



Assets Planning and Delivery Group
Engineering

Strategic Product Specification

SPS 230 Rapid Response Non-Return Valves

VERSION 1
REVISION 2

JANUARY 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.

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REVISION STATUS

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

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Strategic Product Specification

SPS 230

Rapid Response Non-Return Valves

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1 Scope and General

1.1 Scope

This Specification sets out requirements for the manufacture, supply, handling and delivery of rapid response non-return valves designed to limit water hammer pressure rises under conditions of rapid flow reversal. The Specification also details the means by which compliance with the Specification shall be demonstrated and the criteria for acceptance of the valves.

Classification covers valve Pressure Classes PN 16, 21, 25 and 35 for size DN 300 to DN 1800 inclusive, with the maximum temperature of the operating fluid not exceeding 40°C.

This Specification covers valves for the following applications:

- (a) Water supply applications including drinking, raw and recycled water.
- (b) Where the system deceleration will be 5 m/s² or higher.
- (c) Where for environmental reasons it is desirable to minimize hydraulic noise during flow or as a consequence of closure.

NOTES:

1. Non slam valves are also referred to as nozzle check valves.
2. Valves are not suitable for use in sewage or where solids or fibrous material may be present.

1.2 Referenced Documents

The following documents are referenced in this Specification:

AS

- | | |
|---------|--|
| 1646 | Elastomeric seals for waterworks purposes |
| 1646.1 | General requirements |
| 1831 | Ductile cast iron |
| 2074 | Cast Steels |
| 2317 | Collared eyebolts |
| 2550.1 | Cranes, hoists and winches Safe use - General |
| 2550.3 | Cranes, hoists and winches Safe use – Bridge, gantry, portal (including container cranes), jib and monorail cranes |
| 2550.5 | Cranes, hoists and winches Safe use – Mobile cranes |
| 2550.11 | Cranes, hoists and winches Safe use – Vehicle loading cranes |
| 3894.1 | Site testing of protective coating - Non-conductive coatings – Continuity test – High voltage (“brush”) method |
| 4087 | Metallic flanges for waterworks purposes |

AS/NZS

- | | |
|--------|--|
| 3679.1 | Structural steel – Hot rolled bars and sections |
| 4020 | Products for use in contact with drinking Water Corporation |
| 4158 | Thermal-bonded polymeric coatings on valves and fittings for water industry purposes |
| 4680 | Hot-dip galvanized (zinc) coatings on fabricated ferrous articles |

EN

EN1092-1 Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges

EN1092-2 Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 2: Cast iron flanges

AS/NZS ISO

9001 Quality management systems – requirements

ISO/IEC

17025 General requirements for the competence of testing and calibration laboratories

ASTM

A216 Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service

A240 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

A351M 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

A536 Standard Specification for Ductile Iron Castings

A593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

A743 Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

A890M Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Applications

Corporation Coating Specifications

DS95 Standard for the Selection, Preparation, Application, Inspection and Testing of Protective Coatings on Water Corporation Assets

1.3 Definitions and Notation

1.3.1 Allowable Operating Pressure

The maximum allowable steady-state internal pressure which the valve can safely withstand in service.

1.3.2 Coating

A corrosion-inhibiting medium applied to the product surface.

1.3.3 Coating Defect

A physical defect in the corrosion-inhibiting medium applied to the product surface.

1.3.4 Compliant Product

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

1.3.5 Corporation

The Water Corporation of Western Australia.

1.3.6 Disc

The primary moving component of the valve (e.g. obturator).

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 (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

1.3.9 Non-Return Valve

A valve which prevents reversal of flow by automatic closure of a plate, flap, disc or other mechanism.

1.3.10 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.

1.3.11 Officer

A duly authorised representative or appointed agent of the Corporation.

1.3.12 Pressure Class (PN)

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

1.3.13 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.

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.

1.3.14 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.

1.3.15 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.

1.3.16 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.

1.3.17 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.

1.3.18 Product Warranty

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

- In conformity with the nominated product specification and referenced standards;
- Fit for the nominated Product end use or application;
- Designed for sustained operation at the nominated service performance levels for the specified design life;
- Adequately packaged for intended transportation, handling and storage conditions;
- Supported by English language installation, operating and servicing instructions;
- 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.

1.3.19 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.

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 specified test procedures.

