



**SUNSHINE COAST COUNCIL –  
AUTOMATED WASTE COLLECTION  
SYSTEM (AWCS) BUILDING GENERAL  
DETAILS**

Project No: LCE14626



**Automated Waste Collection System  
Specification**

**Preliminary Issue**

**Revision P1**



**SPECIFICATION ISSUE REGISTER**

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## 1 PREFACE

This Specification and accompanying Preliminary Issue design drawings have been developed by Lucid Consulting on behalf of Sunshine Coast Council (SCC) to demonstrate a typical private installation for an Automated Waste Collection System (AWCS). The intent of the documentation is to enhance the understanding of potential developers as to the requirements of an AWCS within a building.

The AWCS shown has been completed in accordance with the requirements of the SCC Prescribed Waste Infrastructure Standard (PWIS) 2017 and details requested by SCC. It should be noted that a number of different detailed configurations and options are available for the system design to individual lots, developments, uses and configurations. Detailed design should be undertaken to ensure the services requirements of the development can be properly and efficiently met.

For further information on the requirements for detailed design of AWCS within private developments, please do not hesitate to contact Lucid Consulting Australia.

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## 2 GENERAL

### 2.1 GENERAL DESCRIPTION AND CROSS REFERENCES

The scope of this specification encompasses the design, supply, fabrication, installation, testing and warranty for an Automated Waste Collection System (AWCS) within a mixed-use multi-storey development.

Services within a private development will connect to AWCS infrastructure at the property boundary with final system commissioning, post construction monitoring and training undertaken by the Waste Infrastructure Authority's nominated AWCS Operating and Maintenance (O&M) Contractor.

An AWCS within a development is able to offer inlets of the following types: -

- Indoor Inlets.
- Outdoor Inlets.
- Bulk Waste Inlet.

Waste deposited into the system at inlets will be transported offsite within heavy gauge mild steel pipework to utility infrastructure. Non-AWCS waste as designated by the SCC Prescribed Waste Infrastructure Standard (PWIS) shall be disposed of separate to the AWCS using conventional means and is outside of the scope of this design.

The following documents will be made available to the installing contractor to assist with the final coordination and shop drawing preparation process.

- Architectural Drawings in Revit format
- Electrical, Mechanical, Hydraulic and Fire Services Drawings in Revit format
- Structural and Civil Drawings
- Acoustic Documentation
- Fire Engineering Report
- Envac AWCS General Construction Standards Specification

The above documents shall be made available on request through the proprietor.

### 2.2 DEFINITION OF TERMS

Proprietor	- Client or end user of the proposed building
Head Contractor	- Building Contractor appointed to carry out the construction of the development.
Contractor	- Installer undertaking the works.
Consulting Engineer	- Lucid Consulting Australia
Works	- As described within this specification
Provide	- Supply, install, commission and place into service
Equal Approved	- Alternative product/method of installation which is presented to the consulting engineer and written approval is received.

AWCS	- Automated Waste Collection Station
PWIS	- Prescribed Waste Infrastructure Standard
SCC	- Sunshine Coast Council
Private AWCS	- AWCS within the private development lot
Waste Infrastructure Authority	- Council body responsible for the maintenance and operation of the AWCS.
AWCS Infrastructure	- AWCS external to the private development and owned and operated by SCC and operated by the Waste Infrastructure Authority and the SCC AWCS O&M Contractor.
AWCS O&M Contractor	- The contractor appointed by the Waste Infrastructure Authority to operate and maintain the AWCS infrastructure.

### 2.3 CONTRACT

The form of contract between contractor and the proprietor shall be reviewed and mutually accepted by both parties. Should any discrepancy occur between the contract and this specification, the precedent shall be to meet the requirement of the PWIS, connection requirements for the AWCS infrastructure and AWCS O&M contractor commissioning the system.

### 2.4 DRAWINGS

Drawings associated with and forming part of this specification are scheduled below:

Drawing No.	Drawing Title
LPA-14626-AWC-BD-000-1-1	Drawing Index, Location Plan, Legend of Symbols and General Notes
LPA-14626-AWC-BD-050-1-1	Building Site Plan
LPA-14626-AWC-BD-100-1-4	Basement/Car Park – AWCS Building Arrangement
LPA-14626-AWC-BD-100-2-4	Ground Level – AWCS Building Arrangement
LPA-14626-AWC-BD-100-3-4	Level 1 to 9 – AWCS Building Arrangement
LPA-14626-AWC-BD-100-4-4	Level 10 Roof Plan – AWCS Building Arrangement
LPA-14626-AWC-BD-200-1-2	Typical Flow Diagram and Details
LPA-14626-AWC-BD-200-2-2	Typical Details and Options
LPA-14626-AWC-BD-300-1-2	Outdoor Inlet Compressed Air Connection and Fitting Details
LPA-14626-AWC-BD-300-2-2	Piping and Instrumentation Diagram
LPA-14626-AWC-BD-400-1-2	Outdoor Inlet Communication and Power Connection Details
LPA-14626-AWC-BD-400-2-2	Single Line Diagram and Communication Schematic

The arrangements and details indicated on drawings are approximate only. Confirm all dimensions and building details prior to commencement of the work.

## 2.5 SCOPE

### General Requirements

The work covered by this Specification includes the following: -

- The supply, installation, testing, warranty and all sundry and material items, whether mentioned in detail or not, required to complete the installation and place into working order. Final connection to AWCS infrastructure and system commissioning shall be undertaken by the AWCS O&M Contractor.
- The planning, scheduling, procurement of components and installation to meet the programme, coordination and liaison with the Head Contractor and other trade packages. It is the responsibility of the contractor to procure proprietary Envac equipment for the installation where designated by this Specification.
- Full responsibility for the execution of the complete AWCS installation in accordance with the requirements of the PWIS, and in accordance with this Specification and associated drawings. Failure to adhere to these requirements will result in defects remediation at the cost of the private AWCS installation contractor.
- The provision of a waste management installation that satisfies all local statutory legislative, authority, code requirements and satisfies the general details herein.
- Compliance with all relevant Work Health and Safety legislation and best practice including any site-specific requirements or regulations such as attendance at site inductions and adherence to the procedures covered in such inductions.

## 2.6 DESCRIPTION OF THE INSTALLATION AND SERVICES

The following items are associated with the AWCS and shall be provided by the contractor to complete the AWCS installation.

The extent of the services and installation are based on the design, supply and installation of proprietary Envac equipment where designated in this Specification. Locally procured equipment may be used where designated and in conformance with the performance requirements of this Specification. The following systems and services shall be included: -

- Internal AWCS inlets and riser for general waste and recyclable waste streams.
- Outdoor AWCS inlets for general waste and recyclable waste streams.
- Bulk waste inlet in common back of house area on the ground floor of the development.
- Valves and air inlets required for the correct control and operation of the AWCS.
- Roof level carbon filter and exhaust fan for negative pressurisation of the AWCS riser.
- Horizontal pipework reticulation within the basement and as detailed on drawings for connection of inlet to AWCS infrastructure at the site boundary.
- Inspection openings in horizontal pipework as detailed on the drawings.
- Electrical installation associated with the above systems.
- Compressed air equipment associated with the above systems.
- Automatic controls associated with the above systems.
- Pipework supports and bracing for compliance with Australian Standards.



