Liveable City Solutions

Extract from

Technical Specification

Part 2

Mechanical Works

(Section M9 Valves)

Notes:

1. This Technical Specification is for the design, supply and installation of mechanical works. It is intended for use with the Sydney Water GC21 Contract shells.
2. Equivalent alternative design, materials and construction methodology may be used if approved by the Principal.
3. The content of this Specification must not be changed without notifying the custodian of this document.
4. This Specification is not intended to be a stand-alone document. Project specific documents and additional technical clauses must be added to the contract document.
5. The other two technical specifications are Part 1 – Civil Works and Part 3 – Electrical Works.

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M9 VALVES

M9.1 General

Unless stated otherwise in this Specification, the valves shall satisfy the following minimum requirements:

1. The number of different types and makes of valves used shall be kept to a minimum. Valves of the same size, duty and type supplied for the same project shall be identical.
2. Valves shall be designed and manufactured in accordance with the latest editions of relevant Australian Standards and WSAA Product Specifications. In their absence suitable ISO, EN or other international standards may be considered, subject to Principal's acceptance.
3. All parts of valves shall be suitable for the worst case operational conditions, including maximum (emergency) flows, pressures and temperatures.
4. The Contractor shall select valve materials best suited for the service conditions and resistance to corrosion.
5. The galvanic potential between adjacent parts of valves shall not exceed 0.3 Volts. Where necessary parts shall be electrically insulated from each other to achieve this requirement. Stainless steel of grade 303, 416, or other “free machining” grades shall not be used.
6. Unless specified otherwise, minimum pressure class shall be PN16.
7. Unless specified otherwise, valve flanges shall be circular and conform in dimensions and drilling to AS4087. Where sizes and pressure class exceed those contained in AS4087, valve flanges shall conform to AS4331.2 or relevant international standards as agreed with the Principal. Flanges shall be either raised or flat face type and faced parallel and square by machining. The backs of flanges shall be machined or spot faced to provide a satisfactory bearing for bolt heads and nuts.
8. Valves shall have proven record of reliable operation in the intended environment. Spare parts shall be readily available.
9. Valves shall be of standard and proven design to give optimum performance in meeting the specified operating conditions.
10. Unless specified otherwise, actuated valves shall be fitted with suitable manual operating elements, such as hand wheels or handles. Loss of power or failure of the actuator shall not prevent manual operation of the valve.
11. Isolating valves shall be supplied with spindle caps. Spindle caps and keys for valve operation shall be designed in accordance with the relevant Australian Standards.
12. The manual operating elements, such as hand wheels or handles on isolating and control valves DN80 and larger shall close the valve in an anti-clockwise direction. Valves DN65 and smaller and all hydrant / air valve isolating valves (globe valves with vertical spindle installed on stand pipe) shall close in clockwise direction. The direction to turn the valve

open and close shall be indicated on the valve manual operating elements or stainless steel plates fitted on or adjacent to the valve.

13. The hand wheel diameter shall not exceed 600mm.
14. Isolating valves shall be capable of opening and closing against full unbalanced head and maximum flow and shall open and close smoothly without damage to any components.
15. Unless specified otherwise, all isolating and control valves shall be fitted with non-rising spindles.
16. Manually operated valves shall open and close with a maximum operator applied force of no more than 160N applied on the operating element to overcome their normal running torque, based on the maximum differential pressure, maximum flow and orientation of the valve.
17. The “cracking” torques and forces of manually operated valves required to be applied for approximately ½ to 1 turn to off-seat or on-seat the valve under maximum differential head conditions shall not be higher than as stated by the Contractor and agreed to by the Principal.
18. All gate, butterfly, knife edged gate, ball, globe, plug, diaphragm and piston valves shall be bi-directional, ie capable of operation with flow in both directions and pressure on either side of the valve.
19. The size, shape, strength and rating of all valve parts shall be sufficient to provide an ample factor of safety under all working conditions, taking into account corrosion and wear.
20. Valve castings shall be sound and clean. Structural defects in ductile or cast iron valve components shall not be repaired and used in valve assembly. No welding is permitted on cast components.
21. Drainage holes shall be drilled or formed in any external pockets on the valve body or associated equipment, when necessary, to prevent moisture ponding.
22. Valves DN80 and larger shall be supplied with support feet or include lugs to allow for the mounting of feet and attachment of anchor bolts or legs.
23. All internal and external fasteners shall be made of grade 316 stainless steel and shall have standard ISO thread to AS1110, AS1111 and AS1112. This includes flange fasteners on integral bypasses etc. Stainless steel bolt threads shall be coated with anti-seize lubricant.
24. Valve parts requiring grease lubrication (eg. gearboxes) shall be fitted with grease nipples.
25. The valve leakage rates shall not exceed that specified in the relevant standard and this Specification.
26. Valve assemblies exceeding 25kg shall be provided with adequate lifting attachments. The lifting attachments shall be designed to withstand the total assembled mass of the valve, including the gearbox and actuator, if supplied. Where eyebolts are provided they shall comply with AS2317.
27. The valve internal surfaces shall be devoid of sharp protrusions which may initiate secondary cavitation at high velocities.
28. All valve materials, coatings, lubricants etc. for drinking water application shall comply with AS/NZS4020.
29. Isolating and control valves may be electrically, hydraulically or pneumatically actuated or operated by portable actuators, as specified.