1.3.24 Valve

Valve or valves shall mean rapid response non-return valve or valves supplied in new unused condition. Valves are also known as non slam non-return valves or nozzle check valves.

1.3.25 WSAA

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

1.4 Nomenclature

$V_{D.P.}$ =	water velocity based on D for steady state pipeline operation at the Duty Point given in Purchasing Schedule.	[m/s]
V_0 =	critical water velocity based on D_i required to fully open valve, guaranteed at time of Tender.	[m/s]
V_R =	Reverse velocity based on D_i at the point of valve closure, guaranteed at time of Tender.	[m/s]
V_S =	steady state velocity based on D_i	[m/s]
dv/dt =	deceleration of the water column based on D_i	[m/s]
D_i =	The nominal diameter of the valve based on the inlet diameter.	[m]
D =	diameter of pipework downstream of valve, up to first enlargement	[m]
a =	celerity	[m/s]
K =	bulk modulus of elasticity of water = 2.1×10^9	[Pa]
ρ =	density of water	kg/m ³
C_1 =	constant for pipework restraint = 0.91 (for the purposes of this Contract)	
E =	Young's modulus for steel	[Pa]
e =	shell thickness of discharge pipe	[m]
g =	acceleration due to gravity	[m/s ²]
H =	pressure rise above steady state pressure due to stoppage	[m]

of reverse flow at valve closure, used as a basis for guarantees at time of Tender.

$$\Delta p = \text{pressure drop across the valve.} \quad [\text{Pa}]$$

1.5 Designation of Size

Valve size shall be designated by the nominal size as follows: DN 300, *DN 350*, DN 400, *DN 450*, DN 500, *DN 550*, DN 600, *DN 650*, DN 700, DN 800, *DN 850*, DN 900, *DN 950*, DN 1000, *DN 1050*, DN 1200, DN 1400, DN 1600 and DN1800.

NOTES:

1. Sizes shown in italics are non-preferred.
2. Where practicable, the valve selected should be of the preferred size, however dynamic performance is more important than size in considering the selection criteria.

1.6 Allowable Operating Pressure and Required Test Pressures

Allowable operating and required test pressures shall be as shown in Table 1.1.

TABLE 1.1 – ALLOWABLE OPERATING AND REQUIRED TEST PRESSURES

Class of Valve	Allowable Operating Pressure, kPa	Seal Hi Test Pressure kPa	Seal Lo Test Pressure kPa	Body Test Pressure, kPa
16	1600	1760	600	2400
21	2100	2310	600	3150
25	2500	2750	600	3750
35	3500	3850	600	5250

2 Materials and Components

2.1 General

Materials and components for raw water or drinking water service shall comply with the requirements of Table 2.1. The materials listed are minimum acceptable standard materials. Other materials may be used, provided they are equivalent in performance, particularly with respect to strength, corrosion-resistance, valve operation and durability.

TABLE 2.1 – MINIMUM MATERIAL REQUIREMENTS

Valve Components	Materials	Standard and Grade	
Body <= DN300	Stainless Steel	A351M	CF-8M
Body >DN300	Ductile cast iron	AS 1831 ASTM A536	400-12, 500-7 60-40-10
	Carbon Steel	ASTM A216	WCB
Body seat	Stainless steel	AS 2074 ASTM A351M ASTM A743	H6C CF-8M 316ti
Disc	Stainless Steel	ASTM A240 A351-M	316 CF-8M
	Duplex stainless steel	ASTM A890M	4A, 5A
Disc stem	Stainless Steel	ASTM A276	316
	Duplex stainless steel	ASTM A276 ASTM A 890M	UNS S31803 H6C
Spring	Stainless steel	ASTM A313M	316, 316ti
Disc seal (where applicable)	EPDM, NBR	AS 1646	-
Stem guide housing	Stainless steel	ASTM A276	316, 316ti
Guide bush	Glass filled teflon	-	-
Fasteners	Stainless steel	ASTM A276 ASTM A593	316, 316ti
O-rings	EPDM, NBR	AS 1646	-

2.2 Corrosive Water Service

Where specified in the Purchasing Schedule (Table 11.1), valves required for service in seawater, brine, brackish or highly corrosive water, shall have ferrous components, which are in contact with the water, manufactured from suitable grades of duplex stainless steel.

2.3 Contamination of Water

Components in contact with drinking water shall comply with AS/NZS 4020. International equivalent certification may be accepted subject to approval.