- Maintenance, servicing and defects liability and warranty for 12 months from the date of practical completion.
- Payment of all fees and authority costs associated with the connection to AWCS infrastructure and commissioning of the system.
- Submission of Shop Drawings for approval prior to commencing fabrication and installation.
- Testing and certification of the above systems to confirm compliance with PWIS and AWCS O&M Contractor requirements.
- Three (3) copies of approved Operation and Maintenance Manual including hard copies of work-as-executed drawings and electronic AutoCAD Version 2012 (or later) copies on CD.

### **Variations to the Scope**

Instructions may be issued throughout the project which may alter the scope of works. Any aspects of any such works which are not specifically mentioned in any instruction are to comply with this specification.

Any claims for any additional costs or credits for any such variations must be submitted with a complete breakdown of costs including quantities and rates for all labour, materials and equipment. Variation Claims submitted without breakdowns will be rejected.

### **Substitutions to the Scope**

Where a substitution to the specification is proposed, the contractor shall submit each substitution, incorporating technical details and a cost breakdown, to the Head Contractor. The substitution shall be reviewed by the Consulting Engineer and the client for consideration. Unless approved by the Consulting Engineer and the client, the substitution will not be acceptable as an equal or approved approach to the Specification.

## **2.7 ASSOCIATED WORKS**

The following works related to the AWCS installation shall be carried out by other trade packages at the direction of and under the direct control of the Head Contractor unless otherwise indicated.

The contractor shall provide technical assistance for the installation of associated works as required to integrate with the AWCS.

### **Mechanical Services**

- Ventilation louvre to basement level plant room for make-up air to air inlet valves.

### **Electrical Services**

- Electrical power supply terminating with at Main Local Control Panel (LCP) in basement plant room. Final termination by Contractor.
- UPS capable of providing 72 hour back-up power to LCP6.
- Electrical power supply to roof mounted chute exhaust fan serving riser chutes comprising switched electrical isolator adjacent. Final termination by Contractor.

**Civil Services**

- Trenching and backfill for installation of buried pipework serving the externally mounted AWCS outdoor inlets.

**Building Related Trades**

- The Contractor shall set-out locations of all associated building works.
- Provision of formed penetrations to walls, floors and ceilings for the passage of pipework, cabling and equipment. Contractor to provide dimensioned shop drawings for the penetrations required.
- Fire and/or smoke sealing cabling penetrations which penetrate fire/smoke barriers. Chute risers to be installed within Bin Rooms on each level comprising fire rated wall and door construction to form a separate vertical fire compartment to house the chutes.
- Fire rating of rooms and doors containing Envac plant and equipment.

**2.8 STANDARDS**

Comply in all respects with the requirements of the following codes and regulations applicable to the works:

- Building Code of Australia
- Sunshine Coast Council Prescribed Waste Infrastructure Standard (2017)
- Work Health and Safety Regulations
- Local and State Government Acts governing the works
- Loading Code - Earthquakes

Comply in all respects with the requirements of the following Australian and International Standards applicable to the works (most recent revision unless previous revision is referenced in the current BCA):

AS 1049	Telecommunications cables – Insulation, sheath and jacket materials.
AS 1055	Acoustics – Description and measurement for environmental noise
AS 1345	Identification of the contents of pipes, conduits and ducts
AS 1170.4	Structural design actions - Earthquake actions in Australia
AS/NZS 1660	Test methods for electric cables, cords and conductors
AS 2053 (Set)	Conduits and fittings for electrical installations
AS 2373	Electrical cables - Twisted pairs for control and protection circuits
AS 2648	Underground marking tape
AS 2670	Vibration

AS 2700	Colour standards for general purposes
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008	Electrical Installations – Selection of Cables
AS/NZS 3111	Approval and test specification – Miniature overcurrent circuit-breakers
AS/NZS 3820	Essential safety requirements for electrical equipment
AS 3992	Pressure equipment – Welding and brazing qualification
AS 3996	Access covers and grates
AS 4041	Pressure piping
AS 4603	Flashback arrestors – Safety devices for use with fuel gases and oxygen or compressed air
AS/NZS 4805	Accessories for electrical cables
AS/NZS 5000 (Set)	Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 kV
AS/NZS 61439 (Set)	Low-voltage switchgear and controlgear assemblies
AS/NZS IEC 60898 (Set)	Electrical Accessories – Circuit breakers for overcurrent protection for household and similar installations
AS/NZS IEC 60947(Set)	Low-Voltage Switchgear and Controlgear
AS/ACIF S008	Requirements for Authorised Cabling Products
AS/ACIF S009	Installation Requirements for Customer Cabling (Wiring Rules)
SAA HB29	Communications Cabling Manual – Module 2: Communications cabling handbook.
SAA HB 243	Communications cabling manual – Module 1: Australian regulatory arrangements.
TIA 607	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
ISO/DIS 11619	Polyurethane tubing for use primarily in pneumatic installations.
ISO/IEC 11801	Information Technology – Generic cabling for customer premises

### **3 CONTRACT SUBMISSIONS**

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The Contractor shall prepare and submit the items in each section identified below to the Consulting Engineer for approval.

#### **3.1 TENDER SUBMISSIONS**

The submissions required at Tender shall incorporate, as a minimum, all information defined within the Appendices of this Specification. Any appendices not completely filled out will be rejected.

Tenderers are required to submit full selection details of equipment offered at time of tender submission for approval, incorporating the following as a minimum:

- Electrical full load amps, voltage and phase data where applicable
- Performance data relevant to the equipment specification clause
- Equipment technical data demonstrating compliance with this specification
- Acoustic data measured in Sound Power as per the equipment specification clause
- Size and weight information including maintenance clearance where applicable

Identical equipment to that approved by the Consulting Engineer must be installed on site. Equipment will only be considered “equal approved” if it has been approved by the Consulting Engineer. Approval of equipment does not override the requirement to comply with the requirements of the specification.

Select Envac proprietary equipment where designated. Alternatives to Envac specified equipment will not be accepted.

For non-Envac proprietary items, select manufacturers with local representation, technical support and expertise, proven local long-term performance and readily-available spare parts.

#### **3.2 PRE-CONSTRUCTION SUBMISSIONS**

##### **3.2.1 SAMPLES**

Submit the following samples fittings and accessories to obtain approval prior to ordering:

- AWCS Pipework heat shrink wrapping
- Services marker tape
- Compressed air pipework and fittings
- Communication cables and associated cast filled resin joints.

Deliver the samples to the Consulting Engineer at least 14 days before approval is required and notify the Head Contractor of their arrival. Make due allowance to courier samples to and from the Consulting Engineers office for all required sample reviews (including re-submitted samples).

