Hunter Water Corporation

A.B.N. 46 228 513 446

Standard Technical Specification for:

STS 600

GENERAL MECHANICAL REQUIREMENTS

This Standard Technical Specification (STS) was developed by Hunter Water Corporation to be used in the design, construction or installation and maintenance of facilities that are, or are to become, the property of Hunter Water Corporation. It is intended that this STS be used in conjunction with various other standard and project specific drawings and design requirements as defined by Hunter Water Corporation for a particular project.

Hunter Water Corporation does not consider this STS suitable for use for any other purpose or in any other manner. Use of this STS for any other purpose or in any other manner is wholly at the user’s risk.

Hunter Water Corporation does not assume a duty of care to any person using this STS for any purpose other than as stated.

In the case of this document having been downloaded from Hunter Water Corporation’s website:

– Hunter Water Corporation has no responsibility to inform you of any matter relating to the accuracy of this STS which is known to Hunter Water Corporation at the time of downloading or that subsequently comes to the attention of Hunter Water Corporation.

– This document is current as at the date of downloading. Hunter Water Corporation may update the document at any time.

Copyright in this document belongs to Hunter Water Corporation.

Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.
1 Purpose ........................................................................................................5
  1.1 Scope ..................................................................................................... 5

2 Interpretation .............................................................................................. 6
  2.1 Order of Precedence ........................................................................... 6

3 Roles and Responsibilities ......................................................................... 7
  3.1 Document Owner ................................................................................ 7
  3.2 Responsibilities .................................................................................. 7

4 Definitions .................................................................................................. 8

5 Compliance Requirements ......................................................................... 10
  5.1 Legislation and Standards .................................................................. 10
    5.1.1 Legislative Requirements ......................................................... 10
    5.1.2 Codes of Practice ..................................................................... 10
    5.1.3 Standards ................................................................................. 11
    5.1.4 Quality Accreditation ............................................................. 11

6 Design Principles ....................................................................................... 12
  6.1 General .............................................................................................. 12
  6.2 Designed Equipment .......................................................................... 12
  6.3 COTS Equipment ............................................................................... 13
  6.4 Mechanical Systems .......................................................................... 13
  6.5 Services routing ................................................................................. 13
  6.6 Lifting Equipment ............................................................................... 14
  6.7 Pressure Equipment ........................................................................... 15
  6.8 Chemical Storage and Delivery Systems ......................................... 15
  6.9 Approved Products ............................................................................ 15
  6.10 Operational availability ..................................................................... 15
    6.10.1 Reliability ................................................................................. 15
    6.10.2 Maintainability ................................................................. 16
    6.10.3 Equipment Redundancy ...................................................... 17
  6.11 Alternative designs ............................................................................ 17
  6.12 Allowance for Expansion ............................................................... 17
  6.13 Modification of Existing Equipment .............................................. 17
  6.14 Decommissioning ............................................................................ 18

Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.

Version 2 authorised by Lutz Backhausen on 26/02/2019
7 General Mechanical Requirements ..................................................19

7.1 Materials ............................................................................................ 19
  7.1.1 Materials in sewage handling locations ........................................... 19
  7.1.2 Asbestos .......................................................................................... 19
  7.1.3 Carcinogenic products ................................................................... 19

7.2 Potable water locations ........................................................................ 19

7.3 Guarding of Equipment ........................................................................ 19

7.4 Metal fabrication work .......................................................................... 20
  7.4.1 General ............................................................................................ 20
  7.4.2 Tolerances ....................................................................................... 20
  7.4.3 Machining ......................................................................................... 21
  7.4.4 Fabrication ....................................................................................... 21
  7.4.5 Welding ............................................................................................. 21
  7.4.6 Site hot work .................................................................................... 21
  7.4.7 Fabricated steel items ...................................................................... 22
  7.4.8 Assembly .......................................................................................... 22

7.5 Installation and Workmanship .............................................................. 22

7.6 Commissioning .................................................................................... 23

7.7 Training .................................................................................................. 23

7.8 Decommissioning/disposal ................................................................... 23

7.9 Documentation ....................................................................................... 23

8 Component Mechanical Requirements ...............................................25

8.1 Bearings ............................................................................................... 25
  8.1.1 General ............................................................................................ 25
  8.1.2 Rolling element bearings ................................................................. 25
  8.1.3 Plain (journal) bearings ................................................................. 25

8.2 Chemical Dosing Equipment ................................................................. 26

8.3 Equipment mounting arrangements ..................................................... 26
  8.3.1 Equipment plinth ........................................................................... 26
  8.3.2 Equipment bed / baseplate .............................................................. 27
  8.3.3 Grouting .......................................................................................... 27
  8.3.4 Alignment – flexible couplings ....................................................... 27
  8.3.5 Mounting on Walls (Sole Plates) ..................................................... 28

8.4 Fasteners ............................................................................................... 29

8.5 Anchor bolts .......................................................................................... 30
  8.5.1 Integrated anchor bolts ................................................................. 30
8.5.2 Chemical anchors ........................................................................................................... 30
8.6 Gaskets .......................................................................................................................... 31
8.7 Instruments and gauges .................................................................................................. 31
8.7.1 Pressure gauges ......................................................................................................... 31
8.8 Labelling, Signage and Colour Coding ........................................................................ 32
8.8.1 Safety Signs ............................................................................................................... 32
8.9 Lifting Equipment .......................................................................................................... 32
8.10 Lubrication .................................................................................................................... 32
8.10.1 Automatic lubrication ............................................................................................... 33
8.10.2 Lubrication Schedule .............................................................................................. 33
8.11 Noise and acoustic enclosures .................................................................................... 33
8.11.1 Noise Level Testing .................................................................................................. 33
8.11.2 Acoustic enclosures ................................................................................................. 33
8.12 Pressure pipes and pipe fittings .................................................................................. 34
8.12.1 Pipe anchorage (thrust) ........................................................................................... 34
8.12.2 Pipe fittings ............................................................................................................. 34
8.12.3 Pipe flanges ............................................................................................................. 34
8.13 Power transmission ....................................................................................................... 35
8.13.1 Gear boxes ............................................................................................................... 35
8.13.2 Flexible couplings ................................................................................................. 36
8.13.3 Belt and chain drives .............................................................................................. 36
8.14 Pumps ............................................................................................................................ 37
8.15 Seals on rotating elements .......................................................................................... 37
8.15.1 Gland seals .............................................................................................................. 37
8.15.2 Mechanical seals ..................................................................................................... 37
8.16 Special tools .................................................................................................................. 38
8.17 Stairways, landings, walkways, platforms and ladders .................................................. 38
8.18 Surface preservation (coatings) ................................................................................... 38
8.19 Vibration ....................................................................................................................... 38

9 Related Documents ........................................................................................................ 40

10 Document Control ......................................................................................................... 41

Appendix A: STANDARDS ............................................................................................... 42
1 Purpose

This standard technical specification (STS) details the general requirements of Hunter Water Corporation (Hunter Water) for the design, manufacture, supply, installation or modification of mechanical equipment that is, or is to become, the property of Hunter Water.

These specifications are available from the Hunter Water website: www.hunterwater.com.au.

1.1 Scope

STS 600 addresses:

- General mechanical requirements applicable to all mechanical equipment supplied to Hunter Water, including:
  - Compliance and regulatory
  - Design
  - Materials
  - Guarding
  - Installation and workmanship
  - Documentation

- Mechanical requirements for components, which are common to mechanical equipment installations supplied to Hunter Water, such as:
  - Bearings
  - Equipment mounts
  - Fasteners
  - Lubrication
  - Metal fabrication work
  - Power transmission
  - Stairways, landings, walkways and platforms

STS 600 is supplementary to the mechanical requirements in specific equipment type and facility type Standard Technical Specifications and facility Design Manuals issued by Hunter Water.
2 Interpretation

For the purposes of the interpretation of STS 600 General mechanical requirements, except where the context requires otherwise:

- ‘drawings’ means the drawings detailing the work involved in a particular project in hand
- ‘include’ means including, but not limited to, and is used to provide clarification or examples of the type and nature of items intended
- ‘specification’ means a specification detailing the work involved in a particular project
- ‘standard drawings’ means Hunter Water drawings
- ‘standards’ means applicable industry standards and includes:
  - Australian Standards (AS)
  - Australian/New Zealand Standards (AS/NZS)
  - American National Standards Institute (ANSI) Standards and
  - International Organization for Standardization (ISO).
- ‘standard technical specification’ (STS) references any of Hunter Water’s standard technical specifications, as implied by the text.
- ‘mechanical’ work includes work carried out by the core trades: Fitting, Machining, Fabricating, Welding (Boiler making), Plumbing and the Engineering (Mechanical) Trade

Headings are for the convenience of the reader and shall not be used in the interpretation of this standard technical specification.

Unless otherwise stated, expressions such as ‘give notice’, ‘submit’, ‘approval’, or ‘directed’ mean ‘give notice to’, ‘submit to’, ‘approval by’, or ‘directed by’ the person nominated by Hunter Water.

Approval does not imply acceptance of responsibility by Hunter Water for compliance with this STS. Unless issued in writing, approval has not been granted.

Failure to comply with the requirements of this STS or any referred documentation may result in rejection. Where equipment or manufacture are rejected, notice will be given by Hunter Water in writing. All associated rectification work shall be completed by the contractor at their cost.

2.1 Order of Precedence

All work shall meet all stated requirements in this STS in addition to project specifications or standards specified.

Any deviation from this STS shall be approved in writing on a case by case basis by Hunter Water’s Document Owner.
3 Roles and Responsibilities

3.1 Document Owner

The Document Owner of STS 600 is the Group Manager Capability Engineering.