2.4 Stainless Steel

2.4.1 Welding, Heat Treatment and Passivation

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.

2.4.2 Graphite Compounds

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.

2.4.3 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 HB) fitted with grade 316 stainless steel nuts (217 HB);
- (b) Use of food grade anti-seize lubricant (grease) when fitting stainless steel fasteners;
- (c) Provision of surfaces that do not promote galling e.g. rolled threaded stainless steel fasteners in lieu of machined threads;
- (d) Selection of close tolerance bolts and nuts;
- (e) Eliminating contaminants (grit) during fitting and operation of susceptible components;
- (f) Adopting material design loads which are below those that would produce galling.

2.5 Non-metallic Materials

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

2.6 Immersed Components

All continuously immersed components shall be manufactured from corrosion-resistant materials except for ductile cast iron components which shall be coating in accordance with the Coating section of this Specification. Components in contact with each other shall be designed so as to minimise galvanic corrosion via insulation or optimal selection.

2.7 Elastomeric Materials

Elastomeric materials shall be made of material that is not injuriously affected by the fluid, temperature or environmental conditions to which the material will be subjected in service.

2.8 Castings

Castings shall be close, with uniform grain and homogeneous, and 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 castings may be repaired providing approval is obtained from the Officer in accordance with Clause 10.3.2 Manufacturing Repairs (In-process).

3 Design

3.1 General

The valve shall be of the rapid response non-return type, designed for rapid closure under the effect of high system deceleration. The valve shall exhibit smooth and stable operation for the flow conditions specified in the Purchasing Schedule (Table 11.1).

Valves shall be double flanged, designed for use with the axis of the body and ports in the horizontal position, or for vertical up-flow, and shall be suitable for above ground service.

The design criteria of the valve and fasteners should be based on a minimum life expectancy of 50 years.

3.2 Valve Selection

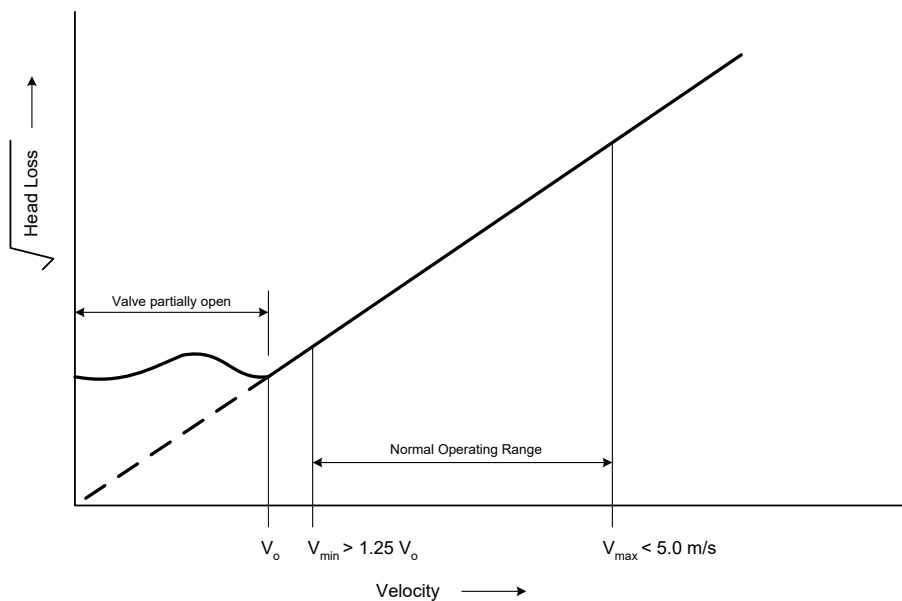
3.2.1 Flow Velocities

The valve shall be selected to operate within the following velocity boundaries:

- (a) The minimum steady state velocity shall be determined on the basis of the critical velocity, V_0 required to fully open valve, based on the valve inlet diameter, D_i .

V_0 shall not exceed 0.8 times the minimum steady state velocity of the pipe. Preferred values of V_0 are between 0.7 and 0.8. Lower values of V_0 are to be avoided.

