size, mm.

6.1.2 Electric Motor

(a) Manufacturer's name.

(b) Rated power in kW.

(c) Motor type.

(d) Serial number.

(e) Locked rotor current.

(f) Full load current.

(g) Voltage.

(h) Current.

(i) Power factor.

(j) Insulation class.

(k) Degree of protection.

6.1.3 Motor Thermal Switches/Thermistors/RTDs

Motors with thermal switches/thermistors/RTDs fitted shall include the following additional information on the nameplate in accordance with AS 60947.8:

(a) Manufacturer of thermal switch/thermistors/RTD.

(b) Type.

(c) Tripping temperature.

(d) Number of thermal switches/thermistors/RTDs per phase of winding.

(e) Resistance of each thermal switches/thermistors/RTD at the tripping temperature.

(f) A warning on the thermal switches/thermistors/RTD terminal box stating the following:

WARNING

THERMAL SWITCHES[1] OR THERMISTORS[1] OR RESISTANCE TEMPERATURE DETECTORS[1] INSTALLED

DO NOT MEGGER

NOTE:

1. Delete as appropriate.

6.2 Packaging

6.2.1 General

Product shall be packaged with appropriate protection, which shall 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.

6.2.2 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 number (MMR).

(b) Contract number.

(c) Purchase order number.

6.2.3 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.

7 Manuals

7.1 Format and Language

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

7.2 Content

The manuals shall contain all the relevant information required to commission and maintain the Product in operational service, including 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.

8 Spare Parts and Special Tools

8.1 Spare Parts

8.1.1 Interchangeability

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

8.1.2 Availability

Spare parts and servicing facilities for the product shall be readily available in Western Australia.

8.2 Special Tools

Any special tools required for service and maintenance of the Product shall be supplied.

9 Transportation, Handling and Storage

9.1 General

Transportation, handling and storage facilities shall be designed to prevent Product damage or defects and to maintain Product free of deleterious matter. Product shall not be dropped off elevated vehicle platforms or sites. Mechanical handling equipment shall be in accordance with AS 2550.1, AS 2550.3, AS 2550.5 and AS 2550.11 and shall be appropriate to the loads to be lifted. Manual handling shall be in accordance with the National Standard for Manual Handling and the National Code of Practice for Manual Handling, published by National Occupational Health and Safety Commission, Australia. Product restraint during transportation shall be in accordance with Load Restraint Guide—Guidelines for Safe Carriage of Loads on Road Vehicles, published jointly by the Federal Office of Road Safety and the National Road Transport Commission, Australia.

NOTE: Where wire ropes or chains are used for loading and unloading, they should not come into direct contact with Product. Lifting elements in direct contact with Product should be of a non-abrasive design e.g. elastomeric or fabric webbing straps. During transportation, Product restraints should be checked for tension at regular intervals of travel and should not be released until the transporting vehicle is resting in a secure stable disposition on level ground.

9.2 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 1646.1 Clause 6. 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.

10 Quality Assurance

10.1 Certification

10.1.1 Certification of Product

Wherever this Specification requires compliance with nominated Product and test Standards, conformance shall be certified by means of a Certification Scheme, conducted by a Certification Body. Each Certificate shall expressly attest compliance of all Product items with the nominated Standards. Wherever specified, Certificates shall be submitted to the Officer nominated for this purpose. Product shall be marked in accordance with the requirements of the Certification 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.

10.1.2 Quality System

The processes for manufacture, testing, supply, transportation, handling, delivery and storage of Product to be supplied in accordance with this Specification shall form part of a documented Quality System. The System shall be certified by a Certification 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.

10.1.3 Product Re-verification

Product compliance with the Specification 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 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 Corporation.

Wherever the requirements of the Specification 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 Specification

10.2 Compliance and Acceptance

10.2.1 Means of Demonstrating Compliance

Compliance with this Specification 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 Corporation 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 Specification including all relevant 'Technical Compliance Schedule' Appendices and the currency of a Certificate where relevant to the Product.

10.2.2 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 Specification includes Technical Compliance Schedules, the nature and extent of all non-compliances should be provided in accordance with the appropriate Schedules.