30. Valves fitted with electric actuators shall include position transmitters and torque and limit switches. Pneumatically actuated valves shall have limit switches and manual override. Where specified, manually operated valves shall also be fitted with limit switches and torque limiting devices. The position transmitters and limit switches shall comply with this Specification and Sydney Water Technical Specification Part 3 - Electrical Works.
31. For valves fitted with pneumatic, electric or hydraulic actuators the gearbox and all valve components shall be designed to withstand the maximum rated torque capacity of the actuator plus 20%.
32. Unless specified otherwise, isolating valves DN450 or larger up to PN16 and DN300 or larger for PN21 and above shall be fitted with bypass arrangements, which may be integral with the valve (gate valves only) or external. The bypass arrangements and sizes shall comply with the requirements of WSA 03, Sydney Water Edition. Subject to Principal's acceptance, reduced size integral bypasses may be used on smaller gate valves where the specified size fittings cannot be accommodated on valve body castings.
33. Manually operated gate, butterfly and knife edge gate valves larger than DN300 or valves which require more than 100 turns from fully closed to fully open position shall have an adapter on the valve spindle for use of a portable electric actuator. This spindle needs to be in the vertical position.
34. Unless specified otherwise, gate valves DN600 and above shall be fitted with gearboxes. Gearboxes shall also be fitted to smaller gate valves if the effort on their operating elements required to overcome their normal operating torque exceeds 160N.
35. Valve gearboxes shall not be buried or installed in locations where they may become submerged.
36. Where specified, valves shall be fitted with a keyed locking mechanism to prevent their unintentional operation.

Notes:

a) The term "isolation valve" defines a valve (such as gate, butterfly, knife edged gate, plug, globe, ball, diaphragm etc.) that is in the normally fully open or fully closed position. Isolation valves are not used to control flow or pressure. They may occasionally be opened or closed under full unbalanced head or flow conditions.
b) The term "control valve" defines a valve (such as butterfly, needle, plug, globe, ball, diaphragm etc.) that may operate in a partially open or closed position to control flow or pressure.

M9.2 Marking

Unless specified otherwise in the relevant standards, as a minimum the following lettering shall be cast on the body of each valve equal to or greater than DN80:

- Manufacturer's name or mark
- Nominal size (DN)
- Year of manufacture
- Pressure class (PN)
- Body material designation

- Standard to which manufactured
- Serial number
- Gear ratio (if applicable)
- An arrow denoting the preferred flow direction (if applicable)
- Arrows on the face of each operating element with the words OPEN and CLOSE (if applicable). Where operating element can be removed or is not supplied, this marking shall be provided on other prominent place on or next to the valve, eg. spindle cap, surface box, valve chamber cover etc.
- Valve total mass

The lettering shall be in legible block type letters projecting not less than 3mm. The lettering shall be as large as practicable but not less than 6mm high for sizes up to DN 150, 10mm high for DN 200 to DN 300, 20mm high for DN 350 to DN 600 and 25mm high for DN 700 and above.

Where, owing to the size or any other reason (eg. valves smaller than DN80), casting of the above lettering is not practicable, such information shall be shown on an engraved stainless steel nameplate or a permanent label. This nameplate or label shall be permanently attached to a raised pad on the body of the valve casting or to the rim of the flange using suitable adhesive, and shall be positioned to be clearly visible after installation. Nameplates shall have minimum 3mm high etched or engraved letters. Labels shall be printed with minimum 3mm high letters.

Buried valves shall be provided with secondary marking in the form of an engraved stainless steel nameplate securely fixed to the underside of the surface box lid. Apart from containing the same information as above, the nameplate shall also clearly designate the valve type, seal design.

M9.3 Installation

Valves shall be installed strictly in accordance with manufacturers' instructions and this Specification. Valves may be installed in the following applications:

- Above ground / floor;
- Valve chamber with extended spindle; or
- Buried with extended spindle.

All valves shall be adequately supported. The valves, their gearboxes, actuators and operating elements shall be installed so that they are easily accessible for operation and maintenance. Adequate dismantling means, such as load bearing dismantling joints, flanged pipe elbows or threaded unions for threaded valves, shall be provided close to each valve to facilitate its dismantling and re-installation. Subject to Principal's approval, the dismantling means and easy access may not be provided for buried valves.

Where approved, union joint valves may be used on sizes DN50 and smaller.

Butterfly and short bodied tilting disc non-return valves shall be installed so that they can be safely removed from the pipework even if jammed open. This may include a load bearing dismantling joint on one side and a pipe not shorter than the length of the valve disc protruding outside the valve body on the other.

Butterfly, non-return, plug and ball valves shall be installed with their shafts / hinge pins horizontal and the bottom of their discs shall open in the direction of flow. The valve discs shall operate freely from open to close into adjacent pipework, fitting or dismantling joint internal diameters. Disc clearance dimension shall be stated for each butterfly and non-return valve. Sufficient space must be allowed around the non-return valves to remove the hinge pins.

During installation of butterfly valves their discs shall be in partially open position.

Isolating valve operating elements, such as hand wheels, handles and removable keys shall be easily accessible. They shall preferably be positioned horizontally approx. 900mm to 1200mm or vertically with the spindle centreline approx. 1000mm to 1500mm above the operating platform level. Subject to Principal's acceptance, other positions may also be considered. Where necessary, adequate operating or "step up" platforms shall be provided. The centreline of a horizontally installed operating element and valve spindle must not be more than 300mm from the operating platform hand railing, or edge of the operating platform where no hand railing is required. The face of the vertically installed operating elements must be within the operating platform. Operating elements must have min. 100mm clearance all around from other fixed items such as handrails, walls, pipes etc.

Valves installed at heights may be fitted with chain wheels and chains. Such installations may be considered only where suitable operating platforms cannot be provided and manual operation cannot be eliminated, eg. by installing valve actuators. Each chain wheel operated valve shall be equipped with a chain guide to prevent chain from coming off the wheel and permit reasonable side pull on the chain. The chain wheel shall be keyed. The chain wheel and chain guide shall be secured to the valve or gearbox input shaft, where fitted, by means of a locking bolt which shall prevent them from becoming loose or falling off the shaft under any possible operating conditions. Grub screws, retaining washers, circlips, split pins or similar shall not be used. The locking bolt shall be prevented from becoming loose. Operating chains shall be hot dipped galvanised and shall be looped to extend within 900mm of the operating level below the valve. The maximum operating effort (pull) on the chain shall not exceed 200N.

Manual operation of the valves shall be carried out with ease and without the need for any other extra equipment. All valves shall be capable of being removed from their location in a pipeline without obstruction by the pipeline or other equipment.

Where necessary, buried isolating valves and those installed under and operated from operating platforms or valve chamber covers shall be fitted with extension spindles.