- (b) The maximum steady state velocity in the valve shall not exceed 5.0 m/s



NOTES:

1. It is expected that the flow velocities in the system may vary depending on the system design (refer Purchasing Schedule – Table 11.1). Valve size selection will be greatly influenced by the flow velocities through the valve, and it is expected that the valve size will be less than the pipeline nominal diameter.
2. In applications where the system deceleration is high, the valve configuration is likely to include high strength springs to increase the valve's dynamic response to system deceleration. Care must be taken to not oversize the valve and thus cause the valve to operate in a partially open condition.

3.2.2 Dynamic Response

The valve shall be selected to produce a dynamic response to rapid flow reversal that:

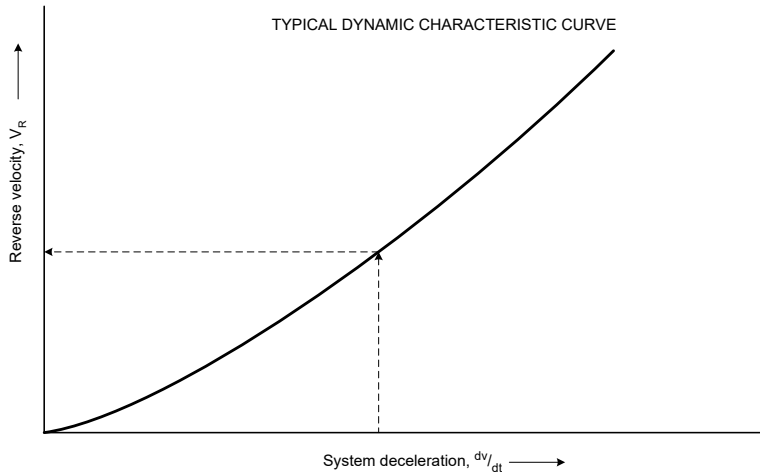
- (a) is sufficient to limit any reverse flow to a value which will keep the transient pressure rise to an acceptable level (see below); and,

- (b) will limit slamming of the valve moving element on its seat so that the seat shall have a long, maintenance-free life under the specified service conditions.

The dynamic response of the valve to various system decelerations shall be described in the form of a tabulation and a graph (for the particular valve to be supplied) of the resulting reverse velocity, V_R through the valve caused by the system deceleration,

The tabulated values shall be verified results of type tests carried out by an accredited hydraulics laboratory and shall be provided by the Supplier.

3.2.3 Acceptable Reverse Velocities



The acceptable *reverse velocity*, V_R shall be determined as follows:

1. The transient pressure rise that is caused at valve closure added to the system pressure at the time of valve closure shall not exceed the allowable operating pressure of the valve.
2. The *reverse velocity*, V_R shall not exceed the following values:

Operation	Environmentally sensitive locations	Remote locations
Normal steady state operation	0.15 m/s	0.20 m/s
Less frequent operation (<10% of cycles)	0.20 m/s	0.25 m/s
Infrequent operation ($\leq 1\%$ of cycles)	0.25 m/s	0.30 m/s

3.3 Body

The valve shall be long body style unless otherwise stated in the Purchasing Schedule (Table 11.1). The body shall incorporate streamlined flow passages based on the venturi principle in order to provide smooth flow transition and to minimize pressure drop, turbulence and eddies due to separation.

The stem guide housing shall be fitted with low friction bushes (where the valve design incorporates a disc stem) that shall exhibit dimensional stability when continuously immersed in water. Non stem type valves shall incorporate a low friction guidance system.

3.4 Body Seat(s)

The valve body shall incorporate a replaceable seat or seats which shall be fully machined and securely fixed into a machined recess(s) in the valve body. Threaded seats shall not be permitted unless a watertight seal, preventing ingress to the tread, is guaranteed. The internal surface of the seat shall be shaped to provide a streamlined nozzle entry and conform to the body waterway profile.

3.5 Valve Disc

The disc shall be of low inertial mass to enable rapid dynamic response. The valve disc shall be profiled to suit the waterway venturi shape and shall be machined and lapped to seat drip tight at the onset of reverse flow.

3.6 Disc Stem

Where the valve design incorporates a disc stem, it shall have a length/diameter ratio and surface finish that will provide a smooth operation without the tendency for cocking or sticking in the bushes. Use of anti-rotation pins on the stem shall not be permitted.

3.7 Spring(s)

The valve shall be designed so that with the disc in the fully open position the spring(s) and guide(s) are protected from impingement by the water flow through the valve waterway. The spring(s) shall be of stiffness appropriate to the system deceleration value shown in the Purchasing Schedule (Table 11.1).