3.2 Responsibilities

The Document Owner shall approve the issue of any updated version of this STS in writing. Any concession to any requirement in STS 600 is valid only when authorised in writing by the Document Owner.
### 4 Definitions

Where the following term, abbreviation or expression occurs in STS 600, it is defined as follows, unless the context implies otherwise:-

<table>
<thead>
<tr>
<th>Term / Abbreviation / Expression</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>Acrylonitrile butadiene styrene.</td>
</tr>
<tr>
<td>AGMA</td>
<td>American Gear Manufacturers Association.</td>
</tr>
<tr>
<td>Angularity</td>
<td>Angularity in the context of shaft alignment is the gap difference at the coupling edge for a 100mm diameter coupling.</td>
</tr>
<tr>
<td>ANSI/ASME</td>
<td>American National Standards Institute / American Society of Mechanical Engineers.</td>
</tr>
<tr>
<td>AS</td>
<td>Australian Standard.</td>
</tr>
<tr>
<td>AS/NZS</td>
<td>Australian and New Zealand Standard.</td>
</tr>
<tr>
<td>Coastal environments</td>
<td>Sites up to 5km from the coast.</td>
</tr>
<tr>
<td>Consumable equipment</td>
<td>Equipment that is not designed for overhaul or renewal. Non-repairable equipment.</td>
</tr>
<tr>
<td>COTS Equipment</td>
<td>Commercial-Off-The-Shelf Equipment, proprietary equipment from an Original Equipment Manufacturer, which is supplied to Hunter Water without additional or modifying design work.</td>
</tr>
<tr>
<td>Designed Equipment</td>
<td>Equipment designed for a specific Hunter Water project or developed from COTS Equipment for a specific Hunter Water project.</td>
</tr>
<tr>
<td>Designer</td>
<td>Person or organisation creating design and drawings for manufacture of equipment or construction of a system of mechanical equipment.</td>
</tr>
<tr>
<td>Equipment mount</td>
<td>The part of the equipment that is secured to an equipment bed or to a structural element.</td>
</tr>
<tr>
<td>Equipment bed</td>
<td>Frame that equipment is mounted to, element between equipment and plinth. Also known as a baseplate.</td>
</tr>
<tr>
<td>Equipment Design Life</td>
<td>The required life, in years, from commissioning to disposal, including any overhaul as required, or for COTS Equipment the designer's stated life of the equipment from the OEM.</td>
</tr>
<tr>
<td>FAT</td>
<td>Factory Acceptance Testing.</td>
</tr>
<tr>
<td>FRP</td>
<td>Fibre reinforced plastic.</td>
</tr>
<tr>
<td>Hunter Water</td>
<td>Hunter Water Corporation.</td>
</tr>
<tr>
<td>IP Rating</td>
<td>Degree of protection as described in AS 60529 Degrees of protection provided by enclosures (IP Code).</td>
</tr>
<tr>
<td>IR</td>
<td>Infra-red Technology or thermography.</td>
</tr>
<tr>
<td>LCC</td>
<td>Lifecycle costs.</td>
</tr>
<tr>
<td>Mechanical System</td>
<td>A combination of a Designed and/or COTS Equipment with interconnections to provide an integrated mechanical function.</td>
</tr>
<tr>
<td>NDT</td>
<td>Non-destructive testing.</td>
</tr>
<tr>
<td>Term / Abbreviation / Expression</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>NPV</td>
<td>Net present value.</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer.</td>
</tr>
<tr>
<td>Offset (with respect to shaft alignment)</td>
<td>The maximum misalignment of shafts’ centre lines. Offset is measured in both the X &amp; Y axes.</td>
</tr>
<tr>
<td>Overhaul</td>
<td>Correction of inadequacies to return equipment to original function and capacity.</td>
</tr>
<tr>
<td>PE</td>
<td>Polyethylene.</td>
</tr>
<tr>
<td>Proprietary</td>
<td>Relating to a technology or product that is owned exclusively by a third party.</td>
</tr>
<tr>
<td>Qualified tradesperson</td>
<td>A person with a relevant trade certificate recognised by the NSW Government, Department of Education and Communities.</td>
</tr>
<tr>
<td>Renewal</td>
<td>Renewal of equipment is replacement of all wearing and/or consumable parts.</td>
</tr>
<tr>
<td>Response time</td>
<td>Time from notification of equipment failure to rectification of service.</td>
</tr>
<tr>
<td>RPM</td>
<td>Revolutions Per Minute.</td>
</tr>
<tr>
<td>SI</td>
<td>International System of Units.</td>
</tr>
<tr>
<td>SOA</td>
<td>Spectrographic oil analysis.</td>
</tr>
<tr>
<td>Soft foot</td>
<td>The condition in which one of the feet of a machine does not sit flat on the machine base. This includes parallel and angular soft foot.</td>
</tr>
<tr>
<td>Special tools</td>
<td>Tools which are uniquely applicable to an item of equipment. Tools made to suit a particular piece of equipment or maintainable item and which are not generally available from a retail tool outlet (catering for tradespersons) within the state of NSW, Australia.</td>
</tr>
<tr>
<td>Thermal growth</td>
<td>Thermal growth in the context of machine alignment is the change in length from the machine base to its output shaft axis.</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible power supply.</td>
</tr>
<tr>
<td>uPVC</td>
<td>Unplasticised polyvinyl chloride.</td>
</tr>
<tr>
<td>VA</td>
<td>Vibration Analysis.</td>
</tr>
<tr>
<td>Wet environment</td>
<td>Any of the following</td>
</tr>
<tr>
<td></td>
<td>• outdoor area</td>
</tr>
<tr>
<td></td>
<td>• room containing pipe work which contains liquid under pressure</td>
</tr>
<tr>
<td></td>
<td>• area where equipment is located that requires wash down</td>
</tr>
<tr>
<td></td>
<td>• area below natural ground level</td>
</tr>
<tr>
<td></td>
<td>• any area which could reasonably be expected to become wet through operation of the equipment or any surrounding equipment.</td>
</tr>
</tbody>
</table>
5 Compliance Requirements

These compliance requirements apply to all mechanical equipment and Mechanical Systems supplied to Hunter Water.

5.1 Legislation and Standards

All mechanical equipment and Mechanical Systems supplied to Hunter Water shall comply with the applicable legislative, regulatory, Codes of Practice and/or Standards in force at the time of commissioning of the equipment.

5.1.1 Legislative Requirements

The relevant Commonwealth and New South Wales (NSW) legislation and Local Council Requirements shall apply to all mechanical equipment and Mechanical Systems supplied to Hunter Water. The following are key aspects of these legislative requirements.

5.1.1.1 Work Health and Safety Legislation

The Work Health and Safety (WHS) Act, NSW, 2011 (WHS Act), Work Health and Safety Regulation, NSW, 2011 (WHS Regulation) and NSW WorkCover Codes of Practice have specific requirements, including:

- Requirements in relation to the design, manufacture, import, supply, installation, construction and/or commissioning of equipment. Whether these are directly applicable to the Contractor, OEM or indirectly to Hunter Water, these provisions shall be met and a Contractor shall provide all equipment, services and documentation within its scope of supply to meet these requirements.
- The application of the relevant Codes of Practice
- Requirements for guarding of plant

5.1.2 Codes of Practice

5.1.2.1 NSW WorkCover Authority

The NSW WorkCover retained, approved and endorsed Codes of Practice shall apply, including:

- How to Manage Work Health and Safety Risks Code of Practice
- Managing Work Environment Facilities Code of Practice
- Technical Guidance Code of Practice
- WHS Consultation, Co-operation, Coordination Code of Practice
- Managing the Risk of Plant in the Workplace Code of Practice, which includes:
  - Guarding and Controls
  - Risk Management
  - Registrable Plant
5.1.2.2 Safe Work Australia

Any Safe Work Australia Model Codes of Practice that have not yet been approved by NSW WorkCover should be used as guides.

5.1.2.3 Australian Building Codes Board

Any building work associated with the installation of mechanical equipment or Mechanical Systems at Hunter Water shall comply with the Australian Building Codes Board National Construction Code (NCC).

5.1.3 Standards

Any Standards relevant to mechanical equipment or Mechanical Systems supplied to and operated by Hunter Water shall apply, including specific Standards or suites of applicable Standards referenced in STS 600.