10.3 Non-compliant Product

10.3.1 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 Specification 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 Specification.

10.3.2 Manufacturing Repairs (In-Process)

Welding, the use of fillers and other repairs shall generally not be permissible on 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 Corporation 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 Corporation.

The Manufacturer shall make provision in its production Quality System and in the appropriate inspection and test plans (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 Corporation in writing that:

(a) Repair of the non-compliant components in lieu of their replacement is acceptable; and

(b) Proposed repair procedures are acceptable; and

(c) Any proposal to vary the terms of the original Product Warranty as a consequence of the in-process repair is acceptable.

10.3.3 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 Corporation against all losses suffered by the Corporation 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.

10.3.4 Product Repair

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

11 Appendix A: Project Specific Requirements (Normative)

11.1 General

Project specific information and requirements, not included elsewhere in this Strategic Product Specification, shall apply as specified in the following Clauses.

11.2 Technical Requirements

11.2.1 Mechanical

The following table details project specific requirements for the pumps to be procured.

TABLE 11.1: SCHEDULE OF PROJECT TECHNICAL REQUIREMENTS

No Off	DN Inlet/Outlet	Head m	Quantity m^3/h	Special Requirements

11.2.2 Electrical

For Project Specific electric motor requirements refer to DS 26.6 Annexure to Specification for Standard Cage Induction Motors.

Appendix B: Technical Compliance Schedules (Normative)

11.3 Compliance Schedules

Suppliers shall demonstrate Product compliance with the Specification by completing Technical Compliance Schedules 1 and 2 as shown in **TABLE 12.1** and **TABLE 12.2** on an item by item basis. The schedules basically cover the pump end.

The Supplier shall separately complete the Annexure to the Electrical Type Specification DS 26-06 which will be supplied separately and covers the electric motor.

For acceptance, the extent of scheduled technical item compliance shall be supported by verifiable documentary evidence. Each scheduled item nominates a Standard or Specification clause number with which the extent of Product compliance shall be demonstrated.

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 Specification clause by ticking the corresponding 'Noted' column wherever unshaded.

Failure to notify the Corporation 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 12.1: TECHNICAL COMPLIANCE SCHEDULE 1

Vertical Multi-Stage Centrifugal Pumps – Supplier Clause-by-Clause Response					
Clause	**Section**	**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	General				
2.2	Contamination of Water				
2.3	Corrosion-Resistant Materials				
2.4	Stainless Steel				
2.5	Dezincification-Resistant Materials				
2.6	Non-Metallic Materials				
2.7	O-Rings				
3.	**DESIGN AND MANUFACTURE**				
3.1	General				
3.2	Pump Inlet/Outlet Casing				
3.3	Pump Head				
3.4	Stage Casings				
3.5	Impellers				
3.6	Diffusers				
3.7	Pump Shaft				
3.7.1	Orientation and Construction				
3.7.2	Size and Deflection				
3.7.3	Critical Speed				
3.8	Shaft Bearings				
3.9	Mechanical Seal				
3.10	Fasteners				
3.11	Immersed Components				
3.12	Defects				
3.13	Machining				
3.14	Balance of Rotating Elements				
3.15	Vibration				

3.16	Noise				
3.17	Electric Motor (*the Supplier shall complete DS 26-06, Tender Technical Response Schedule)*				
4.	**PROTECTIVE COATINGS**				
4.1	General				
4.2	Preparation				
4.3	Coating				
5.	**PERFORMANCE TESTS**				
5.1	General				
5.2	Notification of Testing				
5.3	Access to the Place of Manufacture				
5.4	Place of Manufacture other than WA				
5.5.1	Pump Tests				
5.5.2	Electric Motor Tests				
5.6	Test Certificates				
6.	**MARKING AND PACKAGING**				
6.1	Nameplate Marking				
6.1.1	Pump				
6.1.2	Electric Motor				
6.1.3	Motor Thermal Switches/Thermistors/RTDs				
6.2.1	General				
6.2.2	Identification Tag				
6.2.3	Marking of Packaging				
7.	**MANUALS**				
7.1	Format and Language				
7.2	Content				
8.	**SPARE PARTS AND SPECIAL TOOLS**				
8.1.1	Interchangeability				
8.1.2	Availability				
8.2	Special Tools				
9.	**TRANSPORTATION, HANDLING AND STORAGE**				
9.1	General				
9.2	Preservation of Product in Storage				
10.	**QUALITY ASSURANCE**				
10.1.1	Certification of Product				
10.1.2	Quality System				
10.1.3	Product Re-verification				
10.2.1	Means of Demonstrating Compliance				
10.2.2	Acceptance Criteria				
10.3.1	General				
10.3.2	Manufacturing Repairs				
10.3.3	Product Warranty				
10.3.4	Product Repair				