3.8 End Connections

The valve end connections shall be double-flanged to AS 4087, as nominated in the Purchasing Schedule (Table 11.1). The flanges shall be parallel, flat or raised faced and shall be suitable for contact with narrow face gaskets in accordance with AS 4087.

Flange sizes and rating outside the scope of AS 4087 shall comply with EN 1092.

Flanges shall be machined such that the bore of the valve body is circular and concentric with the bolt P.C.D. to within 3 mm. The backs of flanges shall be machined or spot faced for the seating of bolts and nuts.

3.9 Lifting Points

Valves exceeding 25 kg shall be provided with at least one lifting point. Collared eyebolts shall comply with AS 2317.

3.10 Mountings and Supports

Where floor mounting supports (for valves installed horizontally) are required in the Purchasing Schedule (Table 11.1), they shall be capable of resisting the dead weight and all operational loads. Supports shall be fabricated from steel to AS 3679.1, grade 250 and shall be provided with adequate anchorage to foundations.

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

Where founded on a concrete surface an allowance shall be made in the length of the supports for a mortar pad, 25mm thick.

4 Protective Coatings

4.1 General

Valves with ductile cast iron body shall be internally and externally coated with a polymeric coating in accordance with AS/NZS 4158 or an epoxy coating in accordance with Corporation Technical Specifications DS 95.

Stainless steel valves shall not be coated internally or externally.

4.2 Coating Design

The coating system shall be fully effective for all internally wetted surfaces and restricted to ductile iron components only. The coating of the ductile cast iron body at all component interfaces shall form a complete seal in order to prevent formation of galvanic couples. This includes interfaces for the guide housing, bearings, seat(s), seat-retaining fasteners and all other components, which shall be sealed via the coating or an effective thread sealant.

5 Testing

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 14 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 Tests at Manufacturer's Works

5.5.1 General

Each valve shall be tested with water in accordance with Clauses 5.5.3 to 5.5.5. Leakage at pressure-containing joints shall not be a cause for failure of the test. Valve coatings shall be tested in accordance with Clause 5.5.7.

5.5.2 Material Tests

Where requested in the Purchasing Schedule (Table 11.1) material test certificates shall be provided by the valve manufacturer.

5.5.3 Body Test

Before any coatings are applied or components assembled, the cast body of the valve shall have end connections blanked off. The valve shall then be subjected to a hydrostatic pressure of 1.5 times the allowable operating pressure for the particular class of valve shown in Table 1.1, for a period of 10 minutes. There shall be no leakage through the body nor shall any part be permanently deformed.

5.5.4 Disc Strength Test

The coated and assembled valve shall have the outlet end connection blanked off and the inlet shall be open to atmospheric pressure. With the disc in the closed position, the outlet of the valve shall be

subjected to a hydrostatic pressure of 1.5 times the allowable operating pressure for the particular class of valve shown in Table 1.1, for a period of 10 minutes. There shall be no leakage through the disc or body of the valve, nor any permanent deformation. Minor seat leakage is permitted.

5.5.5 Valve Seat Test (Hi Pressure)

The outlet end connection of the valve shall be blanked off and the inlet shall be open to atmospheric pressure. With the disc in the closed position, the outlet of the valve shall be subjected to a hydrostatic pressure (refer also table 1.1) of 1.1 times the allowable operating pressure for the particular class of valve shown in Table 1.1, for a period of 5 minutes.

There shall be no leakage through the seat (or casting) for resilient seated valves. For metal-to-metal seated valves the leakage rates shall be no greater than 5 mL/min for valves \leq DN 600 and 10 ml/min for valves $>$ DN 600. There shall be no permanent deformation of the components.

5.5.6 Valve Sensitivity Test (Lo Pressure)

Following the valve seat test an additional seat test shall be conducted in the same manner at a pressure of no greater than 600kPa with the same duration and acceptance leakage criteria applicable.

5.5.7 Coating Tests

All coated surfaces shall be tested in accordance with AS/NZS 4158. The entire coated surface (except for external corners or embossed areas) shall be tested for coating continuity using a fully variable DC high voltage holiday detector in accordance with AS 3894.1 using a voltage of 5V/micron of coating thickness. Defects found during testing may be repaired, where allowable, in accordance with AS/NZS 4158. Where a coating defect cannot be repaired, the valve shall be rejected.