5.1.4 Quality Accreditation

Any mechanical equipment or Mechanical Systems should be designed, manufactured, and where practicable installed and commissioned by an organisation with a quality management system accredited as compliant with ISO 9001:2008 Quality management systems — Requirements.
6 Design Principles

6.1 General

The following general design requirements shall apply to all mechanical equipment and Mechanical Systems:

- Compliance with the relevant:
  - Australian federal, state and local government legislation
  - Codes of Practice
  - Standards
  - Hunter Water Standard Technical Specifications
- A means for isolation from all energy sources for maintenance actions and/or removal/replacement of the equipment or a serviceable part
- Guarding, which ensures the equipment is, where practicable, without risk or at least minimises the risk to the health and safety of persons without impacting the operation or maintenance of the equipment
- Any equipment or serviceable item which is greater than 50 kg in weight shall be fitted with lugs or eyebolts for lifting purposes.
- Clear and safe access for:
  - operating and maintenance purposes
  - removal/replacement of the equipment or a serviceable part of it, including clearances from surrounding equipment and structures
  - removal/replacement of neighbouring equipment
- Drainage to avoid liquids pooling on or around equipment
- Provision for clean air to any equipment air intake(s)
- Vermin proofing, where vermin may impact the performance of the equipment in the operating environment
- Avoidance of:
  - the creation of confined spaces and/or the installation of equipment in a confined space
  - the placement of equipment over water bodies
- Minimisation of loss of function of equipment due to vandalism

6.2 Designed Equipment

Designed Equipment shall:

- Achieve the specified Equipment Design Life
- Operate throughout its Equipment Design Life in the defined or expected operating environment(s)
6.3 COTS Equipment

Hunter Water prefers the use of Approved Products, however, COTS Equipment may be supplied, provided it:

- Is capable of achieving the OEM’s stated Equipment Design Life
- Is capable of operating throughout its Equipment Design Life in the defined or expected operating environment(s)
- Is fit for service of the equipment in the defined or expected operating environment(s)
- Creates minimal normal operational vibration and transmission of such vibration to connected or adjacent equipment

6.4 Mechanical Systems

All Mechanical Systems shall

- Be designed to provide a reliability level, which may include redundant equipment, so that it does not impact on Hunter Water’s network and service obligations
- Have effective and efficient interfaces with surrounding equipment and systems
- Allow for dismantling/re-installation, in particular associated pipe work and services
- Allow for thermal movement in the equipment in normal operation without impacting performance
- Ensure the interface of any new mechanical equipment with existing equipment / systems shall be designed to allow for maintenance and ease of fault finding of the new and existing equipment.

6.5 Services routing

Services shall be routed / installed in service corridors provided in the Specification. Service corridors have two or more services grouped and installed on a common route. The intent of service corridors is to provide safe, unobstructed access to services for operation and maintenance.

Above ground service corridors shall:

- Be on walls of structures or on a pipe rack or cable tray, consisting of a corridor of columns around equipment to mount services. Pipe rack structure shall be designed to carry the weights and loads expected,
- Be designed to allow clear access to all equipment for operation and maintenance
- Ensure walkways are unobstructed
- Be sized based on the quantity of services
- Be self-draining
• Have electrical services installed at higher levels than fluids, wherever possible
• Where practicable, have individual services installed in order of potential contamination, with cleanest at the top and most contaminated at the bottom. Services include, in typical contamination order:
  o Control and instrumentation cabling
  o Power cabling
  o Potable water
  o Blower air
  o Compressed air
  o Odour control ducts
  o Recycled water
  o Chemical dosing
  o Process water (diameter less than 100mm)
  o Drainage
• Space services to allow maintenance access and comply with relevant standards
• Make allowance for future services as stated in the Specification.

Below ground services shall:
• Only combine compatible services in the same trench
• Be installed in accessible service corridors

Where below ground services are mounted in a culvert, the culvert shall:
• Have services mounted on the walls, not on the floor
• Be rated for expected loads
• Have road crossing plates, where required, installed to prevent movement by passing traffic.

The Contractor may put forward alternative arrangements for installation of services in service corridors, but they shall meet the intent of the requirements above.

6.6 Lifting Equipment


Hunter Water has lifting equipment ranging from manual chain blocks to overhead travelling cranes. Hunter Water also has lifting equipment mounted on some of its service vehicles.

Wherever practical, the design of equipment or a Mechanical System and its installation and maintenance requirements shall be optimised to using this existing lifting equipment.

Where the installation and maintenance requires mobile lifting equipment, the Contractor shall ensure that there is adequate access and suitable ground conditions for these mobile lifting vehicles.

Where the project includes using existing fixed lifting equipment, the Contractor shall ensure that existing access routes / loading bays for the transfer or equipment directly onto / from a road transport
vehicle are not impacted by the project. Where the project includes installing new fixed lifting equipment, the Contractor shall include access routes / loading bays for the transfer or equipment directly onto / from a road transport vehicle.

The proposed method(s) of lifting of equipment / serviceable units, including the recommended crane group, structural and mechanical classifications (Refer to AS 1418 Cranes, hoists and winches – Set), shall be submitted to Hunter Water for approval before proceeding with the design. The Contractor shall be responsible for verifying that either Hunter Water’s existing lifting equipment is suitable for the installation / maintenance tasks or advising the proposed design solution for these lifting tasks.

All lifting equipment shall be designed, manufactured, tested, installed and commissioned in accordance with current Compliance and Regulatory requirements (see Section Error! Reference source not found.) and compliant to Hunter Water’s Standard Technical Specification STS 640 Lifting Equipment.

### 6.7 Pressure Equipment

Refer to Hunter Water’s Standard Technical Specification STS 650 Pressure Equipment for detail.

### 6.8 Chemical Storage and Delivery Systems

Refer to Hunter Water’s Standard Technical Specification STS 670 Chemical Storage and Delivery Systems for detail.

### 6.9 Approved Products

Hunter Water endeavours to minimise the LCC of its infrastructure. In support of this objective, Hunter Water requires the use of equipment and materials listed on the Hunter Water Approved Products and Manufacturers List, where practicable, to minimise maintenance and repair costs. The current Approved Products and Manufacturers List is available on the Hunter Water website, www.hunterwater.com.au.

A Contractor may apply for a manufacturer, equipment and/or material to be added to the Approved Products and Manufacturers List. An application form for inclusion of a manufacturer, equipment and/or material on the Hunter Water Approved Products and Manufacturers List and information on this process is available at this website.

### 6.10 Operational availability

Hunter Water has service obligations, which are achieved partly through the operational reliability of each Mechanical System. Hunter Water seeks to achieve the most cost-effective solution over the Mechanical Systems’ design life.

#### 6.10.1 Reliability

The Contractor should provide details of the reliability claimed for each item of equipment in the specified operating environment including the source of reliability data. If the claimed reliability performance is based on calculation, the basis and methodology for the calculation should be quoted. If based on actual field operating performance, the source of the data, including details of the installation and, where possible, methods of verification should be provided.

Determination of the reliability data should take into account:

---

**Warning** – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.

---

Version 2 authorised by Lutz Backhausen on 26/02/2019
- Hunter Water service level obligations
- Equipment duty cycle
- Operating environment
- Single points of failure and method(s) to avoid them

Reliability data should include the mean time between failure (MTBF), where a failure is defined as a condition which will prevent the equipment performing its intended primary functions.

6.10.2 Maintainability

The assessment of maintainability and its impact on life cycle costs and Hunter Water service obligations should take into account such factors as:

- Availability of skills within Hunter Water or locally to perform any maintenance task
- Skills training required at Hunter Water or locally to perform any maintenance task
- Accessibility of maintainable items, including avoiding buildings, structural components, access platforms/walkways/stairs and baseplates preventing access to or removal of equipment or a repairable item
- Minimising the complexity of maintenance actions
- Efficient ergonomics of the maintenance actions
- Efficient and effective use of lifting equipment or lifting equipment access, where required
- Avoiding the introduction of any additional risks to maintenance operators
- Ease of failure detection
- Ease of failure isolation
- Ease of testing and inspection of maintenance actions
- Minimisation of special tools required
- Efficient preventative and corrective maintenance actions
- Local availability and lead time for spares and repairs
- Integration of preventative maintenance actions throughout the Mechanical System and flexibility to integrate with other Hunter Water network preventative maintenance programs
- Fastener coatings or paint shall not affect removal/installation of fasteners

The Contractor shall provide information on specific maintainability features included in the design and shall provide typical and average times needed by Hunter Water maintenance personnel to replace major replaceable items (including test where necessary) (Mean Time To Repair – MTTR) and to perform routine inspection and replacement of consumable items such as lubricants and filters.

Estimates should include a clear statement about whether the MTTRs quoted include any allowance for response times and waiting times to obtain suitable spares and other equipment necessary for the task.
6.10.3 Equipment Redundancy

The Contractor shall recommend any need for redundant equipment to minimise impact of the projected equipment reliability and maintenance actions on

- Mechanical System availability
- Process criticality
- Loss of network capacity
- Environmental risks
- Safety risks

6.11 Alternative designs

Where the Contractor proposes alternative equipment or an alternative configuration of equipment in the Mechanical System to meet the reliability requirements in a Specification, the Contractor shall submit an assessment including net present value comparisons, of the impact of the alternative on the process and/or operational requirements of the Mechanical System in the Specification.

Inputs to the net present value comparison should include:

- Acquisition costs (including design, material selection, redundant equipment)
- Installation costs
- Commissioning costs
- Operational input costs (including energy)
- Operator input
- Maintenance costs (including overhaul)
- Removal / disposal costs

6.12 Allowance for Expansion

When requested in a Specification, allowance shall be made in the design and layout of Mechanical Systems for future equipment installation, including:

- Space for additional equipment
- Plinths consistent with the installed equipment
- Electrical cable conduit consistent with the installed equipment
- Pipes that allow simple pipe extension to the additional equipment, minimising interruption to processes. This may require allowance for a stop valve and/or a blanking flange.
- Lifting coverage, consistent with the installed equipment, when overhead lifting is provided.

6.13 Modification of Existing Equipment

Any proposed modification of existing mechanical equipment shall include a condition assessment of all retained elements of the existing machine/system, to ensure that the retained elements will
continue to operate within their design capabilities, following the proposed modification. Any proposed machine/system modification shall demonstrate its integration with:

- Current Hunter Water operational strategies
- Current Hunter Water maintenance strategies

And compliance with:

- Hunter Water’s Standard Technical Specifications
- Section 5, Compliance Requirements

A formal risk assessment shall be completed on the impact of the proposed modification, including details of any controls necessary to reduce the risks to as low as reasonably practicable.

When any equipment is modified, all relevant/affected drawings and documentation shall be submitted to Hunter Water for review prior to being revised for reissue. All documentation of the modification, including the risk assessment, shall be provided to Hunter Water.