The extension spindles shall comprise a rigid shaft capable of transmitting the maximum torque requirement of the valve. The extension spindles for gate valves shall be manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS – 262 and AS2638.2 or AS2638.1, as applicable. The extension spindles for all other valves shall comply with WSAA Product Specification WSA PS – 269. No welding of spindle cast components is permitted.

In buried valve installations, extension spindles shall be enclosed in a rigid tube or shroud. The spindle cap shall be protected by a surface box. The surface box shall be installed in accordance with WSAA Water Supply Code of Australia WSA 03 -

Sydney Water Edition, drawing no. WAT-1303-V and WAT–1304–V. Unless approved otherwise, the depth of buried valves shall not exceed 3m to invert.

Buried valves shall be provided with clear and permanent marking showing their operating fluid, i.e. sewage, water or recycled water. The marking shall be provided at the surface, either next to or underside the surface box lid or on a permanent structure next to the valve spindle.

For valves installed below operating platforms, their (extension) spindles shall end approximately 50mm below the platform level and the platforms shall be provided with adequate keyholes directly above the spindles to enable operation with removable keys. The extension spindles shall be fitted with supporting brackets.

One removable key for each valve / spindle size supplied under the Contract shall be supplied for operation of buried, submersed or valves installed below operating platforms.

Where permanent hand wheels need to be fitted to valves installed below operating platforms, their extension spindles shall extend 900mm to 1200mm above the platform and provided with suitable spindle pedestals fastened to the top of the platform.

Valves not installed directly below but operated from platforms shall also be supplied with extension spindles ending above the platforms hand railing. The extension spindles shall be fitted with supporting brackets as required and be suitable for installation of operating elements. The horizontal distance from the edge of the operating platform to the centreline of the extension spindle shall not exceed 500mm.

M9.4 Gate Valves

M9.4.1 Metal Seated Gate Valves

Metal seated gate valves DN80 and larger shall be double flanged or double socketed, as specified, manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS – 261 and certified compliant with AS2638.1.

The valves shall be of the required class, suitable for installation in horizontal, vertical or inclined pipelines with their spindle in vertical, horizontal or inclined position, as specified. The double flanged valves face-to-face dimensions shall comply with AS2638.1. Unless approved by the Principal, no alternative face-to-face dimensions, including those specified in older versions of this Standard, will be accepted.

The gate valves shall be used for isolation purpose and shall in normal operation be either fully open or fully closed.

Gate guides shall be provided in all gate valves to ensure alignment of the gate and carry the loads imposed. Integral gate guides cast in the valve body may be used for valves up to and including DN600. Separately fitted, replaceable guide liners and gate slippers shall be provided in gate valves DN700 and above and in all gate valves installed in vertical or inclined pipelines or with their spindle in horizontal or inclined position. The guide liners and gate slippers shall be recessed into the valve body and gate and held in position to resist loads imposed.

M9.4.2 Resilient Seated Gate Valves

Resilient seated gate valves DN80 and larger shall be double flanged or double socketed, as specified, manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS – 260 and certified compliant with AS2638.2.

The valves shall be of the required class, suitable for installation in horizontal, vertical or inclined pipelines with their spindle in vertical, horizontal or inclined position, as specified. The double flanged valves face-to-face dimensions shall comply with AS2638.2. Unless approved by the Principal, no alternative face-to-face dimensions, including those specified in older versions of this Standard, will be accepted.

The resilient seated gate valves shall be used for isolation purpose and shall normally be either fully open or fully closed.

Integral gate guides cast in the valve body shall be provided in all resilient seated gate valves to ensure alignment of the gate and carry the loads imposed.

The gates of resilient seated valves shall be fully vulcanised internally and externally to the substrate metal with no metal parts exposed to the medium. The gate nut shall preferably be integral with the gate.

M9.4.3 Thrust Retention

Gate valve design shall incorporate a fail-safe method of thrust retention, such as a thrust collar that is an integral part of the valve spindle, an external thrust bearing, a separate split ring, or other multiple part assembly. Unless specified otherwise, the thrust retention mechanism shall be supported off the valve body.

Gate valves fitted with external thrust retention bearing shall be fitted with a safety collar designed to support the gate, spindle and other associated parts in the fully open position should the thrust retention mechanism be removed.

Gate valves fitted with external thrust retention mechanism where the gate and spindle can fall upon its removal shall have an engraved stainless steel plate attached close to the thrust retention mechanism stating that the gate shall be in the fully closed position prior to removing the thrust retention mechanism. In addition, wherever possible such valves shall be fitted with a safety pin or bolt installed on the spindle above the valve gland to stop the spindle and gate from falling completely through the stuffing box should the thrust retention mechanism be accidentally removed. The position of the safety pin or bolt shall ensure sufficient space to allow the gland to be repacked.

M9.4.4 Gearboxes

Gate valve gearboxes shall be sized in accordance with Appendix D of AS2638.1 or AS2638.2, as appropriate, such that the maximum force to operate the valve applied on the operating element to overcome its normal running torque, based on the maximum differential pressure, maximum flow and orientation of the valve does not exceed 160N. The force required to be applied for approximately ½ to 1 turn to off-seat or on-seat the valve (i.e. “cracking” torque) for gearboxes with single input shaft may exceed this value.

Unless specified otherwise, for gate valves DN750 and above the gearboxes shall be supplied with two gear ratios and dual input shafts. The primary input shaft shall have

a lower gear ratio and shall be used for normal operation. The secondary input shaft shall have a higher gear ration and shall be used for off-seating and on-seating. Unless agreed otherwise, the maximum force applied on the operating element required to off-seat or on-seat the valve using the secondary input shaft under maximum differential head shall also be no more than 160N. Both input shafts shall turn in the anti-clockwise direction to close the valve.

The gearboxes shall be capable of withstanding the forces generated by an output torque of not less than 1.5 times the minimum strength test torque given in the relevant standards.

The gearboxes shall be self-locking in all positions.

Gears shall comply with AS2938 and the input and output bearings shall be of corrosion resistant materials.