### 3.2.2 TRADE DOCUMENTATION AND INSTALLATION COORDINATION

The Contractor shall take the lead role in the shop drawings process. The Contractor shall produce a combined services (AWCS, Mechanical, Electrical, Communications, Hydraulic and Fire Services as a minimum) set of working drawings outlining the trade coordination and builder's work drawings for all formed structural penetrations (roof, floor, walls, etc.).

The drawings shall be submitted to the Head Contractor, prior to concrete placement or equipment order/manufacture/installation onsite.

All building services related trades shall submit workshop drawings to the Contractor to develop the fully coordinated workshop and Head Contractor's work drawings. The Contractor will be responsible for providing the appropriate deadlines to each trade for their submission of drawings to the mechanical contractor.

Obtain all available up-to-date CAD drawings from all other trades and overlay to ensure that all services are fully coordinated.

The Contractor shall make the necessary arrangements with all services trades and the Head Contractor to undertake coordination sessions and changes required to produce a coordinated set of workshop drawings.

The final coordinated set of drawings shall be submitted to the Consulting Engineer and Architect for review and approval before proceeding with any manufacture of equipment/materials and installation.

### 3.2.3 WELDING PROCEDURE SPECIFICATION

The Contractor is to document a Welding Procedure Specification (WPS) for review and approval by the Consulting Engineer. No works shall be undertaken on site until the WPS has been approved in writing.

The WPS shall contain the following as a minimum:

- Welding process
- Welding type (ie GTAW)
- Details of the joint design
- Preheating requirements
- Post weld heat treatments
- Base and filler metals
- Shielding gases
- Electrical characteristics
- Welding technique
- Training and installation records.

### 3.2.4 CATHODIC PROTECTION

The Contractor is to undertake cathodic protection site testing and selection of equipment components for the installation of a sacrificial anode cathodic protection system. Final selections are to consider the requirements of, and be compatible with, the existing AWCS infrastructure to which the system will connect.

The Contractor is to make due allowance for all professional fees and onsite testing associated with detailed calculations and equipment selections.

### 3.2.5 WORKSHOP DRAWINGS

The Contractor shall prepare and submit for approval before commencing manufacture or installation, 1 copy of shop drawings from which the contract works shall be built. Further copies shall be required upon review of the preliminary issue of workshop drawings.

Shop drawings shall all be on the same size drawings sheets and shall be of a scale not less than 1:100 and larger where necessary.

Shop drawings shall cover the following parts of the work.

- All required wall, ceiling and floor penetrations.
- Trenching details including proposed backfill and compaction.
- Connection to AWCS infrastructure.
- Plant, equipment and pipework layouts including manufacturer's equipment details.
- Communications and power cable runs including termination points.
- Compressed air pipework runs including termination points.
- AWCS pipework support details
- Locations of all local control panels and cathodic protection equipment.
- All equipment and pipework support details including details of loads imposed on the building structure.
- Location of other building engineering services for coordination purposes.
- Termination location for connection to AWCS infrastructure.

Examination of shop drawings shall not remove from the Contractor the responsibility for the correctness of the dimensions on such drawings nor compliance with Statutory Regulations or the requirements of the tender documentation.

The Contractor shall co-ordinate with all other trades to ensure non-clashing of services. Obtain all available up-to-date CAD drawings from all other trades and overlay to ensure that all services are fully coordinated.

Submit shop drawings with due account for the construction programme. Allow for 5 working days for the return of such drawings. Complete shop drawings, ordering of equipment and

accept responsibility for dimensions and configuration of equipment ordered to suit the spatial restrictions of the project.

### 3.2.6 AUTHORITIES, PERMITS, FEES, CERTIFICATES AND APPROVALS

Make applications, obtain all permits, and arrange testing, as necessary for the installation and placing into operation of the works where required by any Authority including: -

- Application for connection to AWCS infrastructure
- Testing and commissioning of the system by the AWCS O&M contractor.
- Work Safe insurance requirements

Provide all associated documentation required for the applications and pay all associated fees.

### 3.2.7 FACTORY TEST CERTIFICATION

Provide factory test certificates for the following:

- Roof fans
- Carbon filter

## 3.3 CONSTRUCTION SUBMISSIONS

### 3.3.1 OPERATING AND MAINTENANCE INSTRUCTIONS

#### General

The Contractor shall instruct the Proprietor's representative in the correct practice, routine adjustment and maintenance of the installation before it has reached practical completion.

Instructions shall continue as required during the period of operation preceding the date of issue of the Certificate of Practical Completion.

#### Operating and Maintenance Manuals

Within 30 days of reaching Practical Completion hand over three (3) copies of an Installation Manual.

Initially one (1) copy shall be prepared and submitted to the Consulting Engineer for approval. Make due allowance to courier manuals to and from the consulting engineers office for all required reviews (all draft and final reviews).

The manuals shall contain the following as a minimum:

- Index
- Emergency Contact List
- General Description of Plant and systems

- Plant Operation Instructions which provides a description of all control strategies and functions, with instructions for starting, stopping re-setting and adjusting controls.
- Schedule of Technical Data
- List of Equipment Suppliers and lead typical lead times for replacement equipment.
- Equipment Suppliers Literature
- Routine and Preventative Maintenance Instructions
- 'As-Installed' Drawings
- Copy of completed Training Record
- USB with the full PDF copy of Operating and Maintenance manual (including CAD 'As-Installed' drawings)

The manual shall be professionally prepared and bound in a vinyl hard-back folder with insert sleeves on the front to an approved format.

In addition, the project title and "Automated Waste Collection System" shall be inserted vertically along the spine insert sleeve of the folder.

#### **Operating Instruction Summary**

Provide a brief summary of plant operating instructions including project specific features and control procedures on a single laminated card to be handed to the client's representative. Submit a draft of the Operating Instruction summary with the Installation Manual.

#### **Asset Register**

Fill out a copy of the client's standard "Asset Register" form including all details of all equipment installed under this contract as required by the client.

### **3.3.2 USER TRAINING**

Carry out training on systems as nominated within this Specification with user groups and other parties as nominated by the Proprietor. The intent of this training is to ensure that building management can operate the systems as required and facilitate ongoing routine maintenance.

### **3.3.3 WORK-AS-EXECUTED DRAWINGS**

Before the date of practical completion "as-installed" drawings shall be provided with the installation manuals. These drawings are to be prepared on AutoCAD computer aided drafting system version 2012 or later. Hard copies of the work-as-executed drawings along with copies of the AutoCAD Drawings are to be included on USB within the Operation and Maintenance Instructions. The work-as-executed drawings must indicate the full installation within the area of the works as it exists at the completion of the project including any design modifications which occurred during the project.



## **4 MATERIALS & WORKMANSHIP**

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### **4.1 UNIFORMITY AND QUALITY**

Obtain approval for and maintain uniformity of the manufacturer and type of all materials and equipment. Use only new, current manufacture, first quality materials and equipment.

Comply with the manufacturer's recommendations in respect to installation techniques and the requirements for associated materials, access clearances, equipment, components and devices.

Ensure compatibility of materials and equipment with the installed environment in respect of ambient temperatures, utilities supplies and vibration.

Support all equipment including pipework, cabling and the like, independently of other services and/or non-structural building.