### 6.14 Decommissioning

The design of a Mechanical System and its installation shall include provision for:

- Practical decommissioning and removal requirements
- Disposal of unsafe or environmentally hazardous materials
- Potential replacement with alternative equipment or re-use of that position
7 General Mechanical Requirements

7.1 Materials

All materials shall be new at the time of manufacture or installation, as applicable.

All materials shall be handled, transported and stored in accordance with section 5, Compliance Requirements and the manufacturer’s recommendations.

Structural steel shall comply with the requirement of AS/NZS 3678 Structural steel - Hot rolled plates, floorplates and slabs and AS/NZS 3679 Structural steels, Parts 1 and 2.

7.1.1 Materials in sewage handling locations

For equipment in contact with sewage or its constituents (including gases), the following materials shall be used:

- Stainless steel (grade 316)
- Aluminium (corrosion resistant alloys e.g. Alloy 6061-T5)
- Non-metallic corrosion resistant and ultra-violet resistant materials such as FRP, ABS, uPVC and PE.

7.1.2 Asbestos

New equipment shall not contain any asbestos or asbestos based products.

Where installation of equipment involves in an area containing asbestos, all work shall be in accordance with WHS Regulation Chapter 8 Asbestos and Hunter Water Asbestos Management Manual and Asbestos Register.

7.1.3 Carcinogenic products

Equipment supplied to Hunter Water shall not contain a prohibited carcinogen in accordance with WHS Regulation, Section 380 and Schedule 10, table 10.1.

A restricted carcinogen shall only be used in accordance with WHS Regulation, Section 381 and Schedule 10, table 10.2.

7.2 Potable water locations

Any material or equipment which is in contact with potable water shall comply with AS 4020 Testing of products for use in contact with drinking water.

Where practicable, any equipment or Mechanical Systems should not be installed above open surface potable water.

7.3 Guarding of Equipment

All equipment shall be fitted with guards that meet the requirements of the Work Health and Safety legislation and Codes of Practice, and where practicable, in the relevant Australian Standard, e.g. AS4024 Safety of machinery or AS1755 Conveyors – Safety Requirements.

 Guards shall be provided for protecting personnel against hazards including:

Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.
• Preventing contact with moving parts
• Controlling access to dangerous areas of the equipment
• Hot (above 50ºc) or cold (below -5ºc) surfaces
• Radiation (UV, light, laser)
• Noise
• Hazardous process products (biological)
• Preventing ejected parts or product from striking people
• Chemicals

Equipment guards shall be designed to be removable with standard tools and without the need to dismantle the equipment or surrounding equipment. Intentional removal of any guard in accordance with the operator or maintenance manual shall not introduce any additional risk or increase a risk.

All drive guards shall be fabricated such that the guards can be removed without disturbing any sensing devices, chain or belt tensioners, instrumentation, control system or lubrication system.

Where there is an operational/maintenance requirement for visual inspection, a means of inspection shall be provided, eliminating the need to remove the guard, e.g. clear windows, mesh or inspection covers. Any removable inspection cover shall have an additional internal guard, or an interlock that prevents exposure to any hazards, whenever the inspection cover is removed.

7.4 Metal fabrication work

All metal fabrication work shall be performed in accordance with relevant Standards, including but not limited to those contained in Appendix A:STANDARDS.

7.4.1 General

All metal fabrication work shall:

• Have all sharp edges de-burred and corners rounded, where appropriate; with the minimum amount of material removed to achieve a safe and functional result
• Be free from deformations, distortions, open joints and sharp edges/corners at commissioning;
• Be performed with appropriate protection for any surrounding equipment from such items as weld splatter, grindings, and swarf, when performed on site.

The resultant component/assembly/system shall be safe and fit for purpose, once manufactured, assembled, installed, and commissioned or modified and commissioned.

7.4.2 Tolerances

The Contractor shall specify tolerances in accordance with the relevant Standard on the drawings, including when required for safety, functionality or durability. These tolerances shall include:

• Size dimensions
• Limits and fits of machined components
• Parallelism and perpendicularity
• Surface finish.

Steel structure tolerances shall be in accordance with *AS 4100 Steel structures*.

### 7.4.3 Machining

All machining shall be:

• Carried out by or supervised by appropriately qualified tradespersons.

Machined components shall be inspected for full compliance with design drawings.

### 7.4.4 Fabrication

Fabrication shall be:

• Carried out or supervised by appropriately qualified tradespersons.

Fabricated components shall be inspected for full compliance with design drawings.

### 7.4.5 Welding

Welding shall be:

• Carried out or supervised by appropriately qualified tradespersons compliant with *AS 1796 Certification of welders and welding supervisors*.

• Performed in accordance with the applicable welding Standard and welding safety Standard

All welds shall be inspected and tested:

• In accordance with the applicable Standard, and,

• For full compliance with the design drawings.

NDT shall be performed when required to comply with the relevant Australian Standard or design drawing. Certified results of weld inspections and NDT shall be provided to Hunter Water prior to commissioning. Design drawings shall specify required NDT method.

### 7.4.6 Site hot work

Where practical, site hot work (including welding, heating, grinding and thermal cutting) shall only be carried out:

• When necessary and unable to be carried out in an off-site workshop

• With written approval from Hunter Water

• In a dedicated site welding bay.

Any site hot work shall be conducted in accordance with Hunter Water WHS Standard – Hot Work and Safe Work Method Statement – Hot Work, including conducting a Risk Assessment and obtaining a Hot Work Permit prior to commencing hot work activities,

• in buildings (other than those designed for hot work)

• in or around:
7.4.7 Fabricated steel items

Fabricated steel items, such as pipe and machinery supports, platforms, stairs, handrails, baseplates and covers shall be hot dip galvanised prior to installation. Assembly of hot dip galvanised items shall be by bolts through holes drilled prior to the galvanising.

Galvanising shall comply with the requirements of AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles. Any surface damage to the galvanising shall be shot or grit blasted clean and given two coats of Amercoat No 62 primer or equivalent. The second coat shall be applied after the first coat is touch dry and within twenty-four hours of application of the first coat. Where site welding of galvanised steelwork has been approved, the resulting weldment shall be chipped and cleaned to bare metal and painted with Galmet zinc enriched paint or equivalent.

Frame members constructed from hollow sections shall have fully closed and sealed ends to prevent the ingress of moisture.

Galvanised hollow frame members shall have bleed holes that are sealed after being galvanised. Bleed holes shall be tapped prior to galvanising the frame member and then plugged with a corrosion resistant and compatible threaded plug.

7.4.8 Assembly

Assembly holes shall:

- Be drilled, as required, for the correct assembly and alignment of component parts
- Be spaced sufficiently distant from the nearest edge to ensure the strength of the joint and prevent break-through of the fastener.
- Be drilled, not flame cut, when forming holes for fasteners
- Not be elongated or enlarged to achieve mating of misaligned components.

7.5 Installation and Workmanship

All equipment installations for Hunter Water shall comply with Section 5, Compliance Requirements. Installation shall be undertaken in a manner that is, where practicable, without risk to the health and safety of persons.

Equipment shall be installed on engineered structures e.g. motor beds, plinths, structural steel, etc., that meet the Design Life of the equipment.

All installation work shall be carried out:

- any confined spaces, which includes in close proximity to the confined space, such that a spark or flame could occur in the vicinity of any openings to the confined space
- areas with combustible vegetation
- areas where chemicals or flammable substances are stored or used or may be generated by Hunter Water processes
- in times of a Fire Danger Rating – High or higher for the location, as rated by the NSW Rural Fire Service
• Using a whole-of-system approach; with an understanding of the impact of component adjustment/modification/replacement on the associated systems
• By qualified tradespersons or supervised trades assistants.
• By individuals who are suitably competent, experienced and authorised by licensing where required
• In a tradesman like manner to current industry standards
• Under the supervision of individuals meeting the requirements of the preceding statements where tasks are carried out by apprentices / trainees / trades assistants

7.6 Commissioning

On completion of the installation of any mechanical equipment, Hunter Water may require an experienced, competent, authorised representative of the supplier of each item to visit the installation and the commissioning of mechanical equipment to:

• Demonstrate all of the functions of the equipment
• Confirm the equipment is fit for purpose and meets all of its specifications
• Confirm the operation of all safety features
• Demonstrate safe access for operation, maintenance and removal
• Confirm the equipment may be operated and maintained without risk to the health and safety of persons

7.7 Training

The Contractor shall identify what specific skills and/or training is required to install, operate, maintain or decommission the equipment and provide a skills, licence and certificate list for the identified tasks.

Where the training is specific to the equipment supplied, training manuals shall be supplied for the equipment prior to commissioning.

7.8 Decommissioning/disposal

The Contractor shall identify any specialised skills required for the decommissioning and disposal of the equipment.

The Contractor shall identify any hazardous materials in the equipment and the required handling methods for their disposal.

7.9 Documentation

The following references outline the documentation which shall be supplied with any mechanical equipment.

Documentation shall be provided in accordance with the following Hunter Water Standards;
Standard Technical Specification STS 903 Work As Constructed WAC) Information
Standard Technical Specification STS 911 Preparation of Civil, Structural and Mechanical Drawings

Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.
8 Component Mechanical Requirements

The following section details mechanical requirements for components which are common to mechanical equipment installations supplied to Hunter Water.

8.1 Bearings

8.1.1 General

Bearings shall be rated in accordance with AS 2729 Rolling bearings - Dynamic load ratings and rating life.

Bearing lubrication requirements (including lubricant specification, capacity and feed rate as a minimum) shall be provided in the Maintenance Manual.