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.

5.7 Site Validation Tests

5.7.1 General

Site validation tests may, at the Corporation's sole discretion, be performed at the commissioning stage of the project by a nominated representative of the Corporation. Where the results of these tests are inconsistent with the guaranteed performance of the valve, the valve Supplier may:

- Undertake additional testing, where practical, to prove the specified performance of the valve
- Rectify or replace the valve, to meet the specified performance parameters.

The tests are generally intended for larger valves (\geq DN300) and more critical hydraulic systems. However the Corporation reserves the right to perform the full range of tests and reject any valve that fails to meet guaranteed performance parameters.

5.7.2 Dynamic Performance Guarantees

The Supplier shall guarantee the performance of the valves to be supplied.

Performance characteristics to be guaranteed are:

- (a) Head loss across the valve at the specified duty point velocity, $V_{D.P.}$ (Refer to the Purchasing Schedule – Table 11.1).
- (b) A critical velocity for valve opening, V_0 , as a ratio of the specified duty point velocity, $V_{D.P.}$ (Refer to the Purchasing Schedule – Table 11.1).

- (c) A maximum reverse velocity in the valve inlet, V_R , at the value for fluid deceleration in the valve inlet, $\frac{dv}{dt}$, specified in Purchasing Schedule (Table 11.1).
- (d) A dynamic performance characteristic curve of maximum reverse velocity in the valve inlet, V_R , versus fluid deceleration in the valve inlet, $\frac{dv}{dt}$, for a range of deceleration values from 0.5 to 1.3 times the value stated for fluid deceleration in Item (c) above.

5.7.2.1 Head Loss Tests

Measurements shall be made of the differential pressure, Δp , upstream to downstream of the valve tested, at flow rates ranging from $0.5V_{D.P.}$ to $1.3V_{D.P.}$. At least seven readings shall be made, at points equally spaced in the range, with additional readings taken as required.

The results will be tabulated and graphed as $\sqrt{\Delta p}$ versus steady state velocity, V_S

5.7.2.2 Reverse Velocity Tests

The flow delivered to the valve to be tested shall be stopped from a steady state operating condition, and the pressure of the pipeline downstream of the valve being tested recorded, using a high speed data logger.

A record of pressure versus time shall be scaled to show:

- (a) the full resulting pressure rise;
- (b) a time scale with divisions of not less than 0.1 seconds per centimetre.

At least two sets of tests shall be carried out for each valve tested.

In instances where the valves are installed on the discharge of pumps and there are multiple pumps discharge into the same pipeline, additional tests shall be carried out with several pumps in the pumping station continuing to operate while the pump associated with the valve being tested is tripped off line.

5.7.3 Interpretation of Test Results

5.7.3.1 Head Loss at Duty Point Flow Rate

The graph of $\sqrt{\Delta p}$ versus steady state velocity, V_S , shall be used to determine the pressure loss (Δp) across the valve at the specified duty point flow rate.

5.7.3.2 Critical Velocity

The graph of $\sqrt{\Delta p}$ versus steady state velocity, V_S , shall be used to determine the critical velocity at which the valve is fully open, V_0 :

The critical velocity (test), V_0 , is determined as the velocity at which the slope of the curve becomes constant and intersects the origin.

The critical velocity (test), V_0 , shall not exceed 1.1 times the critical velocity guaranteed, or 0.88 times the Duty Point velocity, $V_{D.P.}$

5.7.3.3 Maximum Reverse Flow at Duty Point Flow Rate

The high speed data log of pressure versus time shall be used to determine:

- (a) The reverse velocity at the point of valve closure (under test), V_R .
- (b) The fluid deceleration in the valve inlet (under test), $\frac{dv}{dt}$.

The method of determination shall be as follows:

- (i) The celerity of the water in the discharge pipework up to the first significant increase in pipe diameter shall be calculated using the formula:

$$a = \left(\frac{K}{\rho}\right)^{0.5} \left(1 + C_1 \cdot \frac{K \cdot D}{E \cdot e}\right)^{-0.5}$$

- (ii) The reverse velocity at the point of valve closure (test) shall be determined by measuring the first sharp rise in pressure and applying the formula:

$$V_R = \frac{g \cdot H}{a} \left(\frac{D}{D_i}\right)^2$$

- (iii) The average deceleration of the water column (test) shall be determined using the time measured from the chart recorder trace and applying the formula:

$$\frac{dv}{dt} = 1.08 \times \left(\frac{V_S + V_R}{t}\right)$$

where, t = the time shown on the trace from the point where there is a change in the general slope of the trace indicating tripping of the pump to the first abrupt pressure rise indicating closure of the valve on reverse flow, and the factor 1.08 is applied to compensate for non-linearity of the water column deceleration.