### **4.2 WARRANTIES**

Warranties shall extend for a minimum of 12 months.

All equipment and workmanship to be provided with a written warranty.

Warranty to commence at date of practical completion, not the date of installation.

### **4.3 INSTALLATION COORDINATION**

The positions of equipment shown on drawings accompanying the Specification are for Tender purposes and are diagrammatic only. Check and coordinate on site for positions and obtain approval and verification of all locations with the Head Contractor on mounting depth and bearing prior to fixing.

Should relocation of pipework or equipment be required to conform to the above, submit details of the required changes to the Consulting Engineer and AWCS Specialist for review and approval prior to proceeding. Allow relocation of accessories and equipment a distance of 3m without variation to the contract.

Verify locations of all equipment to ensure:-

- Co-ordination with other services, landscaping and finished surface levels;
- Locations of equipment to ensure other trades provide supporting services in the correct location;
- Compatibility of interfaces with works provided by other trades;
- Equipment locations and routes do not adversely impact building construction or other services;
- Compliance with code, Waste Infrastructure Authority and Australian Standard requirements.

## **Anomalies**

Promptly report any anomalies, for consideration and instructions. Work proceeding without obtaining approval, and subsequently rejected by the Consulting Engineer shall be made good at nil additional expense to the Proprietor.

## **4.4 PENETRATIONS**

Refer to architectural drawings for indication of all fire walls, floors ceilings, and the like, for allowance required to fire rated penetrations throughout. Provide treatment to the penetrations as follows:-

### **Cable and Cable Trays Penetrating Fire Rated Walls and Floors**

Seal the penetration at both sides with an approved fire resistant joint filler equal to "Hilti CP620". Extent of filler (depth) shall be appropriate to maintain the integrity of the fire barrier.

### **Acoustic Barrier and Plant Room Penetrations**

Pack penetrations with acoustic insulation (70kg/m<sup>3</sup> fibreglass or rockwool) and seal airtight with flashing angles and mastic. Ensure ducts and pipes do not come into contact with the barriers/walls.

### **Major External Penetrations**

Install weatherproof overflashings to upstand and complete with appropriate silicone sealant to prevent water ingress through penetration. Provide trimmer beams or other reinforcement necessary to support equipment, ducts, pipes, electrical and controls conduits and flues passing through the penetration.

On completion the Contractor shall test all penetrations for leaks to the satisfaction of the Architect.

### **Minor External Penetrations**

Utilise "Dektite" or "Roofite" seal or equal approved and silicon sealant. Utilise a single seal for each pipe / conduit where not concealed under flashings. Utilise a multiple seal where seal is protected under sheetmetal flashing, not exceeding three (3) services through the Seal. Appropriately size all seals, silicone around the top of each seal and install clamps.

On completion the Contractor shall test all penetrations for leaks to the satisfaction of the Architect.

### **Exposed Penetrations**

In addition to the above, flash pipework and ductwork penetrations where exposed to view with sheet metal escutcheon plates. Paint sheet metal to the architects approved colour

### **Protection of Penetrations**

All floor and wall penetrations shall be protected to ensure no personnel can fall through the penetration at all times.

Temporarily seal all ductwork penetrations with sheet metal blanking plates.

Temporarily seal open ends of pipes with fitted covers of pressed steel or UPVC. Rags, paper or wood plugs are not acceptable.

#### **4.5 TRENCH EXCAVATION, BACKFILLING AND COMPACTION**

##### **General**

Backfill and excavation shall be completed by the civil contractor as associated works to this specification. The Contractor is to liaise with the Head Contractor to ensure trenching, backfill and compaction is completed in a manner that will not damage the coating applied to buried pipework and that trenching provided is adequate for the correct installation of the AWCS pipework.

##### **Trench Excavation**

The Contractor shall coordinate all excavation requirements with the Head Contractor to ensure that the required locations, depths, lengths, breadths, grades and alignment as may be necessary for the construction of the AWCS Pipe Network and ancillaries are provided in accordance with the Drawings.

Trenches are to be excavated to the correct line and level with vertical sides at least 300 mm wider (150 mm on each side) than the external dimensions of the pipes to be laid in them. Sufficient extra width and depth is to be excavated at each weld location to allow the pipes to be properly welded. Excavation shall be 100mm lower than required for 100 mm thick compacted sand base for pipework bedding.

Trenches must be kept clear of water at all times throughout construction and benched or shored where necessary to prevent collapse.

Excess excavation below the required level shall be backfilled by the Head Contractor with sand, gravel or other material approved by the civil engineer, and thoroughly compacted. Any soft or yielding material shall be removed and replaced with sound material and compacted to the requirements of the civil details on the drawings.

Suitable safety barriers shall be provided around the excavation at all times. The barriers shall be suitably defined. The barriers shall not be removed until completion of all work.

Trenching, benching, shoring and final backfilling and compaction shall be co-ordinated with the Head Contractor prior to the commencement of construction. Provide trenching and backfilling hold points to the head contractor to allow for co-ordination of testing of the installation as required. Should any discrepancies occur with the civil installation, notify the Consulting Engineer prior to construction.

All backfilled and compacted trenches shall be supervised by the site geotechnical representative and tested to the level specified.

Required excavation of completed backfilled and compacted earth for AWCS rectification works due to lack of co-ordination or incorrect installation shall be at cost to the Contractor.

Excavated material shall be removed off site by the Head Contractor.

### **Pipe Bedding/Support**

Pipes shall have a minimum 100 mm bed of compacted sand base provided in accordance with AS 3500.

The bedding surface shall provide a firm foundation, carefully shaped true to line and grade.

### **Laying Pipes**

Pipes shall bear evenly on the bed prepared as specified above. All pipes shall be laid in straight lines and in accordance with details provided in the design drawings.

### **Laying Conduits**

Underground power conduits shall be of the heavy duty (orange) type. Underground conduits for Communications services shall be class B (white) type as approved by ACMA. Suitable care shall be taken where conduits enter pits and buildings to allow for earth movements.

After installation of cables all conduits shall be sealed to prevent ingress of dirt and moisture.

Conduit runs shall generally be straight, however where bends exist they shall not exceed the bend radius requirements of the cabling to be installed within. Plan and gain approval for all routes before excavation.

### **Cable Cover**

Polymeric (Batt) cable cover strip, complying with AS 4702, shall be laid no more than 75 mm above all communication conduits and flexible electrical conduits. The cable cover strip shall be a minimum width of 180 mm

### **Trench Backfilling**

The Contractor shall receive approval of the AWCS installation from the Consulting Engineer and Waste Infrastructure Authority prior to backfill of the installation. Upon approval, the installation shall be backfilled and all remaining AWCS works carried out in the approved manner.

The trench is to be filled with imported fill and suitable backfill to the approval of the civil engineer to prevent damage to the AWCS pipework coating.

It shall be the Contractor's responsibility to ensure the inspection, testing, documentation and approval of the installation prior to the backfilling. All installations without completed documentation shall be deemed non-conforming.