Bearing lubrication point requirements are in Section 8.10, Lubrication

Wasted grease from bearings shall be captured for disposal and shall not be permitted to enter the associated process stream.

Bearings, bearing seals and bearing housings shall be commercial off the shelf items, stocked in Australia.

8.1.2 Rolling element bearings

Rolling element bearings, shall have a minimum design life of 10 years of continuous operation.

Rolling element bearings shall be grease lubricated. Grease pressure relief devices shall be fitted to bearing housings on dry-mounted equipment with a shaft diameter of 40mm or greater.

Rolling element bearing housings shall be fitted with seals. Bearing seals shall be adequate to stop ingress of foreign material, including water, grit, and process materials.

Bearing isolators, labyrinth and lip seals should be used along with improved sealing and lubrication arrangements to achieve the design life of equipment in any of following environments:

- Wet environments
- Submerged or partially submerged
- In contact with sewage or other wastes
- Exposed to corrosive gases
- Located in a coastal environments
- Exposed to corrosive liquids
- Subjected to an abrasive environment

8.1.3 Plain (journal) bearings

Plain bearing design details shall be included in the Maintenance Manual. These details shall include drawings, materials, tolerances, lubrication requirements, design life, maintenance/procedures and sealing arrangement.

Plain bearings with suitable sealing and lubrication arrangements may be used in:

Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.
- Submerged environments
- Abrasive environments
- Slow rotating applications
- Heavy load applications

8.2 Chemical Dosing Equipment

Refer to Hunter Water’s Standard Technical Specification STS 670 Chemical Storage and Delivery Systems for detail.

8.3 Equipment mounting arrangements

Where applicable, all equipment shall be installed and aligned in accordance with the manufacturer’s written instructions.

Installation instructions shall include:

- A procedure for installing each component of the equipment supplied
- Drawings/sketches/diagrams showing, in detail, all the main components to be installed with their overall dimensions and weights
- A method for safely lifting and handling components/equipment
- Details of methods, settings, tolerances and adjustments required to correctly install the equipment and make it ready for operation
- A list of equipment and instruments required for adjusting and checking the accuracy of settings and adjustments that are specified by the manufacturer.

Equipment shall be mounted:

- With positive support between equipment bed and plinth, by jacking nuts (preferred) or shims. These shall be sacrificial for grouting.
- To avoid induced mounting stresses (such as pulling motor/machine to machine bed)
- With clear access to fasteners

8.3.1 Equipment plinth

Equipment plinths shall:

- Be designed for specific equipment and operational loads
- Extend a minimum of 100mm beyond the mounted item on all sides (see Section, 8.5, Anchor bolts)
- Be self-draining through:
  - Contouring to shed fluids, or
  - Drainage holes/channels sized and located to prevent blockage
- Be integrated into any surrounding concrete and reinforcing (keyed in)
8.3.2 Equipment bed / baseplate

Where the installation of equipment requires an equipment bed / baseplate, the equipment bed / baseplate shall provide a stable platform for the equipment, facilitating accurate alignment, and without inducing stresses to the equipment or equipment bed.

Equipment beds / baseplates shall:

- Be designed to be grouted in place
- Provide for collection and controlled drainage of process product, lubricant or coolant
- Have permanent drain lines for collection/disposal of fluid, where the capacity exceeds 5L (e.g. Gearbox oil)
- Have mating faces for the equipment milled flat after fabrication or casting
- Have permanent jacking bolts to assist in equipment alignment. Any jacking bolt should be aligned with the equipment’s hold down bolts. There shall be four (4) jacking bolts per item of equipment, 2 bolts located on each side
- Have lifting eyebolts compliant with AS 2317 Collared eyebolts on the equipment bed / baseplate
- Not be subject to deflection under operating loads
- Not be subject to deflection induced by adjoining equipment or pipework
- Not be encased or embedded in concrete

8.3.3 Grouting

Grout between equipment/equipment beds and plinths, shall be installed to minimise the potential for corrosion or other degradation of the equipment/equipment bed through accumulated or incidental contact with moisture.

Grouting shall:

- Be installed according to the grout manufacturer’s instructions
- Be a minimum of 25mm to permit flow of the grout into position and a preferably no more than 50mm thickness, unless recommended otherwise by the Contractor or OEM
- After correct alignment of the equipment, fully encase jacking/lock nuts and/or shims supporting equipment/equipment bed
- Allow fluid/debris to drain away from the equipment or equipment bed
- Be non-shrink, flow able grout with a minimum compressive strength of 50Mpa at 28 days

8.3.4 Alignment – flexible couplings

Motor and machine assemblies with flexible couplings shall be aligned to meet:

- The manufacturer’s recommendations for the motor and machine, or, in the absence of this
- The requirements in Table 1 below

Equipment/equipment beds shall be fully secured and grout cured prior to alignment.
8.3.4.1 Prime Mover (motor) to machine alignment

This procedure applies to installations with concentric flexible couplings.

Where recommended by the OEM, a motor should be fastened to its base with bolts into drilled and tapped holes in the equipment bed.

The motor alignment process shall include:

- Measuring and recording any soft foot condition and correcting any soft foot condition
- Measuring and recording angular and offset misalignment before alignment
- Measuring and recording angular and offset misalignment after alignment
- Calculating theoretical thermal growth
- Realigning to rectify any misalignment and checking that the required alignment
- Realigning to account for the theoretical thermal growth, when the calculated theoretical growth is greater than 50% of the target mis-alignment (see Table 1)

The allowable tolerances for machine couplings, after taking into account theoretical thermal growth, are included in the table below.

Table 1: Alignment Tolerances

<table>
<thead>
<tr>
<th>RPM</th>
<th>Acceptable (mm)</th>
<th>Target (mm)</th>
<th>Acceptable (mm)</th>
<th>Target (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>750</td>
<td>0.12</td>
<td>0.09</td>
<td>0.12</td>
<td>0.09</td>
</tr>
<tr>
<td>1000</td>
<td>0.09</td>
<td>0.07</td>
<td>0.08</td>
<td>0.06</td>
</tr>
<tr>
<td>1500</td>
<td>0.09</td>
<td>0.06</td>
<td>0.07</td>
<td>0.05</td>
</tr>
<tr>
<td>3000</td>
<td>0.06</td>
<td>0.03</td>
<td>0.04</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Where required, stainless steel shims shall be used for any alignment adjustments.

Alignment shall be achieved without:

- Modifying hold down bolts / screws
- Modification of any holes in the feet of motor or equipment bed

8.3.5 Mounting on Walls (Sole Plates)

Sole plates shall be used when mounting or fastening equipment to the top of any walls. This method shall be used for both machines (e.g. step screens, penstocks) and structures (e.g. walkways).

Sole plates shall:

- Be minimum 16mm grade 316 stainless steel
- Grade 316 stainless steel legs shall be:
  - Welded to the underside of the plate by continuous fillet weld

Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.
8.4 Fasteners

Threaded fastenings shall be metric, and comply with:

- AS 1111.1 ISO metric hexagon bolts and screws - Product grade C - Bolts
- AS 1111.2 ISO metric hexagon bolts and screws - Product grade C - Screws
- AS 1112.3 ISO metric hexagon nuts - Product grade C
- AS 1237 Plain washers for metric bolts, screws and nuts for general purposes, Parts 1 and 2
- AS 2528 Bolts, stud bolts and nuts for flanges and other high and low temperature applications

Fasteners shall:

- Wherever practical, be of the same material as the equipment being fastened
- Where dissimilar metals are used in the fastening of equipment, insulating washers and sleeves shall be used to meet the design life
- Be of the same grade
- Have insulating washers fitted under all nuts, and under bolt or screw heads for connections to equipment with protective coatings
- Include bolts with self-locking nuts or screws with tension washers, where the connection is subject to vibration
- Have an application specific lubricant applied, unless a thread locking compound is required.
- Apply a suitable thread anti-seize agent for all threads on stainless steel fasteners, such as:
  - Proprietary stainless steel thread anti-seize agent
  - Molybdenum disulphide
  - Loctite anti-seize, nickel based anti-seize agent or equivalent
• Have a protrusion from the nut on bolted connections with:
  o A minimum of 2.5 threads (nominal), and
  o A maximum of 5 threads (nominal)
  o Multiple washers, nuts or packers shall not be used to meet this requirement.
• Have the thread ends cut square, chamfered and deburred to make safe, and ensure positive nut engagement;
• Where a fastener is cut to length, have the parent material coated according the manufacturer’s protective coatings specification

Threaded bar shall:
• Shall not be used in place of a bolt or screw, unless access prevents use of a bolt or screw
• Have a hex head end, an Allen key socket end or 2 machined flat faces (to a metric dimension) at the end so the threaded bar may be gripped for installation/disassembly.