From the value of $\frac{dv}{dt}$ thus determined, the value of $V_{R (guarantee)}$ shall be read from the graph of V_R versus $\frac{dv}{dt}$ provided by the Supplier (refer Clause 3.2.3).

The reverse velocity at the point of valve closure (test), $V_{R (test)}$, shall not exceed 1.15 times $V_{R (guarantee)}$.

6 Marking and Packaging

6.1 Marking

6.1.1 Body Markings

Each Product 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 using corrosion resistant fasteners:

- (a) Manufacturer's name or trademark.
- (b) Nominal diameter (DN)
- (c) Year of manufacture.
- (d) Valve Pressure Class
- (e) Serial number
- (f) Direction of flow.

Cast lettering shall be as large as practicable.

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 (Table 11.1) 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 (Table 11.1) 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

Where required, Product 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 Interchangeability

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

8.2 Availability

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

8.3 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 or unloading, these 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. 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:

- Substantive change in Product design, material formulation or performance
- 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 (Table 11.1).

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

- nominate applicable Product Warranty terms; and
- provide documentary verification in the form of a current valid Certificate or Product Verification Report as appropriate to the Product; and
- 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 ITP's 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

Table 11.1 details project specific requirements for the valves to be procured.

TABLE 11.1: SCHEDULE OF PROJECT TECHNICAL REQUIREMENTS

Project Requirements	Clause	Item/Option ¹
Number of valves required	-	
Pressure class - PN	1.6	
Standard materials required ² (Table 2.1)	2.1, 2.2	
Duty flow rate	L/s	3.2, 5.7.2
Duty head	m	3.2, 5.7.2
Duty maximum velocity	m/s	3.2, 5.7.2
Duty minimum velocity	m/s	3.2, 5.7.2
Maximum reverse velocity V_R	m/s	3.2.3
Body style required e.g. long or compact ³	3.3	
System deceleration ($\frac{dv}{dt}$)	m/s ²	3.7
Flanged connection standard ⁴	3.8	
Mountings and supports ⁵	3.10	Required/Not required
Material test certificates ⁶	5.5.2	Required/Not required
Site validation test required	5.7.1	Required/Not required
Supplier to provide and install site testing instrumentation		Required/Not required
Identification tag required	6.2.2	Required/Not required
Marking of packaging required	6.2.3	Required/Not required

NOTES:

1. Purchaser to nominate whether required or not required.
2. For highly corrosive applications (Clause 2.2) special materials should be specified e.g. duplex stainless steel
3. Long body style valves are normally required. Capital vs operating cost (long vs short) should be considered
4. Flange standard is normally to AS 4087. EN1092 may be specified for PN25 applications.
5. If mounting supports are required, provide drawings showing relevant dimensions for design of the supports
6. Material certificates would only be required for critical projects where Supplier quality could be an issue

12 Appendix B: Technical Compliance Schedules (Normative)

12.1 Compliance Schedules

Suppliers shall demonstrate Product compliance with the Specification by completing Technical Compliance Schedule 1 as shown in **TABLE 12.1** on an item by item basis. For acceptance, the extent of scheduled technical item compliance shall be supported by verifiable documentary evidence. Each scheduled item nominates a 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

Non Slam Non-Return Valves					
Section/Clause		Noted	Compliance		Comments
			Yes	No	
1. SCOPE AND GENERAL					
1.1	Scope				
1.2	Referenced Documents				
1.3	Definitions and Notations				
1.4	Nomenclature				
1.5	Designation of Size				
1.6	Allowable Pressure				
2. MATERIALS AND COMPONENTS					
2.1	General				
2.2	Corrosive Water Service				
2.3	Contamination of Water				
2.4	Stainless Steel				
2.4.1	Welding, Heat Treatment and Passivation				
2.4.2	Graphite Compound				
2.4.3	Galling				
2.5	Non-metallic Materials				
2.6	Immersed Compounds				
2.7	Elastomeric Materials				
2.8	Castings				
3. DESIGN					
3.1	General				
3.2	Valve Selection				
3.2.1	Flow velocities				
3.2.2	Dynamic Response				
3.2.3	Acceptable Reverse Velocities				
3.3	Body				
3.4	Body Seat(s)				
3.5	Valve Disc				
3.6	Disc Stem				
3.7	Disc Spring(s)				
3.8	End Connections				
3.9	Lifting Points				
3.10	Mountings and Supports				
4. COATINGS					
4.1	General				
4.2	Coating Design				
5. TESTING					