The gearboxes shall be manufactured in accordance with AS60529 with an enclosure rating of IP68, tested at 5m immersion for 72 hours. Mounting flanges shall comply with ISO5210 or ISO5211, as applicable, using an adaptor piece if necessary.

The gearboxes shall incorporate adjustable mechanical position stops to limit valve travel. Where valve actuators are fitted the stops will only restrict travel if the actuator travel limit stops fail.

Unless specified otherwise in the relevant standards, the gearboxes shall have the following markings:

- Manufacturer's name
- Model and series number
- Year of manufacture
- Gear ratio
- Maximum allowable gearbox input torque

The information shall be shown on an engraved stainless steel nameplate. This nameplate shall be permanently attached with a suitable adhesive. The plate shall be in a location that shall be clearly visible after installation.

The lettering shall be as large as practicable but not less than 6mm nor larger than 25mm high.

M9.4.5 Position Indicators

Gate valves fitted with gearboxes shall have a basic position indicator for local operation attached to the gearbox or shaft or extended spindle.

Where specified, buried or submerged gate valves and those fitted with extension spindles shall be fitted with remote position indicators visible at the operating position. For buried valves the indicator shall be housed in the surface box.

The position indicator shall be sealed against ingress of moisture and contaminants and shall provide indication of the valve in the fully open, intermediate and fully closed positions. The position indicators shall be manufactured in accordance with AS60529 with an enclosure rating of IP68, tested at 5m immersion for 72 hours.

M9.4.6 Testing and Certification

All gate valves shall be subject to full production tests and, where specified, full type tests in accordance with AS2638.1 or AS2638.2, as applicable. Test certificates shall be supplied with each valve.

Permissible seat leakages and minimum test durations for metal seated gate valves up to DN900 and resilient seated gate valves up to DN750 shall be as specified in the appropriate standard. For metal seated gate valves larger than DN900 the permissible seat leakage during valve seat tests shall not exceed 10mL/min and the minimum test duration shall be 10 minutes. For resilient seated gate valves larger than DN750 no leakage shall be allowed and the minimum test duration shall be 10 minutes.

M9.5 Non-return Valves

M9.5.1 General

Non-return valves DN80 and larger shall be double flanged, manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS – 264 and certified compliant with AS4794.

Non-return valves for clean water applications shall be of a short bodied tilting disk type. Nozzle check, double-leaf check and other types of non-return valves may be used only where approved by the Principal.

Non-return valves for sewage and sludge applications shall be of a full bore, long bodied swing check type. Alternatively, where approved by the Principal ball check non-return valves may be used.

The double-leaf check non-return valves shall be used for aeration services.

The non-return valves shall be suitable for horizontal, vertical or inclined installation, as specified. However, wherever possible non-return valves in raw sewage applications shall be installed in horizontal position to avoid solids settlement on the back of the disc. Hinge pins shall always be installed horizontally.

Tilting disc non-return valves shall be provided with a disc hinge pin extended through the valve body on one or both sides. The extended hinge pin shall be fitted with a lever arm and adjustable counterweight.

Unless specified otherwise, swing check non-return valves shall be fitted with a disc hinge pin extended on one side, lever arm and adjustable counterweight.

The counterweight lever arm shall be fitted directly onto the disc hinge pin. Separate hinge pins for the disc and the counterweight lever arm shall not be accepted.

Fixed guards shall be fitted to all non-return valves provided with permanent lever arms and counterweights.

The counterweights shall be fitted to the side of the non-return valves away from the area that is likely to be accessed by maintenance personnel, eg. closer to the wall in case of valve chamber installation.

Where specified, the non-return valves installed on discharge side of pumps shall be fitted with an adjustable cam operated limit switch (also referred to as “no-flow” switch). The control system shall stop the pump if there is no flow detected through the associated non-return valve by its limit switch, i.e. if the valve closes or does not open when the pump operates.

Where fitted with a damping device, the valve hinge pin / shaft shall be designed to withstand the maximum torque and forces that could be developed under extreme conditions of reverse flow.

M9.5.2 Other Types of Non-return Valves

Subject to Principal’s approval, other types of non-return valves, such as ball, nozzle, “swing-flex” etc. and/or hydraulic dampers may be considered in special circumstances, eg. where water hammer, slamming, choking etc. is an issue.

“Swing flex” valves with elastomeric encapsulated discs and hinges shall have the elastomeric material made of EPDM. The discs shall have a cast iron or steel insert and nylon reinforcement in the rubber hinge. The valve seat shall be slanted to reduce disc closing time. The valves shall be designed to accommodate limit switch. They shall be manufactured by companies with extensive experience and supported by test data to prove the valve performance. The valves shall be type and production tested in accordance with AS4794.

For low head drainage applications non-return valves with elastomeric flaps or “bills” may be used, subject to Principal’s approval. The valves shall be of a proven design with the flap or bill and liner of elastomeric material. If a clamp ring is required it shall be made of grade 316 stainless steel. The valve shall not incorporate any metal or mechanical hinges or fasteners to secure the flap or bill to the body of the valve.

M9.5.3 Damping Devices

If required or specified, the damping devices shall employ hydraulic damping in operation and shall facilitate fast, but soft closing of non-return valves, preventing disc slamming under reverse flow conditions and minimising vibration and water hammer. The device shall allow free and rapid disc opening and movement over the normal operating range and become active only within the damping zone which shall extend to 5-15^{o} (adjustable) off the fully closed position.

The hydraulic damping devices shall be of a simple, reliable and compact design, generally consisting of hydraulic cylinders, pressure tubing and flow control valves. No power pack or similar device is to be employed. The damping device may be installed externally to the disc and activated via the valve shaft, or inserted into the flow way (in clean water application only) and acting directly on the disc. In either case the device shall be supported off the valve and require no external support or mounting separate to the valve. It shall be possible to undertake routine and preventative maintenance of the device without dewatering or accessing the pipeline. The device shall be designed to withstand the maximum inertia that could be developed under extreme conditions of reverse flow.