8.5 Anchor bolts

Equipment anchor bolts shall be:
• Designed for any start up torques and/or operational loads in accordance with manufacturer’s recommendations
• Grade 316 stainless steel
• Installed at least 100mm or a minimum of 6 times the nominal bolt diameter (whichever is greater) from the edge of the concrete plinth
• Installed perpendicular to the concrete face

8.5.1 Integrated anchor bolts

Anchor bolts shall be integrated with reinforcing, if:
• Required by the OEM, or
• The equipment has drive power greater than 50kW (nominal) or weighs more than 250kg (nominal)

Integrated anchor bolts shall be:
• An ‘L’ or ‘J’ shaped, or hook bolts, and secured to the reinforcing in the concrete
• Cast into the plinth or concrete slab in a removable foam, to permit minor re-alignment and then grouting during installation

8.5.2 Chemical anchors

Chemical anchors may be used for static/stationary equipment, provided the equipment has drive power less than 50kW (nominal) or weighs less than 250kg (nominal). Chemical anchors shall:
• Comply with OEM’s installation requirements and guidelines for embedment (hole depth), hole diameter and edge distances
8.6 Gaskets

Flange gaskets shall comply with, as applicable:

- AS 4087, Metallic flanges for waterworks purposes.
- AS 1646 Flanges for pipes, valves and fittings

In addition:

- Seals/gaskets shall be used between flanges
- Only full face gaskets shall be used on full face flanges
- Composite material gaskets shall be used for raised face flanges, not rubber gaskets
- Gaskets shall be able to be workshop fabricated from flat gasket stock
- Pipes and fittings shall be in their correct position, alignment and grade before the joints are made, and no springing of joints shall be permitted
- Avoid proprietary gasket systems, such as O-rings or spiral wound gaskets shall not be used

8.7 Instruments and gauges

Instruments shall:

- Indicate on a scale with SI units
- Be guarded, where their position may lead to damage during operation, maintenance and/or inspection activities in the vicinity of the instrument
- Have suitable protection, when installed in a wet environment or a location exposed to the weather

8.7.1 Pressure gauges

The pressure gauges shall:

- Have a maximum value, which is no more than twice the maximum expected pressure
- Be constructed of stainless steel
- Be glycerine fill with a diaphragm seal
- Have a face with a minimum diameter of 65mm
- Have an isolation ball valve installed prior to the pressure gauge
8.8 Labelling, Signage and Colour Coding

All equipment shall have labels, in addition to any proprietary nameplates:

- Made from 316 stainless steel plates
- Fixed with round head stainless steel screws
- Engraved with descriptive and technical information relating to the equipment
- Installed to be convenient to read by an operator / maintainer
- To meet all compliance and regulatory requirements
  - e.g. cranes, pressure vessel registration and road signage
- To identify buildings
- To display equipment weight
- To identify the Hunter Water equipment register reference

8.8.1 Safety Signs

All safety and warning signs shall comply with AS 1319 Safety signs for the occupational environment.

The signs shall warn of potential hazards, assist in preventing accidents and give operational and emergency procedures for potentially hazardous situations. Signs shall provide warnings where equipment may start automatically, where equipment may move without warning and where other potential hazards may occur.

The contents of piping, conduits and ducts shall be identified as per AS 1345 Identification of contents of pipes, conduits and ducts. Arrows shall be provided to show the direction of flow.

8.9 Lifting Equipment


Any deliverable lifting equipment used by the Contractor in the execution of the project shall be refurbished back to as new condition prior to handover to Hunter Water.

Any existing lifting equipment used by the Contractor in the execution of the project shall be refurbished, subject to fair wear and tear, back to its condition prior to its use by the Contractor.

8.10 Lubrication

Lubrication of any rotating equipment shall be provided by either a periodic or continuous lubrication system. Lubrication points shall:

- Be directly accessible either from the ground or an access platform designed in accordance with Section 8.17, Stairways, landings, walkways, platforms and ladders.
- Where grease points are not directly accessible, be plumbed to an accessible point or bank of grease nipples (grease station), accessible either from the ground or an access platform designed in accordance with Section 8.17, Stairways, landings, walkways, platforms and ladders.
• Use grease stations to enable application of grease from a single location on equipment, where practicable
• Have a cap on every exposed lubrication point, including grease nipples, oil fillers
• Ensure waste lubricant is collected in a suitable container and shall not enter the associated process/product
• Have a nameplate indicating the lubricant specification, capacity and feed rate fixed adjacent to the point of lubrication.

8.10.1 Automatic lubrication

Where a bearing requires periodic greasing, monthly or more frequently, automatic greasers shall be fitted. The grease feed rate shall be calculated for each bearing, based on bearing type, speed and environment. Each automatic greaser shall have a visual indicator of grease storage level.

Single point lubricators shall be used for equipment with up to 3 lubrication points; multipoint lubrication machine shall be used for equipment with more than 3 lubrication points.

8.10.2 Lubrication Schedule

The lubricant specifications shall be included in the Maintenance Manual and shall include lubricant reservoir capacity and the estimated usage rate.

8.11 Noise and acoustic enclosures

Equipment noise levels shall comply with the requirements of the WHS Act and WHS Regulation for noise.

During normal operation of an individual item of equipment, its overall A-weighted sound pressure power level shall not exceed 85 dBA measured at a distance of one metre from any point on the equipment.

8.11.1 Noise Level Testing

Prior to commissioning, noise tests shall be conducted on site in accordance with AS 1055 Acoustics - Description and measurement of environmental noise – Set. An installation that is not compliant shall be rectified in accordance with AS/NZS 1269 Occupational noise management – Set and tested until it is compliant.

8.11.2 Acoustic enclosures

Where the rectification in section 8.11.1, Noise Level Testing, identifies the need for the equipment to be housed in a sound attenuating enclosure or building, such an acoustic enclosure shall:

• Ensure adequate air supply for equipment cooling
• Ensure adequate inlet air supply for equipment operation
• Be constructed so that they can be easily removed or opened for maintenance purposes
• Contain hinged panels to access components that require routine inspection or maintenance
- Have acoustic insulating materials positively secured to prevent separation from the supporting cabinet. Glue is not acceptable as the only means of securing acoustic materials.
- Utilise sound proofing material with a minimum life of 10 years in the expected environment.
- Be vermin proof.

Buildings constructed as an acoustic enclosure shall only contain equipment requiring acoustic enclosure. They shall not contain any other equipment, including electrical components such as switchboards, other than local operator panels.

### 8.12 Pressure pipes and pipe fittings

This section applies to above ground pressure pipework and fittings associated with mechanical equipment but not those associated with water supply mains or wastewater mains. Pressure pipes and fittings will be installed and tested in accordance to *AS 4041 Pressure piping*.

#### 8.12.1 Pipe anchorage (thrust)

Pipe anchorages shall be designed and installed to absorb static and dynamic thrust loads from pipes, fittings and valves; including during the operation of these fittings and valves.

Pipe anchorages shall be provided at all changes in pipe direction, tees, valves, tapers and termination points.

Pipes with DN100 or greater that pass through concrete walls shall have puddle flanges cast into the wall.

#### 8.12.2 Pipe fittings

Pipe fittings shall be full bore to match the pipe inside diameter and limit pipe friction losses, except for intentional flow restrictors, e.g. orifice plates.

#### 8.12.3 Pipe flanges

Pipe flanges shall comply with:

- *AS 4087 Metallic flanges for waterworks purposes*
- *AS 2129 Flanges for pipes, valves and fittings*
- *ANSI/ASME B16.5 Pipe flanges and flanged fittings for methane applications*

Pipe flanges shall:

- Be bolted flanges for pipes with an internal diameter greater than 65mm
- Be full circle flanges and not tabbed flanges. Wafer lugged flanging will be accepted where the lug is the full thickness of the fitting
- Have mating faces machined and unpainted, where pressures are greater than 500kPa
- Be installed with flange bolt pattern oriented to avoid a bolt being at the top dead centre position
- Be attached by casting, welding or threading;
• Not be of the mechanically clamping type for pressures above 100kPa. E.g. uni-flanges or similar products
  • Be at a minimum offset from walls and floors of:
    o 200mm for pipe less than 300mm outside diameter
    o 300mm for pipe greater than 300 to 600mm outside diameter
    o 500mm for pipe greater than 600mm outside diameter
• Have metal backing rings for PVC, ABS and FRP pipe flanges.

8.13 Power transmission

8.13.1 Gear boxes

Gear boxes shall be designed in accordance with or compliant with AS 2938 Gears - Spur and helical - Guide to specification and rating and American Gear Manufacturers Association (AGMA) standards.

Gear boxes shall:
• Be designed to operate continuously at maximum duty with a service factor that is based on maximum operating torque and the most conservative load classification for the drive in accordance with AGMA standards
• Be designed to withstand starting torques of up to 300% of the full load running torque of the driving motor as well as external loadings produced by thrust, out-of-balance and vibration resulting from operating conditions
• Have lifting lugs
• For oil filled gearboxes:
  o Have splash lubricated gears
  o Have sight glasses to inspect oil levels; sight glasses shall be accessible from floor or associated access deck level
  o Have air breathers fitted
  o Have a magnetic drain plug
  o Have an oil filling port marked “fill” or be colour coded green
  o Have an oil draining port marked “drain” or be colour coded red, and able to have a waste oil container placed under the drain (which may require installation of a drain pipe)
• Have the direction of rotation of input and output shafts marked or labelled permanently on the housing
• Have guarding which allows access to the following points without the need for guard removal:
  o Oil filler
  o Oil drain
  o Breather
Oil level sight glass
- Labelled with oil volume and type in addition to the general labelling requirements, stated elsewhere.

- Have bearings, which can be either splash lubricated or grease lubricated. When grease lubricated bearings are fitted, the bearing's seals shall retain the grease in the housing and configured in accordance with Section 8.1, Bearings
- Use grade 316, stainless steel fasteners for gearbox mounting and external gearbox fasteners.

Gearboxes greater than 400mm in any dimension shall:
- Be constructed of cast metal
- Have a ball valve on the drain line, with a threaded plug after the valve
- Have two piece construction with a top cover for ease of inspection and maintenance
- Have lockable ports for items such as dipsticks, oil drains and sample taps.

8.13.2 Flexible couplings

Flexible couplings shall be used where shafts will have:
- Minor misalignment (radial, axial or angular)
- Minor vibration

Flexible couplings shall be designed to be sacrificial to protect shafts and attached equipment. Couplings shall be COTS Equipment.