Failure to observe this clause shall render the Contractor liable for re-opening at their own expense any trench backfilled without approval.

### **Weather Damage and Flooding of Excavations**

The Contractor is to coordinate with the Head Contractor for dewatering of trenches throughout the installation. Keep excavations free from water and seepage and take all necessary precautions throughout the duration of the Contract to maintain the safety and stability of the excavation. The Contractor is to blank the pipework ends as required to ensure pipework does not become flooded at any stage during the installation.

### **Barriers and Accessibility**

Coordinate with the Head Contractor to provide all necessary barricades and lighting to excavations to protect the public, as well as the work during the course of all excavations.

All necessary arrangements for access over trenches and safety lighting shall be made so that paths and doorways are trafficable at all times.

### **Shoring of Trenches**

Where necessary and/or required by the Authorities for safe and efficient completion of the work coordinate with the Head Contractor to supply, erect shoring, timbering, planking, etc. of sufficient strength and quality to prevent earth and other materials entering the excavations, tunnels, etc.

Remove all shoring and timbering in an approved manner on completion of the work and after the inspections have taken place.

## **4.6 PIPEWORK WRAPPING**

All AWCS pipework joints are to be wrapped for corrosion protection with heat shrink wrap of Canusa manufacture or equal approved, suitable for site conditions and adhesion to the AWCS pipework. The wrap is to use a mastic type adhesive with a minimum installation temperature of 65°C.

The application of the heat shrink wrap is to conform to the manufacturers recommendations.

Submit technical data and a sample of the proposed product for review and approval by the Consulting Engineer.

## **4.7 PAINTING**

Provide treatment to the surface after installation and welding has been complete in locations where pipework wrapping is not a suitable protection measure. Ensure pipework is free of corrosion and contaminants prior to painting.

## **4.8 DISSIMILAR METALS**

Provide complete material separation between components of dissimilar metal as follows:

### **Pipework**

Where clips, brackets, supports or the like are of dissimilar metal to the associated pipework, completely insulate the piping at all fixing points with at least four layers of 50mm wide black polyethylene tape wrapped around the pipe prior to fixing in position.

### **Roofing & Structure**

Where brackets, stands, supports or the like for equipment or ductwork are of dissimilar metal to the supporting roof sheet or structure, provide complete separation with waffle pad or approved equal. Waffle pad shall extend no less than 25 mm outside the area of contact in all directions.

## 4.9 IDENTIFICATION

### Equipment Designation labels

Provide engraved traffolyte labels with equipment designation (e.g. CAV-A01, etc.) to the following items:

- Compressed air isolation and drain valves
- Termination enclosures
- Control Valves
- Air Intake Valves
- Roof Fans
- Local Control Panels

Labels to be engraved traffolyte with 10mm Arial font type black lettering on white background.

For outdoor use, utilise UV rated traffolyte.

Round or bevel the edges of labels exceeding 1.5 mm thickness.

Labels are to be mounted in locations out of public view but readily accessible and identifiable by maintenance personnel.

Labelling requirements shall be defined in conjunction with the drawings and Consulting Engineer.

### Pipework & Fittings

Provide labelling in accordance with AS 1345. Bands and lettering are to be provided at all pipe connections to equipment, pipe junctions and at approximately 7500mm intervals where visible and in manholes and access pits. Provide arrows indicating direction of flow adjacent the identification bands.

Use the following identification:

<b>Service</b>	<b>Code</b>
AWCS Pipework	AWCS
Compressed air	CA

Provide identification tags to all critical valves within the AWCS and compressed air systems, indicating the 'normally open', 'normally closed' and the like.

Labelling requirements shall be defined in conjunction with the drawings and Consulting Engineer.

### **Marker Tape**

Heavy duty PVC cable marker tape shall be run continuously over the location of electrical and communication conduits and cables where buried. The marker type shall be positioned at approximately 50 % of depth of cover above the wiring system or additional mechanical protection (cable covers) provided with the system

The marker tape shall conform to AS 2648.1, be of minimum width of 150 mm and coloured light orange with black letters stating "DANGER ELECTRIC CABLES" or "DANGER COMMUNICATION CABLES" for power and communications systems.

### **Electrical Supply Labels**

Provide an engraved traffolyte label adjacent each item of AWCS equipment with a connected power and/or controls circuit. Provide label in a location concealed from general public but obvious to maintenance personnel accessing the equipment for maintenance purposes.

Labels to be engraved traffolyte with 10mm Arial font type white lettering on black background.

Use engraved and filled stainless steel labels for external areas. Brother labelling, (or the like) will not be accepted.

Round or bevel the edges of labels exceeding 1.5 mm thickness.

Fix each label by not less than two chrome plated screws or rivets. Where adjacent to terminations, locate the label so that the installed wiring does not mask the label.

Include the following information as a minimum:

- Equipment designations
  - All power cable connections/circuits and source location
  - All control cable connections/circuits and source location
  - All equipment connected to and operating in conjunction with the associated power/controls source.

Identify cables and groups at each end and at crowded intermediate points by means of stamped, non-ferrous tags, clipped around each cable. Tagging shall identify circuit details, equipment serviced and cable specification.

### **Controls Cabling System Labels**

Provide labels for all cables consisting of wrap-around markers and at communications terminations in AWCS equipment. Hand written labelling directly on cables will not be accepted.

Use engraved and filled stainless steel labels for external areas. Brother labelling (or the like) will not be accepted.

Unless otherwise specified, provide the following label types:

- Wrap around markers within pits, manholes and enclosures.
- Engraved and filled stainless steel for exterior use.

Round or bevel the edges of labels exceeding 1.5 mm thickness.

All labels, regardless of their location, shall provide for clear and concise ease of identification of its respective point. It is the Contractor's responsibility to provide and install these pre-printed labels sized appropriately to its location.

Labelling requirements shall be defined in conjunction with the drawings and Consulting Engineer.





## 5 EQUIPMENT

### 5.1 EQUIPMENT PERFORMANCE

#### General

The Contractor shall be responsible for complying fully with this Specification and for ensuring that good trade practice is observed and that all work is completed in an acceptable manner.

In particular, the capacities, technical specifications and outputs of the various items of installed equipment shall be not less than those specified and the Contractor shall make all necessary adjustments to the plant to satisfy the Consulting Engineer and Waste Infrastructure Authority that the installation meets the requirements of this Specification and the PWIS.

Use equipment which operates within the required noise and vibration limits. Prevent the transmission of vibration from rotating or reciprocating equipment to other building elements using static and dynamic balancing, and anti-vibration mounting supports and hangers.

Equipment shall suit the equipment arrangements, configurations and spatial restrictions as indicated on the drawings such as pipework routes, equipment discharge arrangements, orientation and the like.

Envac proprietary equipment shall be used where designated.

#### Equipment Compliance

The Contractor shall be fully responsible for providing plant, equipment and materials complying with all items in Specification clauses and achieve the performance specified below.

The Contractor shall guarantee the performance of all the systems installed under this contract.