The Supplier shall provide the information required by Technical Compliance Schedule 2 as shown in **TABLE 12.2**.

TABLE 12.2: TECHNICAL COMPLIANCE SCHEDULE 2

Vertical Multi-Stage Centrifugal Pumps – Supplier Technical Response					
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 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.	**SUPPLIER TECHNICAL INFORMATION**				
3.1	Performance information supplied		(Yes/No)		
3.2	Manufacturer's inspection and testing plans supplied		(Yes/No)		
3.3	Details of servicing facilities in Perth supplied		(Yes/No)		
3.4	Additional pamphlets and drawings supplied		(Yes/No)		
4.	**PUMPSET GENERAL INFORMATION**				
4.1	Manufacturer's name				
4.2	Place of manufacture				
4.3	Pumpset type e.g. vertical multi-stage centrifugal				
4.4	Pumpset model				
4.5	Flow capacity range	m^3/h			
4.6	Maximum head	m			
4.7	Inlet/outlet connection size (DN)	mm			
4.8	Flanges standard				
4.9	Speed	rev/min			
4.10	Number of stages				
4.11	Impeller type e.g. open, semi-open, closed				
4.12	Impeller diameter	mm			
4.13	Impeller fixing				
4.14	Pump shaft 1st critical speed for max. dia. impeller	rev/min			
4.16	Vibration severity	mm/s r.m.s			
4.17	Maximum sound power level	dB(A)			
4.18	Mechanical seal type				
4.19	Pumpset mass	kg			
5.	**PUMP PERFORMANCE**				
5.1	Duty flow rate	m^3/h			
5.2	Duty head	m			
5.3	Pump efficiency at duty	%			
5.4	Duty power	kW			
5.5	Duty NPSHr	m			
5.6	NOL power for duty impeller	kW			
5.7	Shut-off head for duty impeller	m			
6.	**PUMP COMPONENT MATERIALS**		**MATERIAL**	**STANDARD**	**GRADE**
6.1	Motor adaptor flange, motor pedestal				
6.2	Baseplate (if relevant), backing flanges				
6.3	Shaft coupling				
6.4	Coupling guard				

6.5	Mechanical seal faces - rotating/stationary			
6.6	Mechanical seal springs			
6.7	Mechanical seal flange			
6.8	Pump head			
6.9	Top sealing plate			
6.10	O-rings and seals			
6.11	Shaft			
6.12	Drive keys			
6.13	Stay bolts			
6.14	Internal fasteners			
6.15	Drain and priming plugs			
6.16	Shaft bearing sleeve or bush, inlet bearing bush			
6.17	Inter-stage bearing bush			
6.18	Impellers, diffusers, inner and outer chamber sleeves			
6.19	Casing wear rings or neck ring			
6.20	Inlet/outlet casing			
6.21	External fasteners			
6.22	Coating			
7.	**ELECTRIC MOTOR**			
7.1	Electric Motor (refer to the right hand column requirements)	*The Supplier shall complete DS 26-06, Tender Technical Response Schedule*		

Name of Supplier:

Signature: Date:

12 Appendix C: Material Master Records (Informative)

The following Material Master Records (MMR) comprise Corporation catalogue numbers that are unique to the particular products described for the purposes of Corporation activities or work.