8.13.3 Belt and chain drives

Belt and chain drives shall:
- Have more than 120° chain or belt wrap around the sprocket or pulley. Idler and tensioner sprockets or pulleys are exempted from this requirement
- Be designed with a minimum service factor of 2 based on drive transmitted power
- Be designed assuming motor starting torque shall be at least 300% of motor full load torque
- Have sprockets or pulleys keyed onto the shafts using a taper type locking hub

8.13.3.1 Belt drives

Belts and pulleys shall
- Be COTS Equipment.
- Have a single cast pulley for multi-belt drives.

8.13.3.2 Vee belts drives

Vee belt drives shall:
- Comply with the requirements of AS 2784 Endless wedge belt and V-belt drives
8.13.3.3 Chain drives

Chains shall:

- Be roller chains complying with ISO 606, Short-pitch transmission precision roller and bush chains, attachments and associated chain sprockets.

Sprockets shall:

- Have pinions with 19 teeth or more
- Have the sum of the number of teeth on the pinion and wheel equal to 50 or greater
- Be steel with hardened teeth, with hardness not less than 360 Brinell

8.14 Pumps

Pumps with motor sizes greater than 11 kW shall be works tested at the Supplier’s factory in accordance with AS 2417 Rotodynamic Pumps – Hydraulic performance acceptance test

8.15 Seals on rotating elements

Gland packing or split case seals shall be used where equipment can have limited down time or the cost to replace a mechanical seal is prohibitive.

8.15.1 Gland seals

Gland seals shall:

- Be used where there is a risk of pump/motor misalignment
- Be used where stuffing box pressure/vacuum may be unpredictable
- Have a wear sleeve on the shaft
- Use graphite impregnated packing or packing that is compatible with gland wearing sleeves (due to such issues as graphite lubricant which reacts with stainless steel)

8.15.2 Mechanical seals

Mechanical seals for dry mounted pumps shall:

- Be removable without separating the mechanism and the motor
- Have stationary seals
- Be split design for split case pumps
- Be non-proprietary to a specific manufacturer
- Not have carbon or ceramic faces
- Not be retro-fitted to equipment originally designed with gland seals.

### 8.16 Special tools

The Contractor shall provide any specific tools or jigs for maintenance, repair, overhaul and operation of the equipment. Special tools shall:

- Have a minimum of two sets provided per Hunter Water site
- Be in new and unused condition
- Be supplied in individual lockable tool boxes that are clearly marked to indicate the equipment to which they apply.

### 8.17 Stairways, landings, walkways, platforms and ladders

The design and installation of all stairways, ladders, walkways, platforms and landings shall be in accordance with AS1657 Fixed platforms, walkways, stairways and ladders - Design, construction and installation, with the following additional Hunter Water requirements:

- A ladder should only be used where a stairway is impractical
- Stair treads shall have serrated load bars and an abrasive nosing that is yellow in colour
- Kick (toe) boards shall be provided around product streams to stop foreign materials entering the treatment process
- Kick boards shall be connected by threaded fasteners (i.e. Not welded connection) and be removable
- Joints in handrails/guardrails shall be inside the stanchions
- Hand railing and guard railing (definitions per AS1657) shall not be used for mounting equipment or as a general support system for services routing. Separate support systems shall be provided for these services. (see Section6.5, Services routing)
- Minimum clear width of 900mm for stairways, walkways and landings

### 8.18 Surface preservation (coatings)

Surface coatings, including galvanising and painting shall comply with WSA 201 Manual for the Selection and Application of Protective Coatings

### 8.19 Vibration

Equipment shall be mounted in order to meet the vibration limit requirements of AS 2625 Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts – Set.

Mechanical equipment shall be designed to operate with minimal self-induced torsional and/or translational vibration; and induce negligible vibration to surrounding equipment and structure.

Equipment shall be fitted with Vibration Absorbing (VA) studs where practicable for drives of 50kW or greater.
Equipment with inherently high levels of vibration shall be mounted to isolate the vibration from surrounding equipment and structure.

Equipment and its couplings shall be dynamically balanced, prior to the equipment being inspected and commissioned.
9 Related Documents

In addition to STS 600, all work shall comply with relevant current Standards and regulations inclusive of all amendments. In particular:

- WHS Act and WHS Regulation
- WorkCover NSW Codes of Practice
- Safe Work Australia Model Codes of Practice
- WSA 03 Water Supply Code of Australia Hunter Water Edition
- WSA 02 Sewage Code of Australia Hunter Water Edition
- Hunter Water’s Standard Technical Specifications, including but not limited to;
  - STS 640 Lifting Equipment
  - STS 650 Pressure Equipment
  - STS 670 Chemical Storage and Delivery Systems
  - STS 903 Work As Constructed (WAC) Information
  - STS 906 Operation and Maintenance Manual Requirements
  - STS 911 Preparation of Civil, Structural and Mechanical Drawings
  - Template STS 906 Operation and Maintenance Manual
  - Template STS 906 Technical Data Sheet
- Hunter Water’s Design Manuals

Appendix A, Provides a list of standards referenced in STS 600 and other Standards relevant to the scope of this STS.
10 Document Control

Document Controller: Manager Capability Engineering

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Details of change</th>
<th>Approval Date</th>
<th>Approved by</th>
<th>Next Scheduled Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Dec 2013</td>
<td>G Baker</td>
<td>Initial Release</td>
<td>Dec 2013</td>
<td>S Horvath</td>
<td>Dec 2015</td>
</tr>
<tr>
<td>2.0</td>
<td>Feb 2019</td>
<td>G Baker</td>
<td>Insertion of STS references</td>
<td>Feb 2019</td>
<td>L Backhausen</td>
<td>Feb 2021</td>
</tr>
</tbody>
</table>
Appendix A: STANDARDS

For clarity, where a Standard has several Parts and/or Amendments and/or Supplements, the Reference Number is for the leading Part of the Standard and the Title notes what additional elements are included.