#### Continuous Operation and Electrical Compatibility

All plant selected and installed shall be capable of continuous reliable operation within the following extremes:

Maximum Temperature:	46 degrees C dry bulb
	28 degrees C wet bulb
Minimum Temperature:	0 degrees C dry bulb
Electricity Supply:	400 V, +4%, -8%, 50 Hz + 1 Hz three phase earthed neutral generally in accordance with local power authority rules and conditions of supply.

### 5.2 ENVAC SYSTEM INLETS

#### General

The AWCS requires proprietary Envac waste inlet points for the introduction of waste into the system. Inlet types are available in both indoor and outdoor configurations.

### Indoor Inlet

Indoor inlets are to be provided at the AWCS building riser for use by occupants. Inlets shall allow for 2 primary waste streams (general waste and recyclables).

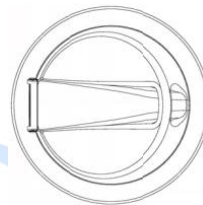
The inlets are to be installed on a proprietary inlet pipework piece in a fire rated Envac room provided centrally within the building. The Envac inlet pieces form a chute rising within the shaft on each storey of the building. Users of the Envac system open the doors manually to expose the entry into the main waste or recycling chute.

The inlets shall be sized to limit the load capacity of the system and prevent chute blockages downstream of the entry point.

An RFID system shall be incorporated to provide access control, record usage and for automatic lock-out to prevent opening of an inlet when the Envac system is evacuating a riser chute. LED lamps are used to inform the user of the functional status of the system.

#### Unit Information

Diameter	650mm
Depth	100mm
Material	Aluminium/Steel
Static Load	6kg



### Outdoor Inlet

Outdoor inlets are proprietary Envac equipment and are able to be provided for general waste and recycling.

Waste is stored temporarily prior to being evacuated into the common Envac pipework. Each inlet requires a dedicated valve to control the entry of waste into the main system.

An automatic lock-out shall be programmed to prevent opening of the inlet when the Envac system is evacuating the inlet.

#### Unit Information

Diameter	690mm
Height	1480mm
Material	Mild Steel
Static Load	230kg



### Bulk Waste Inlets

Bulk waste inlets are proprietary Envac equipment used for the deposit of large and high volumes of waste that would not be typically associated with indoor or outdoor type inlets.

Inlet points for bulk waste are typically within back of house areas that require secure access.

#### Unit Information

Diameter	TBC
Height	TBC
Material	Mild Steel
Static Load	TBC

### 5.3 CONTROL VALVES

Pneumatically actuated valves are used to control the movement of waste and air within the AWCS. Valve types are selected according to functional requirement and installation requirements. The control valves are proprietary Envac equipment.

#### Discharge Valve

A discharge valve is installed at the base of the riser shafts to control the entry of waste into horizontal AWCS pipework.

Valves are pneumatically operated and normally closed. The closed valve stores the waste at the bottom of the riser shaft and opens to allow waste build up to enter the horizontal AWCS pipework. Appropriate sizing of the area between the discharge valve and riser inlets is critical to the performance of the AWCS design to prevent excessive discharge of the system and the associated increase in operating costs.

Variations of the valve include indoor and outdoor type as well as left and right configurations.

#### Unit Information

##### Indoor Type

Diameter	760mm
Height	700mm
Material	Mild Steel
Operating Pressure	6-8 Bar
Static Load	140kg



##### Outdoor Type

Diameter	550mm
Height	1110mm
Material	Mild Steel
Operating Pressure	6-8 Bar
Static Load	220kg

#### Cut-off Valve

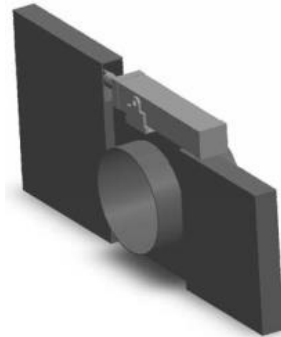
Cut-off valves are proprietary Envac equipment and provided at the entry and exit of the waste collection containers to control the air flow within the collection station.

To ensure that waste or recycling is deposited in the correct collection container, airflow from the exhausters must be directed through only 1 of the 3 collection containers installed in the Level 00 Envac room. To prevent undesired airflow through the remaining containers, cut-off valves are used to isolate both the entry and exit pipework to the containers, forcing the exhauster air through the correct collection containers.

The cut-off valves are pneumatically operated with limit switches provided as a control input to indicate if the valve is open or closed.

#### Unit Information

Length	1590mm
Width	400mm
Height	500mm
Material	Mild Steel
Operating Pressure	6-8 Bar
Static Load	150kg



## 5.4 AIR INTAKES

The AWCS requires air intakes to produce a pressure differential within the waste pipework. Air flows through the intakes when the exhausters are operating, allowing air to flow within the pipework and a pressure differential for the transportation of waste to be created.

The air intakes are proprietary Envac equipment.

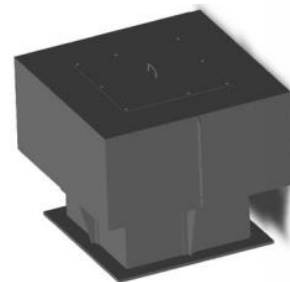
#### **Indoor Air Intake**

Indoor air intakes are provided at the end of pipelines and upstream of waste inlet points in the horizontal Envac pipework where they are able to be suitably located in the basement.

The intakes are controlled pneumatically and are opened and closed to direct airflow through portions of pipework. By allowing air to flow freely downstream of the intake, a low pressure field is created and used to transport waste through the horizontal sections of pipework.

#### Unit Information

Length	1200mm
Width	1200mm
Height	1100mm
Material	Mild Steel
Operating Pressure	6-8 Bar
Static Load	340kg



### Outdoor Air Intakes

Outdoor air intakes perform the same function as indoor air intakes but are weather proof and are able to be located externally to the building.

The outdoor air intakes are mounted directly above a pipework riser upstream of the outdoor intakes served. Valves are housed within an external casing which can be selected to suit the architectural requirements of the development. The outer casing is a mild steel construction and powder coated to the finish appropriate for the installation environment.

Length	TBC
Width	TBC
Height	TBC
Material	Mild Steel
Operating Pressure	6-8 Bar
Static Load	TBC

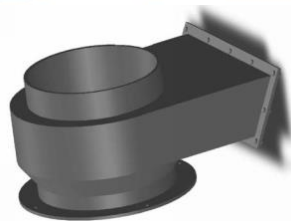
### Secondary Air Valves

Secondary air valves are a supplementary air intakes installed at the base of vertical chutes.

The intakes facilitate negative pressurisation of the riser chutes which is necessary to prevent the escape of odour from the chutes and into a building. Secondary air valves are also used to assist in evacuating waste from chutes and into the horizontal waste pipework.

#### Unit Information

Length	726mm
Width	416mm
Height	329mm
Material	Mild Steel



## 5.5 FANS

### Roof Fan

An in-line axial roof fan shall be installed. The riser chutes merge above the inlet points on each level of the building with the fan provided on top of the single merged chute. The fan may be sourced locally and is not proprietary Envac equipment.