The damping device shall be single acting, i.e. it shall only be effective in the closing direction. The damping zone and time shall be externally adjustable by simple means, such as by operating a flow control valve installed on the damping cylinder. The closing time shall not be significantly affected by the varying ambient

temperature and fluid viscosity. Once set the closing time shall not be readily adjustable, and the adjustment device locked or permanently tagged.

M9.5.4 Testing and Certification

All non-return valves shall be subject to full production tests and, where specified, full type tests in accordance with AS4794. Test certificates shall be supplied with each valve. Valves that do not comply with AS4794 shall also be type tested in accordance with this standard and supplied with type test certificates.

The duration of the valve body and seat hydrostatic tests for valves up to DN750 shall comply with AS4794. For larger valves the tests duration shall be min. 10 minutes.

Permissible seat leakage for valves up to DN750 shall be as specified in AS4794. For larger valves the leakage shall not exceed 30mL/hr for each 25mm of valve diameter.

M9.6 Butterfly Valves

M9.6.1 General

Unless specified otherwise, butterfly valves DN80 and larger shall be resilient seated double flanged type, manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS – 263 and certified compliant with AS4795.2. Where metal seated valves are specified, they shall comply with the same standards as far as practicable.

Lugged type butterfly valves up to DN300 may be used only where approved by the Principal. Lugged type butterfly valves shall comply with WSAA Product Specification WSA PS – 263 and certified compliant with AS4795.1. Wafer body butterfly valves shall not be used.

The valves shall be bi-directional, of the required class and suitable for horizontal or vertical pipeline installation, as specified.

In order to avoid galvanic corrosion, all wetted surfaces and interfaces of dissimilar metals shall be insulated or fully and effectively coated.

The shaft bearings shall be secured in the body of the valve and shall not rotate.

The butterfly valves shall be capable of opening and closing against full unbalanced head and design emergency velocity as specified. The design emergency velocity associated with maximum flow rate in case of burst water main downstream of the valve shall be calculated for each valve, but shall not be less than 7.5m/s. When requested by the Principal, details showing the derivation of the maximum generated torque under emergency velocity conditions shall be supplied.

Butterfly valves shall not be used for unscreened sewage, slurries, sludge or process streams which may contain suspended solids, screenings or grit.

M9.6.2 Application

Butterfly valves should normally be used for isolation purposes where they are either fully open or fully closed. They may also be used for flow control providing that the design flows and pressures are within their cavitation-free operating range.

Unless specified otherwise, valves used for flow control shall be double offset (double eccentric) to increase their seal/seat life.

M9.6.3 Resilient Seated Butterfly Valves

Resilient seated butterfly valves shall be either concentric seal-on-body or double offset seal-on-disc, as specified. Seal-on-body valves may be used for waterworks purposes in normal applications (eg small to medium trunk mains), low emergency velocities (up to 7.5m/s) and up to PN16. Seal-on-disc valves shall generally be used for strategic assets (eg dam outlets, large trunk mains), high emergency velocities (above 7.5m/s) and above PN16. Resilient seated butterfly valves shall provide drop tight sealing from both sides when closed.

M9.6.3.1 Seal-on-body butterfly valves

Seal-on-body type butterfly valves shall be provided with solid synthetic resilient seal, vulcanized to the body. The valve seal shall extend over the flanges forming integral flange gaskets so that separate gaskets or O-rings are not required. Their shaft shall be positioned concentric to the valve bore. The valve disc shall be manufactured from stainless steel or aluminium bronze.

M9.6.3.2 Seal-on-disc butterfly valves

Seal-on-disc type butterfly valves shall be provided with solid synthetic resilient seal fixed on the valve disc. The seal for valves DN750 and above shall be readily replaceable in situ without requiring the removal of the valve from the pipeline. The seal shall be of a low profile, resistant to high velocities and cavitation damage.

The seat ring and seal clamp shall be manufactured from stainless steel grade 316 or other suitable corrosion and cavitation resistant material. The seat ring shall be securely fixed to the body to prevent the valve from leaking past the seat.

The seat ring shall be secured to the body so as to provide a corrosion resistant seating surface. The seat ring shall not be secured into the body by welding.

Fasteners securing the seal clamp and seat ring in ductile or cast iron components shall be protected against the ingress of water with a sealant or thread seal.

All wetted ductile iron or carbon steel surfaces and interfaces shall be fully coated and sealed respectively to eliminate contact with moisture.

The shaft of seal-on-disc butterfly valves shall be positioned eccentrically to the valve body and valve centreline to minimise the seal to seat contact when closing and opening and to achieve better sealing properties.

M9.6.4 Metal Seated Butterfly Valves

Metal seated butterfly valves shall be double offset, seal-on-disc type.

Double offset metal seated butterfly valves shall be used as pump control valves to assist pump starting and stopping and control water hammer surges in the pipework.

The valves shall be designed and selected such that they can operate over the required range of flow and pressures without damage to any components.

Unless specified otherwise, the permissible leakage rate in metal seated butterfly valves shall be as provided in relevant standards and/or agreed with the Principal.

M9.6.5 Position Indicators

Butterfly valves shall have a basic position indicator for local operation attached to the gearbox or shaft. Buried or submerged butterfly valves and those fitted with extension spindles shall be fitted with remote position indicators visible at the operating position. For buried valves the indicator shall be housed in the surface box. The position indicator shall be sealed against ingress of moisture and contaminants and shall provide indication of the valve disc in the fully open, intermediate and fully closed positions.

M9.6.6 Locking Devices

Butterfly valves shall have a locking device which shall enable locking of the valve disc in either the open or closed position, to facilitate safe pipeline inspection and allow repair work to the gearbox or actuator when the pipeline is under pressure. The locking device shall be manually fitted. It shall be capable of withstanding the full stall torque of the actuator or twice the rated input torque of the valve or the gearbox.

Where access is not available (eg. in buried installations) and where specified, the butterfly valve spindle shall be fitted with a keyed locking mechanism to prevent its unintentional operation.

M9.6.7 Torque Limiting Devices

Manually operated butterfly valves shall be fitted with torque-limiting devices.