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	Tests at Manufacturer's Works				
5.5.1	General				
5.5.2	Material Tests				
5.5.3	Body Test				
5.5.4	Disc Strength Test				
5.5.5	Valve Seat Test (Hi Pressure)				
5.5.6	Valve Sensitivity Test (Lo Pressure)				
5.5.7	Coating Tests				
5.6	Test Certificates				
5.7	Site Validation Tests				
5.7.1	General				
5.7.2	Dynamic Performance Guarantees				
5.7.2.1	Head Loss Tests				
5.7.2.2	Reverse Velocity Tests				
5.7.3	Interpretation of Test Results				
5.7.3.1	Head Loss at Duty Point Flow Rate				
5.7.3.2	Critical Velocity				
5.7.3.3	Maximum Reverse Flow at Duty Point Flow Rate				
6. MARKINGS AND PACKAGING					
6.1	Markings				
6.1.1	Body Markings				
6.2	Packaging				
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 & SPECIAL TOOLS					
8.1	Interchangeability				
8.2	Availability				
8.3	Special Tools				
9. TRANSPORTATION, HANDLING AND STORAGE					
9.1	General				
9.2	Preservation of Product in Storage				
10. QUALITY ASSURANCE					
10.1	Certification				
10.1.1	Certification of Product				
10.1.2	Quality System				
10.1.3	Product Re-verification				
10.2	Compliance and Acceptance				
10.2.1	Means of Demonstrating Compliance				
10.2.2	Acceptance Criteria				
10.3	Non-compliant Product				
10.3.1	General				
10.3.2	Manufacturing Repairs				
10.3.3	Product Warranty				
10.3.4	Product Repair				

Name of Supplier:

Signature:

Date:

When requested by the Corporation, 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

Rapid Response Non-Return Valves		
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	Head loss versus flow curves provided as required	(Yes/No)
3.2	Dynamic characteristic curves (based on independent hydraulic laboratory tests) provided as required	(Yes/No)
3.3	Technical Compliance Schedules 1 and 2 completed	(Yes/No)
3.4	Technical brochures, data sheets, and drawings supplied.	(Yes/No)
3.5	Details of servicing facilities in Perth supplied.	(Yes/No)
4.	GENERAL	
4.1	Manufacturer's name	
4.2	Place of manufacture	
4.3	Model	
4.4	Body style – short or long	
4.5	Nominal size (DN)	mm
4.6	Pressure class (PN)	kPa
4.7	Flange drilling standard	
4.8	Flange sealing face type (Flat or raised)	
4.9	Mass of valve	kg
5.	HYDRAULIC DESIGN PARAMETERS	
5.1	Maximum steady state flow rate	L/s
5.2	Minimum steady state flow rate	L/s
5.3	Maximum system deceleration	m/s ²
5.4	Steady state flow rate at maximum system deceleration	L/s
5.5	Steady state head at maximum system deceleration	m
5.6	Pipe size DN	
6.	PERFORMANCE GUARANTEES	
6.1	Critical velocity, V_0 (< 0.8 x min velocity)	m/s
6.2	Reverse velocity V_R , at maximum system deceleration	m/s
6.3	Head loss at maximum steady state flow rate	m
5.0	MATERIALS	
5.1	Body	
5.2	Body Seat	
5.3	Valve Disc	
5.4	Disc Stem	
5.5	Disc Spring	
5.6	Disc Seal	
5.7	Guide housing	
5.8	Guide Housing Bushes	
5.9	Fasteners	

Rapid Response Non-Return Valves

6.0 CONSTRUCTION	
6.1 Method of securing resilient seat	
6.2 Number of disc sealing points	

Name of Supplier:

Signature:

Date:

END OF DOCUMENT