The fan exhausts air to create a negative pressure inside the riser chutes and is required to operate continuously. This prevents the release of odour into the building through indoor inlets installed on the risers.

A power supply shall be provided by the Electrical Contractor comprising a switched isolator installed adjacent fan the installation. Final termination by the Contractor. The Contractor shall provide a VSD for fine tuning of fan speed.

The fan is to be of inline axial type and shall conform to the following criteria: -

- Factory assembled and tested in quantity production fans, similar to Fantech AP series or equal approved.
- Shall be arranged with the motor and impeller mounted in a flanged hot dipped galvanised steel casing, complete with GRP impeller blades, suitable for duct connection.
- Fan shall be complete with drive, motor, mounting feet, vibration isolators, and where required matching flanges and wire guards.
- The impeller shall be directly connected to the motor shaft and shall have a number of variable pitch blades of aerofoil section.
- The impeller design shall have a non-overloading characteristic, the peak power input occurring within the range of the motor.
- Provision of external terminal box.
- The casing shall be provided with an access panel for motor inspection and lubrication.

#### Performance Criteria

##### Fan Designation

##### AWCSF-1

Area Served	Envac Waste Riser
Number of Units	1
Fan Type	Axial
Capacity – L/s	800
Estimated External Static Pressure – Pa	180
Minimum fan diameter – mm	400
Electrical Supply – Amps/Phase/Volts	8.15/1/230
Maximum Noise Level dB(A) @ 3m	60
Fan Motor Size (kW)	1.5

## 5.6 AIR FILTRATION

### Carbon Filter:

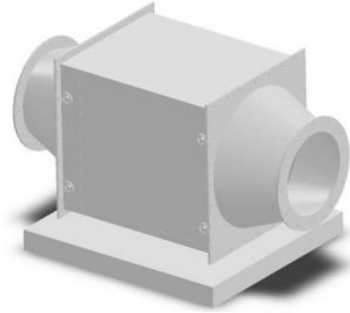
A carbon filter is to be provided at roof level to filter odour from air exhausted out of the waste chutes. The filter is to be selected by the Contractor and is not Envac proprietary equipment.

The waste chutes are held under negative pressure to prevent the release of odour into the apartment buildings. This air is exhausted at roof level and filtered in locations where the exhausted air may come into contact with occupied areas.

### Unit Information

Length	845mm
Width	650mm
Height	705mm

Type	Carbon filter
Capacity	50CMM
Static Load	185kg



**5.7 INSPECTION OPENING**

Inspection openings are installed on the horizontal Envac waste pipework downstream of discharge valves and pipework merge points.

The openings are to allow for access to the pipework for cleaning, inspection and clearing of blockages. They are to be installed on the top of the pipework and require clearance for access to the pipework.

Unit Information

Length	610mm	
Width	420mm	
Height	130mm	
Clearance Requirement	500mm	

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## 6 PIPEWORK SYSTEMS

### 6.1 GENERAL

This section of the Specification covers the general materials and construction standards for installation of the AWCS pipework and compressed air system.

The drawings indicate the general arrangement in which the various systems are to be installed and provide general details on pipework interfaces, off-sets and transitions required for construction of the AWCS. It should be noted that drawings do not necessarily indicate all interfaces, off-sets and transitions required for the necessary detailed co-ordination and that these construction standards are to be applied across the site and final coordination shall be completed by the Contractor where necessary.

Install pipework in accordance with Australian Standards requirements and the approved Welding Procedure Specification. The installation is to achieve a neat and proper appearance, correct grade and alignment, satisfactory clearances, and all necessary provisions for correct and efficient operation and maintenance.

### 6.2 AWCS PIPEWORK

#### General

All pipework required for waste transportation at the private AWCS is to be procured from Envac to ensure conformance with the requirements of the Waste Infrastructure Authority.

The system shall be constructed strictly in accordance with the drawings and to the approval of the Consulting Engineer. The Contractor is to ensure bends, offsets, joints, axial rotations of equipment and pipework thicknesses are completed to the details of the drawings. The Contractor is to prepare a Welding Procedure Specification for review and approval by the Waste Infrastructure Authority prior to undertaking works on site.

Pipework shall be ASTM A53 mild steel or equivalent, procured from Envac with a 3-layer epoxy coating for corrosion protection. Areas where this coating requires removal for installation, such as joints, shall be provided with rust proof paint and / or Canusa heat shrink for corrosion protection. Under no circumstances shall the 3-layer epoxy coating be removed other than jointing of pipework without the direct written instruction of the Waste Infrastructure Authority.

The Contractor shall ensure pipework installed is free of damage and fit for purpose. All pipework is to undergo non-destructive testing to Australian Standards requirements including but not limited to ultrasonic testing to not less than 30% of pipework welds, visual inspection to 100% of pipework weld and internal CCTV inspection upon completion.

### 6.3 COMPRESSED AIR PIPEWORK AND FITTINGS

#### General

All compressed air pipework, fittings and ancillaries may be procured locally and installed by the Contractor unless otherwise noted. The Contractor is to complete the installation in accordance with this Specification, the drawings, suppliers and manufacturers recommendations and Australian Standards.



Compressed air pipework, joints and associated fittings are to be of Georg Fischer Manufacture or equal approved, in accordance with the following:

- Compressed air pipework shall be manufactured in accordance with ISO11619 where applicable.
- Compressed air pipework shall be installed and pneumatically tested in accordance with Australian Standard 4041.
- Co-locate within heavy duty communications conduit to provide mechanical protection. Coordinate installation AWCS communications system installation.
- Suitable for an operating temperature range between -10°C and 90°C.
- Utilise proprietary compression fittings for all joints, elbows, reductions, tees and the like unless otherwise noted on the design drawings. Provide sample fittings to the Consulting Engineer for approval prior to order and installation on site. Fittings shall be installed in easily accessible locations only such as pits and manholes.
- The system components are to be suitable for PN16 pressure rating or greater.
- Provide local pressure gauges within pits as designated on drawings. Network connection for remote monitoring is not required.
- Pipework is to be provided in accordance with the drawings in the following materials:
  - Polybutylene for all 15mm external diameter pipework – minimum wall thickness of 1.5mm
  - Polyurethane for all 8mm external diameter pipework – minimum wall thickness of 1mm
- The Contractor is to submit technical data and samples of the proposed pipework for approval by the Consulting Engineer prior to procuring materials or installation on site.
- Utilise proprietary support system such as “Unistrut” or “Ezystrut” constructed completely from galvanised steel within basement areas for pipework and equipment support.
- Provide additional supports adjacent all valves and equipment.
- Terminate compressed air pipework at AWCS equipment as designated on drawings.

### **Compressed Air Filters**

Air filters are to be provided by the Contractor for final filtration of air prior to connection to solenoids at AWCS equipment and as detailed on the drawings.

Filters are to be Parker P32 series or equal approved and selected in accordance with the following: -

- Flow capacity of 10 l/s or greater at an inlet pressure of 8 bar.
- Suitable for inlet pressures up to 11 bar.