The torque limiting device shall be incorporated in the input shaft to the gearbox. It shall be fully enclosed, adjustable and set by manufacturer to the nominated torque.

The torque limiting device shall be of sturdy and corrosion resistant metal construction, tamper proof and the set torque shall be permanently marked on a stainless steel plate attached to the torque limiting device with a suitable adhesive.

The torque limiting device shall require no maintenance and shall be lubricated for life. Wherever possible, the device shall be located in a position where it cannot become submerged or affected by groundwater.

M9.6.8 Gearboxes

Butterfly valves DN300 and larger shall be provided with suitably sized gearboxes. The valve gearbox shall be self-locking in any position of the valve disc. Butterfly valves smaller than DN300 shall have facility to lock valve disc at selected positions.

Unless specified otherwise, the valves shall be installed with gear boxes, input shafts and actuators on the left hand side with the input shaft vertically upward, when viewed from the upstream face.

The gearboxes shall be capable of withstanding the maximum hydrodynamic torque generated by the valve under maximum velocity for the application.

Valve gearboxes shall be sized such that the required force applied on the operating element to operate the valve under the worst conditions of differential head, unseating force, or emergency flow shall be maximum 160N.

The gearboxes shall be capable of withstanding the forces generated by an output torque of not less than 1.5 times the minimum strength test torque given in the relevant standards. Where the minimum strength test torque is not specified, the gearboxes shall be capable of withstanding the forces generated by an output torque of not less than 1.5 times the published maximum operating torque required to operate the valve under the worst conditions, including maximum or emergency flow, maximum differential head and seating and unseating torque.

The gearboxes shall be grease-lubricated and incorporate seals on the input and output shafts to prevent ingress of foreign matter and water.

The gearboxes shall incorporate adjustable mechanical travel stops to limit valve travel. Where valve actuators are fitted the stops shall only restrict travel if the actuator input stops fail.

The gearboxes shall be manufactured in accordance with AS60529 with an enclosure rating of IP68, tested at 5m immersion for 72 hours. Mounting flanges shall comply with ISO5210 or ISO5211, as applicable, using an adaptor piece if necessary.

The gearboxes shall have the following markings, unless specified otherwise in the relevant standards:

- Manufacturer's name
- Model and series number
- Year of manufacture
- Gear ratio
- Rated input torque

The information shall be shown on an engraved stainless steel nameplate. This nameplate shall be permanently attached with a suitable adhesive. The plate shall be in a location that shall be clearly visible after installation.

The lettering shall be as large as practicable but not less than 6mm nor larger than 25mm high.

M9.6.9 Testing and Certification

All butterfly valves shall be subject to full production tests and, where specified, full type tests in accordance with AS4795.2 or AS4795.1.

Test certificates shall be supplied with each valve.

M9.7 Knife Edged Gate Valves

M9.7.1 General

Knife edged gate valves shall be either double flanged or lugged, as specified, manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS-266 and AS6401. Wafer type knife gate valves shall not be used.

The valves shall be of the required class and suitable for horizontal or vertical installation, as specified.

The knife gate valves will be used for isolation purpose and will normally be either fully open or fully closed. They may also be used for flow control of sludge, scum or similar materials in pipelines. The valves shall be of rugged construction with materials suitable for corrosive and abrasive sewage grit, sludge and scum slurries and operating in an aggressive environment.

Unless specified otherwise, the knife gate valves shall be bonneted. The bonnets shall be full pressure rated.

The valve bodies shall be lugged or flanged to contain holes for the bolts to attach the valve to the pipeline. Where specified the valve spindles shall be encased in a shroud for safety and to prevent the ingress of extraneous matter.

An external packed gland for the gate shall be self-aligning.

The gate shall be adequately guided to ensure that at no stage over its full travel it can deflect enough to allow significant leakage past the seal.

The valves shall have self-cleaning features and be able to cut and dislodge stringy material that may be caught during closing. There shall be no protrusion into the flow as the raw sewage may contain rags and stringy material.

The valves shall preferably be drop tight in the closed position. In any case the maximum leakage rate shall not exceed values specified in AS6401.

M9.7.2 Gearboxes

The gearbox shall be sized to ensure the force applied on the operating element does not exceed 160N.

The torque required to be applied for approximately ½ to 1 turn to unseat (i.e. “crack” open) or seat the valve may exceed this value.

The gearboxes shall be capable of withstanding the thrusts generated by an output torque equal to the 1.5 times the minimum strength test torque given in AS6401.

Gears should comply with AS2938 and the input and output bearings shall be of a corrosion resistant materials.

Mounting flanges shall comply with ISO5210 or ISO5211, as applicable, using an adaptor piece if necessary.

The gearboxes shall be externally coated with a protective coating suitable damp environment.

The gearboxes shall have the following markings, unless specified otherwise in the relevant standards:

- Manufacturer's name
- Model and series number
- Year of manufacture
- Gear ratio
- Rated input torque

The information shall be shown on an engraved stainless steel nameplate. This nameplate shall be permanently attached with a suitable adhesive. The plate shall be in a location that shall be clearly visible after installation.

The lettering shall be as large as practicable but not less than 6mm nor larger than 25mm high.

M9.7.3 Testing and Certification

All knife gate valves shall be subject to full production tests and, where specified, full type tests in accordance with AS6401.

Test certificates shall be supplied with each valve.

M9.8 Diaphragm Valves

Diaphragm valve shall be used for flow throttling of liquids with high solids content.

Metallic diaphragm valves shall be weir or full bore type and conform to BS:EN13397, with cast iron body and bonnet and elastomer diaphragm suitable for the specified use for valves rated up to PN16. Manual diaphragm valves shall have bonnet assemblies with a rising hand wheel design where the mild steel spindle is lubricated after each operation or the spindle is of stainless steel and shall have a distinctive visual indicator.

Diaphragm valves made of thermoplastic materials shall conform to BS:EN16138.

Lines carrying solids shall be equipped with full bore valves. Weir type valves may only be used on air or water pipelines.