MMR	PURCHASE ORDER LONG TEXT
68976	Pump, Centrifugal; Vertical, Multi-Stage Centrifugal Pump; 5-Stages; DN25/32 Inlet/Outlet Connection; Flanges DIN/ANSI/JIS; Rated Flow 0.9m3/h; Rated Head 21.1m; Operating Pressure 25 Bar; HQQE Shaft Seal, Single; Stainless Steel Base and Impeller; Cast Iron Pump Head and Motor Mounting Flange; Flange Size FT85; 3 Phase Fan Cooled Motor; 2-Pole; 3 x 220-240D/380-415Y V, 50Hz; 0.37kW; Rated Speed 2850-2880 Rpm; IP55 Rated Enclosure; Grundfos Model: CRI 1S-5 A-FGJ-A-E-HQQE.
22850	Pump, Centrifugal; Vertical Multi-Stage; Sample Return Pump; Grundfos CRN 1-5; 1.8m3/H Rated Flow; 24m Rated Head; Pump Speed 2575 Rpm; HQQV Shaft Seal; 5 Stage; DN25/32 Pipe Connection; Pressure Stage PN25; 316 Stainless Steel Pump Base and Impeller; Motor Type 71B; 2 Pole; 1 x 220-230/240V, 0.37kW, 50 Hz; FT85 Din Flange; Model: CRN 1-5 A-FGJ-A-V-HQQV. To suit Mt Walker (Mt Roe Dam) Electrochlorination System.
61981	Pump, Centrifugal; Vertical Multi-Stage; Grundfos CRN10-1; Rated Flow: 10m3/H; Rated Head: 7.1m; Pump Speed 2873 Rpm; HQQV Shaft Seal; 2 Stage; DN40 Pipe Connection; Pressure Stage PN16; 316 Stainless Steel Pump Housing; Motor Type 71A; 2 Pole; 3 x 220-240 D/380-415 Y V, 0.37kW, 50 Hz; Din Flange, FT85; Model: CRN10-1 A-FGJ-G-V-HQQV.
61980	Pump, Centrifugal; Vertical Multi-Stage; Grundfos CRN1S-3; 0.37 kW, 50 Hz; HQQV Shaft Seal; DN25/DN32 Pipe Connection; Triple Stage; In-Line Suction and Discharge Ports; 316 Stainless Steel Pump Housing; Fitted with Single Phase Fan Cooled Motor; CRN1S-3,X-FGJ-G-V-HQQV.
61674	Pump, Centrifugal; Vertical Multi-Stage; Grundfos CRN3-2; Rated Flow 3m3/H; Rated Head 9.6m; Pump Speed 2757 Rpm; HQQE Shaft Seal; 3 Stages; 59mm Pipe Connection; 316 Stainless Steel Pump Housing; Motor Type 71B; 2 Pole; 220/240 Vac, 0.37kW, 50 Hz; Clamp Flange, FT85; Model: CRN3-2 A-CA-G-E-HQQE.
61901	Pump, Centrifugal; Vertical Multi-Stage; Grundfos CRN3-2; Rated Flow 3m3/H; Rated Head 9.6m; Pump Speed 2873 Rpm; HQQV Shaft Seal; 3 Stages; DN25/DN32 Pipe Connection; Pressure Stage PN16/PN25; 316 Stainless Steel Pump Housing; Motor Type 71A; 2 Pole; 3 x 220-240 D/380-415 Y V, 0.37kW, 50 Hz; Din Flange, FT85; Model: CRN3-2 A-FGJ-G-V-HQQV.
67292	Pump, Centrifugal; Vertical Multi-Stage; Grundfos CRN90-1; Rated Flow 90m3/H; Rated Head 20.2m; Pump Speed 2919 Rpm; HQQE Shaft Seal; 1 Stage; DN100 Pipe Connection; Pressure Stage PN16; 316 Stainless Steel Pump Housing; Motor Type 132SB; 2 Pole; 3 x 220-240 D/380-415 Y V, 7.5kW, 50 Hz; Din Flange, FF265; Model: CRN90-1 A-F-G-E-HQQE.
67295	Pump, Centrifugal; Vertical Multi-Stage; Grundfos CRN90-1; Rated Flow 90m3/H; Rated Head 20.2m; Pump Speed 2919 Rpm; HQQV Shaft Seal; 1 Stage; DN100 Pipe Connection; Pressure Stage PN16; 316 Stainless Steel Pump Housing; Motor Type 132SB; 2 Pole; 3 x 380-415 D/660-690 Y V, 7.5kW, 50 Hz; Din Flange, FF265; Model: CRN90-1 A-F-G-V-HQQV.