<table>
<thead>
<tr>
<th>Reference Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI/ASME B16.5-2013</td>
<td>Pipe flanges and flanged fittings</td>
</tr>
<tr>
<td>AS 1055-1997</td>
<td>Acoustics - Description and measurement of environmental noise – Set</td>
</tr>
<tr>
<td>AS 1101.1-2007</td>
<td>Graphical symbols for general engineering – Hydraulic and pneumatic systems</td>
</tr>
<tr>
<td>AS 1101.3-2005</td>
<td>Graphical symbols for general engineering – Welding and non-destructive examination</td>
</tr>
<tr>
<td>AS 1111.1-2000</td>
<td>ISO metric hexagon bolts and screws - Product grade C - Bolts</td>
</tr>
<tr>
<td>AS 1111.2-2000</td>
<td>ISO metric hexagon bolts and screws - Product grade C - Screws</td>
</tr>
<tr>
<td>AS 1112.3-2000</td>
<td>ISO metric hexagon nuts - Product grade C</td>
</tr>
<tr>
<td>AS 1171-1998</td>
<td>Non-destructive testing – Magnetic particle testing of ferromagnetic products, components and structures</td>
</tr>
<tr>
<td>AS 1214-1983</td>
<td>Hot-dip galvanised coatings on threaded fasteners (ISO metric coarse thread series)</td>
</tr>
<tr>
<td>AS 1237-2002</td>
<td>Plain washers for metric bolts, screws and nuts for general purposes, Parts 1 and 2</td>
</tr>
<tr>
<td>AS 1275-1985</td>
<td>Metric screw thread for fasteners, including Amendment 1</td>
</tr>
<tr>
<td>AS 1319-1994</td>
<td>Safety signs for the occupational environment</td>
</tr>
<tr>
<td>AS 1345-1995</td>
<td>Identification of contents of pipes, conduits and ducts</td>
</tr>
<tr>
<td>AS 1442-2007</td>
<td>Carbon Steel and Carbon Manganese Steels - Hot rolled bars and semi-finished products</td>
</tr>
<tr>
<td>AS 1443-2004</td>
<td>Carbon Steel and Carbon Manganese Steels - Cold rolled bars</td>
</tr>
<tr>
<td>AS 1444-2007</td>
<td>Wrought alloy steels - Standard and hardenability (H) series and hardened and tempered to designated mechanical properties</td>
</tr>
<tr>
<td>AS 1448-2007</td>
<td>Carbon Steel and Carbon Manganese Steels – Forgings (ruling section 300mm maximum)</td>
</tr>
<tr>
<td>AS 1450-2007</td>
<td>Steel tubes for mechanical purposes</td>
</tr>
<tr>
<td>AS 1627</td>
<td>Metal Finishing - Preparation and pre-treatment of surfaces, including Parts 0, 1, 2, 4 – 6 and 9</td>
</tr>
<tr>
<td>AS 1646-2007</td>
<td>Elastomeric seals for waterworks purposes</td>
</tr>
<tr>
<td>AS 1657-1992</td>
<td>Fixed platforms, walkways, stairways and ladders - Design, construction and installation</td>
</tr>
<tr>
<td>AS 1674 Set-2007</td>
<td>Safety in Welding and allied Processes</td>
</tr>
<tr>
<td>AS 1710-2007</td>
<td>Non-destructive testing – Ultrasonic testing of carbon and low alloy steel plate and universal sections - Test methods and quality classification</td>
</tr>
<tr>
<td>Reference Number</td>
<td>Title</td>
</tr>
<tr>
<td>------------------</td>
<td>-------</td>
</tr>
<tr>
<td>AS 1755-2000</td>
<td>Conveyors – Safety Requirements</td>
</tr>
<tr>
<td>AS 1796-2001</td>
<td>Certification of welders and welding supervisors including Amendment 1</td>
</tr>
<tr>
<td>AS 1830-2007</td>
<td>Grey cast iron</td>
</tr>
<tr>
<td>AS 1831-2007</td>
<td>Ductile cast iron</td>
</tr>
<tr>
<td>AS 1874-2000</td>
<td>Aluminium and aluminium alloys – Ingots and castings</td>
</tr>
<tr>
<td>AS 1929-2009</td>
<td>Non-destructive testing – Glossary of terms</td>
</tr>
<tr>
<td>AS 2062-1997</td>
<td>Non-destructive testing – Penetrant testing of products and components</td>
</tr>
<tr>
<td>AS 2074-2003</td>
<td>Cast steels</td>
</tr>
<tr>
<td>AS 2084-1987</td>
<td>Non-destructive testing – Eddy current testing of metal tubes</td>
</tr>
<tr>
<td>AS 2129-2000</td>
<td>Flanges for pipes, valves and fittings</td>
</tr>
<tr>
<td>AS 2177-2006</td>
<td>Non-destructive testing – Radiography of welded butt joints in metal</td>
</tr>
<tr>
<td>AS 2205</td>
<td>Methods for destructive testing of welds in metal, including all Parts and Sub-Parts</td>
</tr>
<tr>
<td>AS 2207-2007</td>
<td>Non-destructive testing – Ultrasonic testing of fusion-welded joints in carbon and low alloy steel</td>
</tr>
<tr>
<td>AS 2214-2004</td>
<td>Certification of Welding Supervisors - Structural Steel Welding</td>
</tr>
<tr>
<td>AS 2317-1998</td>
<td>Collared eyebolts</td>
</tr>
<tr>
<td>AS 2321-2006</td>
<td>Short-link chain for lifting purposes</td>
</tr>
<tr>
<td>AS 2417-2001</td>
<td>Roto dynamic Pumps – Hydraulic performance acceptance test</td>
</tr>
<tr>
<td>AS 2528-1982</td>
<td>Bolts, stud bolts and nuts for flanges and other high and low temperature applications</td>
</tr>
<tr>
<td>AS 2550 Set-2011</td>
<td>Cranes, hoists and winches – Safe use – Set</td>
</tr>
<tr>
<td>AS 2625.1-2003</td>
<td>Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts – General guidelines</td>
</tr>
<tr>
<td>AS 2625.4-2003</td>
<td>Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts – Industrial machines with a nominal power above 15kW and nominal speeds between 120r/min and 15,000 r/min when measured in situ</td>
</tr>
<tr>
<td>AS 2729-1994</td>
<td>Rolling bearings - Dynamic load ratings and rating life</td>
</tr>
<tr>
<td>AS 2784-2002</td>
<td>Endless wedge belt and V-belt drives</td>
</tr>
<tr>
<td>AS 2812-2005</td>
<td>Welding, brazing and cutting of metals – Glossary of terms</td>
</tr>
<tr>
<td>AS 2938-1993</td>
<td>Gears - Spur and helical - Guide to specification and rating</td>
</tr>
<tr>
<td>AS 3545-2004</td>
<td>Welding positions</td>
</tr>
<tr>
<td>AS 3569-2010</td>
<td>Steel wire ropes – Product specification and Amendment 1</td>
</tr>
<tr>
<td>AS 3978-2003</td>
<td>Non-destructive testing – Visual inspection of metal products and components</td>
</tr>
<tr>
<td>AS 3990-1993</td>
<td>Mechanical equipment - steelwork</td>
</tr>
<tr>
<td>Reference Number</td>
<td>Title</td>
</tr>
<tr>
<td>------------------</td>
<td>-------</td>
</tr>
<tr>
<td>AS 3998-2006</td>
<td>Non-destructive testing – Qualification and certification of personnel</td>
</tr>
<tr>
<td>AS 4024.1-2006</td>
<td>Safety of machinery</td>
</tr>
<tr>
<td>AS 4041-2006</td>
<td>Pressure piping</td>
</tr>
<tr>
<td>AS 4100</td>
<td>Steel structures, including Amendment1 and Supplement 1</td>
</tr>
<tr>
<td>AS 4254-2012</td>
<td>Ductwork for air-handling systems in buildings – Part 1, Flexible duct, Part 2, Rigid duct</td>
</tr>
<tr>
<td>AS 4882-2003</td>
<td>Shielding gases for welding</td>
</tr>
<tr>
<td>AS 60529-2004</td>
<td>Degrees of protection provided by enclosures (IP Code)</td>
</tr>
<tr>
<td>AS/NZS 1163:2009</td>
<td>Cold-formed structural steel hollow sections</td>
</tr>
<tr>
<td>AS/NZS 1167.1:2005</td>
<td>Welding and Brazing – Filler Metals – Filler metal for brazing and braze welding</td>
</tr>
<tr>
<td>AS/NZS 1167.2:1999</td>
<td>Welding and Brazing – Filler Metals – Filler metal for welding</td>
</tr>
<tr>
<td>AS/NZS 1170:2002</td>
<td>Structural design actions – including Parts 0, 1, 2 and 3, Amendments, Supplements and AS 1170.4-2005</td>
</tr>
<tr>
<td>AS/NZS 1252:1996</td>
<td>High-strength steel bolts with associated nuts and washers for structural engineering</td>
</tr>
<tr>
<td>AS/NZS 1269 Set:2005</td>
<td>Occupational noise management – Set</td>
</tr>
<tr>
<td>AS/NZS 1418 Set:2013</td>
<td>Cranes, hoists and winches – Set</td>
</tr>
<tr>
<td>AS/NZS 14341:2012</td>
<td>Welding consumables - Wire electrodes and weld deposits for gas shielded metal arc welding of non-alloy and fine grain steels - Classification</td>
</tr>
<tr>
<td>AS/NZS 1554 Set 2011</td>
<td>Structural steel welding – Set</td>
</tr>
<tr>
<td>AS/NZS 1594:2002</td>
<td>Hot-rolled steel flat products</td>
</tr>
<tr>
<td>AS/NZS 1595:1998</td>
<td>Cold-rolled, unalloyed, steel sheet and strip</td>
</tr>
<tr>
<td>AS/NZS 1664</td>
<td>Aluminium Structures –including Parts 1 and 2 and Amendments and Supplements</td>
</tr>
<tr>
<td>AS/NZS 1664</td>
<td>Aluminium structures, Including Parts, Amendments and Supplements</td>
</tr>
<tr>
<td>AS/NZS 1665:2004</td>
<td>Welding of aluminium structures</td>
</tr>
<tr>
<td>AS/NZS 16834:2013</td>
<td>Welding consumables - Wire electrodes, wires, rods and deposits for gas shielded arc welding of high strength steels - Classification</td>
</tr>
<tr>
<td>AS/NZS 21952:2012</td>
<td>Welding consumables - Wire electrodes, wires, rods and deposits for gas shielded arc welding of creep-resisting steels - Classification</td>
</tr>
<tr>
<td>AS/NZS 2980:2007</td>
<td>Qualification of welders for fusion welding of steels</td>
</tr>
<tr>
<td>AS/NZS 3678:2011</td>
<td>Structural steel - Hot rolled plates, floorplates and slabs</td>
</tr>
<tr>
<td>AS/NZS 3679.1:2010</td>
<td>Structural steels – Hot rolled bars and sections</td>
</tr>
<tr>
<td>AS/NZS 3679.2:2010</td>
<td>Structural steels – Welded I sections</td>
</tr>
<tr>
<td>AS/NZS 4020:2005</td>
<td>Testing of products for use in contact with drinking water</td>
</tr>
</tbody>
</table>

Warning – This document is current at time of printing or downloading. It may be reviewed and amended prior to the noted review date at the discretion of Hunter Water Corporation.
<table>
<thead>
<tr>
<th>Reference Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS/NZS 4087:2011</td>
<td>Metallic flanges for waterworks purposes and Amendment 1</td>
</tr>
<tr>
<td>AS/NZS 4129:2008</td>
<td>Fittings for polyethylene (PE) pipes for pressure applications</td>
</tr>
<tr>
<td>AS/NZS 4600</td>
<td>Cold formed steel structures, including Amendment1 and Supplement 1</td>
</tr>
<tr>
<td>AS/NZS 4671:2001</td>
<td>Steel reinforcing materials, including Amendment 1</td>
</tr>
<tr>
<td>AS/NZS 4680:2006</td>
<td>Hot-dip galvanized (zinc) coatings on fabricated ferrous articles</td>
</tr>
<tr>
<td>AS/NZS 4792:2006</td>
<td>Hot dipped galvanised (zinc)coatings on ferrous hollow sections</td>
</tr>
<tr>
<td>AS/NZS 4998:2009</td>
<td>Bolted unrestrained mechanical couplings for waterworks purposes (Note: For other than PE)</td>
</tr>
<tr>
<td>AS/NZS ISO 14171:2013</td>
<td>Welding consumables - Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non-alloy and fine grain steels - Classification</td>
</tr>
<tr>
<td>AS/NZS ISO 14174:2013</td>
<td>Welding consumables - Fluxes for submerged arc welding and electro slag welding - Classification</td>
</tr>
<tr>
<td>ISO 606:2004</td>
<td>Short-pitch transmission precision roller and bush chains, attachments and associated chain sprockets</td>
</tr>
<tr>
<td>ISO 9001:2008</td>
<td>Quality management systems — Requirements</td>
</tr>
</tbody>
</table>