Diaphragm valve pneumatic actuators shall be "air to close/spring to open" unless otherwise specified. The actuators shall be of the diaphragm type and shall be purpose designed to suit the associated valve, the maximum line pressure anticipated and the supply air pressure.

Manual override and a position indicator and transmitter shall be provided.

M9.9 Plug Valves

M9.9.1 General

Plug valves shall be of either eccentric plug type or lubricated plug type. The eccentric plug valves shall be used to modulate the flow of industrial water or

recycled effluent or for flow control in wastewater applications. Where plug valves are used for modulation of air or gas flow they shall be of lubricated plug type.

Plug valves shall be the double flanged type. Plug valve bores may be 100% or 80% of the pipe area to which the valve is fitted.

M9.9.2 Eccentric Plug Valves

Eccentric plug valves shall be of the non-lubricated eccentric type with a resilient faced plug vulcanised to the substrate metal. They shall comply with AWWA C517, except where specified otherwise.

Unless otherwise shown or specified, valves for sizes DN80 and larger shall have worm gear operators, nickel or stainless steel seats and flanged ends. Valves DN65 and smaller shall have operating handles, nickel or stainless steel seats, and screwed ends. Resilient facing shall be suitable for the intended service.

Submerged and buried valves, shall be equipped with worm-gear operators, lubricated and sealed to prevent entry of dirt and water into the operator. All shaft bearings shall be of stainless steel, furnished with permanently lubricated bearing surfaces. The operator shall clearly indicate valve position.

M9.9.3 Lubricated Plug Valves

Lubricated plug valves shall be of the tapered plug type, worm-gear operated for sizes DN80 and larger, and handle operated for sizes DN65 and smaller.

Lubricated cast iron plug valves shall conform to BS5158 for valves up to PN25 rating. Lubricated steel plug valves shall conform to BS5353.

Manually operated closed bottom taper valves shall conform to EN331.

Lubricated plug valves for digester gas service shall have grade 316 stainless steel plugs and suitable resilient seating, Buna N, Hycar, or equivalent.

The valves shall be provided with a fitting designed to provide for application of a sealant / lubricant through a check valve protected passage in the spindle, or through a stainless steel tube for worm-gear operated valves. Provision shall be made by ducts or grooves to insure the maintenance of a closed pressurized sealant / lubricant system between all contact surfaces of moving parts.

The plugs shall be held toward their seats by factory-adjusted gland assemblies set for proper sealing and operating torque. The gland assemblies shall be adjustable from the valve exteriors and shall utilize either spring washers or gland deflection to allow plug unseating when pressurized sealant / lubricant is injected.

The valve bodies and plugs shall have smoothly finished water passages free from sharp corners when the plugs are in the wide-open position. Worm-gear operators shall be completely enclosed in a watertight and dust-tight grease-packed case, with position indicator.

The Contractor shall supply a manual lubricating gun for lubricated plug valves in sizes up to DN150, inclusive. For larger valves the Contractor shall furnish a pneumatically operated lubricating gun. The guns shall be of the same manufacturer

as the valves. They shall be equipped with flexible connector, pressure gage, and safety valve, with operating instructions and shipped in a labelled toolbox.

The valves shall be leak tight. They shall be supplied with a certificate stating the body and seat test pressure and indicating that there is zero leakage at shut-off under the specified differential pressure.

M9.9.4 Installation

Plug valves shall be installed in strict accordance with the manufacturer's published recommendations.

Unless otherwise directed or advised by the manufacturer, the following rules shall be observed for the installation of eccentric plug valves on sewage, sludge, or other liquid systems containing solids, silt, or fine sand:

1. The valves shall be positioned with the spindle in the horizontal position.
2. In horizontal pipelines, the plug shall swing upwards when opening, to permit flushing out of solids.
3. The orientation of the valve shall prevent the valve body from filling up with solids when closed. However, where the pressure differential through the valve exceeds 150kPa, the higher pressure side for valves without worm gear, electric, or air operators, shall be through the valve, to force the plug against the seat.
4. Valves which may be closed for extended periods (stand-by, bypass, or drain lines), and valves with reversed flow (higher pressure on downstream side, forcing the plug away from its seat), shall be equipped with worm gear operators for sizes DN100 and larger.

In addition to the above, for clean water or special applications, or when in doubt, the valve shall be installed strictly in accordance with manufacturer’s instructions.

M9.10 Ball Valves

Metal bodied ball valves shall conform to AS5830.1. Ball valves of thermoplastic materials shall conform to AS5830.2.

Manually-operated ball valves for gas applications shall conform to EN:331 and AS4617.

M9.11 Air Valves for Water Supply

M9.11.1 General

Air release or admission valves for water supply, including large, small and double orifice and anti-slam and anti-vacuum valves, shall be automatic, flanged kinetic valves, manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS 265 and AS4956.

The valves shall be of the required size and class, suitable for vertical installation.

To facilitate maintenance of the air valve an isolating valve shall be provided between the main and the air valve. For buried mains a hydrant/air valve isolator with vertical

spindle, as specified by the Principal, shall be used. For installations where access is available a resilient seated gate valve to AS 2638.2 shall be used for isolation.

A DN20 drain valve shall be installed in large orifice air valves as per AS4956.

Air-release valves shall vent accumulating air while system is in service and under pressure. The valves shall be drip-tight from a minimum hydrostatic pressure of 20kPa to the rated operating pressure.

The body and cover of valves shall be made of either ductile iron to AS1831 grade 500-7 or 400-15 or stainless steel grade 316. Floats shall be made of stainless steel grade 316 or plastic.

M9.11.2 Testing and Certification

All air valves shall be subject to full production tests and, where specified, full type tests in accordance with AS4956.

Test certificates shall be supplied with each valve.

M9.12 Sewage Air Release and Vacuum Break Valves

M9.12.1 General

Air (gas) release and vacuum break valves for sewage application shall be manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS-275 and AS4883. These valves shall be flanged kinetic type, anti-slam, either of a single or double orifice design. Non-kinetic and semi-kinetic air valves shall not be installed.