MMR	PURCHASE ORDER LONG TEXT
68464	Pump, Centrifugal; Vertical Multi-Stage; Grundfos CR1-8; Rated Flow 1.8m3/H; Rated Head 38.6m; Pump Speed 2856 Rpm; HQQE Shaft Seal; PN16; Rp1 Pipe Connection; Cast Iron Pump Housing; Stainless Steel Impeller; Motor Type 71B; 2 Pole; 3 x 230/400 50Hz, 0.55kW; Flange Size FT85; Model: CR1-8 A-A-A-E-HQQE.
69015	Pump, Centrifugal; Vertical Multi-Stage; Grundfos Model CRN1S-2; Rated Flow 0.9m3/h; Rated Head 8.7m; Pump Speed 2873 Rpm; HQQV Shaft Seal Code; PN25; DN25/32 Inlet/Outlet Connection; DIN/ANSI/JIS Flanges; 316 Stainless Steel Base and Impeller; Motor Type 71A; 3 Phase; 2 Pole; 3 x 220-240D/380-415Y V; 50Hz; 0.37kW; Motor Flange FT85; IP55 Rated Enclosure; Model: CRN1S-2 A-FGJ-A-V-HQQV.
69412	Pump, Centrifugal; Vertical Multi-Stage; Grundfos Model CRN 3-3; Rated Flow 3m3/h; Rated Head 15.1m; Pump Speed 2873 Rpm; PN25; HQQV Shaft Seal; DN25/32 Inlet/Outlet Connection; DIN/ANSI/JIS Flanges; Sic/Sic Bearing; 316 Stainless Steel Base, Housing and Impeller; Motor Type 71A; 3 Phase; 2 Pole; 3 x 220-240D/380-415Y V; 50Hz; 0.37kW; Motor Flange FT85; IP55 Rated Enclosure; Model: CRN 3-3 A-FGJ-A-V-HQQV.
69411	Pump, Centrifugal; Vertical Multi-Stage; Grundfos Model CRN 3-4; Rated Flow 3m3/h; Rated Head 19.1m; Pump Speed 2873 Rpm; PN25; HQQV Shaft Seal; DN25/32 Inlet/Outlet Connection; DIN/ANSI/JIS Flanges; Sic/Sic Bearing; 316 Stainless Steel Base, Housing and Impeller; Motor Type 71A; 3 Phase; 2 Pole; 3 x 220-240D/380-415Y V; 50Hz; 0.37kW; Motor Flange FT85; IP55 Rated Enclosure; Model: CRN 3-4 A-FGJ-A-V-HQQV.
69261	Pump, Centrifugal; Vertical Multi-Stage; Grundfos Model CRN 5-5; Rated Flow 5.8m3/h; Rated Head 24.1m; Pump Speed 2864 Rpm; PN25; 5 Stages; 5 Impellers; HQQV Shaft Seal Code; FKM Seals; DN32 Suction and Discharge Ports; PJE Coupling (Victaulic Type); Cast Iron Pump Head and Base; All other Wetted Parts in Stainless Steel (EN 1.4301); Oversize Motor; 3 Phase; 2 Pole; 3 x 230/400V, 50Hz; Motor Flange FT115; Grundfos Model: CRN 5-5 B-P-A-V-HQQV.
61948	Pump Unit, Centrifugal; Vertical, Multistage Centrifugal Pump and Motor Assembly; DN40; PN16; DIN-JIS Flanged; Type 112MC Motor; 3 Phase, 3 x 380-415D V, 4kW; Flow Rated 10m3/h; HQQE Shaft Seal; Cast Iron Pump Housing/Base; Stainless Steel Wetted Parts; Grundfos CR10-10 A-FJ-A-E-HQQE.

END OF DOCUMENT