Sewage air valves shall be designed to provide separation of the fluid from the orifice sealing mechanism to minimise fouling. The valve body shall provide drainage outlet/s for air recharge in the case of air absorption by the waste water. The design of sewage air valve shall incorporate a manual ball valve located at the lower portion of the valve body to enable pressure release, back washing and testing of the valve operation.

Materials shall be as per basic material requirements of the standard, except where specified. The body and cover may be made of either ductile iron to AS1831 grade 500-7 or 400-15 or stainless steel grade 316.

To facilitate maintenance of the air (gas) release and vacuum break valve a separate isolating valve shall be provided between the main and the valve.

The valves shall be of the required class, suitable for vertical installation and of required size.

Sewage air release valves shall vent accumulating gases during system operation. They shall have long float stems and bodies to minimize clogging. The valves shall be drip-tight from a minimum hydrostatic pressure of 10kPa to the rated operating pressure.

M9.12.2 Testing and Certification

All sewage air (gas) release and vacuum break valves shall be subject to full production tests and, where specified, full type tests in accordance with AS4883.

Test certificates shall be supplied with each valve.

M9.13 Reduced Pressure Zone (RPZ) Valve

A backflow prevention device (Reduced Pressure Zone (RPZ)) valve shall be installed in the water supply line where necessary to prevent contamination of the water supply system. The RPZ valve shall be installed upstream of the hydrant and path tap.

The RPZ valve (Caleffi model No. 574 or equivalent) complying with AS2845 complete with strainer and two resilient seated stop valves shall be installed and tested in accordance with AS3500 by a licensed plumber.

A “Backflow Prevention Device - Inspection and Maintenance Report” shall be completed by the Contractor and a signed copy of this document shall be handed over to the Principal as a record of compliance with the above standard.

M9.14 Hydraulically Operated Automatic Control Valves

M9.14.1 General

Hydraulically operated automatic control valves shall be double flanged, manufactured, tested and supplied in accordance with WSAA Product Specification WSA PS-268 and AS5081.

The valves shall be of the required class and suitable for horizontal or vertical installation, as specified.

M9.14.2 Testing and Certification

All hydraulically operated automatic control valves shall be subject to full production tests and, where specified, full type tests in accordance with AS5081.

Test certificates shall be supplied with each valve.

M9.15 Piston Type Control (Needle) Valves

M9.15.1 General

Piston type control valves shall be double flanged, manufactured, tested and supplied as far as possible in accordance with WSAA Product Specification WSA PS-268 and AS5081.

The valves shall be of the required class and suitable for horizontal or vertical installation, as specified.

M9.15.2 Design

Piston type control valves shall be of either vaned ring, slotted cylinder or special design, as specified. The valve body shall be of a single, two-piece or three-piece design with supporting feet. The body shall be internally streamline shaped. It shall have an annular throttling cross section in any position to ensure a linear regulating characteristic without cavitation.

The piston shall move axially in the flow direction and shall be guided on a minimum of four long guide rails. The valve shall be fitted with a precise O-ring seal in a recess to ensure that the piston seals only in the closed position. In intermediate positions, the piston seal shall be unstressed to ensure long lifetime and low operating torque. The piston shall be pressure balanced.

The vaned ring at the valve outlet shall give the flow a spiral movement to confine cavitation bubbles to the centre of pipe. Slotted cylinder shall achieve similar effect by forcing the high velocity jets to collide in the middle.

The actuating shaft shall be easily operated and supported in maintenance-free bushes on both sides. The shaft-hub connection shall be by means of a parallel key. An internal slider crank mechanism shall turn the rotary movement of the operating shaft into the axial displacement of the piston.

Where specified, eg. when used as a submerged outlet valve, an adequately sized air induction device shall be installed downstream of the valve for cavitation-free discharge operation.

M9.15.3 Materials

Valve main components shall be made from the following minimum acceptable standard materials. Alternative materials may be used, provided they are equivalent in performance, particularly with respect to strength, corrosion resistance, valve operation and durability.

Body	Ductile Iron
Guide rails	Brass
Piston	Stainless Steel grade 316
Vane Ring	Zinc Free Bronze
Air Admission Device	Ductile Iron

M9.15.4 Valve Actuator

The piston type control valve shall be fitted with a slider crank mechanism driven by a manual, electric, hydraulic or pneumatic actuator, as specified. A position indicator shall be fitted on the actuator to indicate the degree of open/close position of the valve. The actuator shall be rated for modulating action. The actuator shall also be suitable for the specified controlled opening/closing period.

The valve body and the gearbox shall be suitable for fully submerged operation. In submerged conditions the actuator shall be weatherproof and mounted on a pedestal, connected to the gearbox by an extended shaft. The actuators other than manual shall have manual over-ride. The gearbox materials and seals shall be suitable for submerged operation.

M9.15.5 Testing and Certification

All hydraulically operated automatic control valves shall be subject to full production tests and, where specified, full type tests in accordance with AS5081 or relevant international standards.

Test certificates shall be supplied with each valve.

M9.16 Valves DN65 and Smaller

Valves up to and including DN50 shall have threaded end connections. Larger sizes shall be flanged.

Gate, globe and non-return valves for water service up to DN65 shall be metallic complying with AS1628.

All other valves and fittings shall be metallic bodied complying with AS5200 and relevant part of ATS5200.

Globe valves shall be diaphragm-operated or piston type. Valve body and trim material shall be de-zincification resistant brass or stainless steel.

Non-return valves shall be bronze body full bore type with freely moving bronze disc.

Float valves shall be made from stainless steel and comply with AS1910.

Safety and liquid relief valves shall comply with AS1271.

Water pressure reducing valves shall be equipped with bronze bodies, neoprene diaphragms and discs.

Solenoid valves for water service shall be equipped with a dampening device, to prevent water hammer. All solenoid valves shall be from a single supplier. Coils shall be continuously rated 24V DC with protection to IP65 in accordance with AS60529. Solenoid valves shall be equipped with a manual override with a detent as a means of operating the valve in the case of power failure. Valve body shall be de-zincification resistant brass or stainless steel.