- Suitable for operating temperatures between -25°C to 52°C
- Capable of providing filtration to a particle size of 5 microns.
- Provide with inlet and outlet connections sized appropriately for compressed air tubing.
- Complete with manual drain point and proprietary mounting bracket.



## 7 CABLES & ENCLOSURE

### 7.1 CABLE SELECTION

Select cables in accordance with this Specification and AS/NZS 3000 and AS/NZS 3008

Use AS/NZS 3008 for the determination of current ratings, voltage drop and cable size.

For 230V circuits, the maximum voltage drop to each final sub-circuit shall not exceed 2.5% unless specified otherwise. For all 48V (extra low voltage) circuits, the final voltage at all equipment shall not be less than 44V.

Unless otherwise specified conductors shall use multi-stranded copper conductors. Aluminium cabling will not generally be accepted.

Provide cables shown on the drawings accompanying this Specification. In any case, they shall be sized to the maximum circuit protection device rating on the circuit, and shall not be sized any less to those shown on the drawings.

### 7.2 CABLE INSTALLATION

All cable installations are to be in accordance with AS/NZS 3000 and unless otherwise specified, install, terminate and joint cables in accordance with manufacturers' recommendations and the Construction Specification.

Terminate each circular multicore cable, using a nonferrous, plastic gland at each end of each cable.

Handle cables so as to avoid damage to insulation and serving or sheathing. Report all damage and replace or repair damaged cable as directed.

Unless unavoidable due to length or difficult installation conditions, run cables for their entire route length without intermediate straight-through joints. Where intermediate joints are unavoidable, provide cast filled resin joints to the requirements of the Construction Specification. Sample joints are to be provided to the Consulting Engineer for approval prior to order and installation on site. Cable joints and junctions shall only be accepted at locations indicated on the drawings. Additional cable joints and junctions will not be accepted unless approved by the Consulting Engineer prior to installation.

Install and adequately support fixed wiring as specified throughout the installation. For cabling routes, submit a proposed route layout and gain approval prior to ordering cables or support equipment.

#### Conductors

For fixed wiring colour the conductor insulation shall be as follows:-

- Active conductors in single phase circuits: RED.
- Active conductors in three phase circuits: RED, WHITE, BLUE.
- Neutral conductors - BLACK
- Earth conductors - GREEN with YELLOW stripe

- Other conductors: To AS/NZS 3000.
- Sheathing: White for single phase.

Identify cables at each end and at crowded intermediate points by means of stamped, non-ferrous tags, clipped around each cable. Tagging shall identify circuit details, equipment serviced and cable specification.

### 7.3 COPPER CONDUCTOR TERMINATIONS

Unless otherwise specified, terminate copper conductors to equipment, other than small accessory terminals, by means of compression-type lugs of the correct size for the conductor, compressed only by the correct tool.

Where core identification is required, fit to each core durable numbered ferrules permanently engraved with numbers and/or letters to suit the specified connection diagrams. Terminate and identify any spare cores into spare terminals.

### 7.4 CONDUITS GENERALLY

All conduits are to be provided to the sizes noted on the electrical detail drawings.

Up to the commercially obtainable conduit lengths of run, install conduits without joints. Remove all rags, burrs, and sharp edges from each length before completing each conduit joint. Fit moulded plastic screwed bushes to the free ends of metallic conduit runs before installing the conductors.

Inspection fittings and the like shall be accessible.

Communications conduits shall be sized appropriately for co-location of compressed air tubing with communications cables and provided with draw wires for each service.

### 7.5 NON-METALLIC CONDUITS AND FITTINGS

Unless otherwise specified, use heavy duty conduits. Associated fittings shall be of the same material as specified for the conduit. Metal conduits will not be accepted.

Use cemented joints. Adopt the manufacturer's recommended procedure for making joints.

Use inspection-type fittings in accessible and exposed locations.

At site, apply heat to form sets in UPVC conduit. Bends shall be of large radii and, after setting, shall maintain effective diameter and shape. Conduit sets distorted by kinks, wrinkles, flats or heating will be rejected.

Install flexible couplings where structural expansion joints occur in straight runs.

The Contractor shall ensure conduits are sealed so as to prevent water ingress into the conduit system including all openings into pits, conduits ends, joints, connections and the like.

## 7.6 FLEXIBLE CONDUIT

Use PVC flexible heavy-duty conduit with protective outer sheath with associated fittings unless otherwise specified. In addition to its use on expansion joints, fit flexible conduit to equipment connections and locations as shown on the drawings.

The maximum length of a flexible conduit connections other than exceptions shown on the drawings shall be 600mm. Obtain approval for lengths greater than 600mm.

The Contractor shall ensure conduits are sealed so as to prevent water ingress into the conduit system including all openings into pits, conduits ends, joints, connections and the like.



## 8 AUTOMATIC CONTROLS

### 8.1 GENERAL

The Envac AWCS is equipped with a Supervisory Control and Data Acquisition (SCADA) system operated from the AWCS Collection Station as part of the Waste Infrastructure Authorities agreement with the AWCS O&M Contractor. This system provides control inputs and gathers data from the private developments via a LonWorks communications protocol.

The Contractor is to provide all necessary communications cabling system and a LonWorks repeater module suitable for interface with the AWCS infrastructure as demonstrated on the drawings.

### 8.2 STANDARDS AND PRACTICE

The entire works shall be carried out by suitably qualified cabling installers. All materials and equipment supplied shall hold relevant certification in compliance with applicable Australian Standards.

The system shall generally be installed in accordance with the standards listed in this Specification however reference shall also be made to the manufacturers requirements.

Where there is a discrepancy the standard which exceeds the requirements of the other shall be adhered to.

### 8.3 PROTOCOLS AND STANDARDS

The communications cable shall be capable of supporting the following minimum protocols and standards:-

- LonWorks system protocols.

### 8.4 SYSTEM CERTIFICATION AND WARRANTY

#### Requirement

The cabling installation shall be provided as an impedance matched end to end solution. The end to end system shall be from readily available materials and equipment with local product support. All products shall exceed requirements for the Envac SCADA system, sensing, control and LonWorks control protocol.

The warranty is to comprise of an Applications Assurance and Extended Product/Labour Warranty that will have a valid warranty for a minimum of a 30-year period.

The Contractor shall be an approved installer of the controls cabling system.

### 8.5 GENERAL

Supply and install all cables to suit the documented arrangement. Coordinate installation with all other AWCS services and civil works.

Underground works shall be carried out in accordance with the "Cables & Enclosure" section of this Specification.

## 8.6 EXTERNAL WORKS

Provide 10 mm nylon draw cords within all conduits including additional draw cords as required for installation of compressed air tubing.

## 8.7 CABLE SUPPORT SYSTEM

Cables are to be generally supported by an underground conduit system.

Provide additional supports for conduit reticulation within manholes as required to secure cables and conduits and achieve a neat and tradesman-like appearance.

## 8.8 COPPER CABLING

### General:-

Install an irradiated cross linked foamed PE insulation, double shielded, PVC sheathed 3 or 4 pair data transmission cable.

All cable installations shall observe the manufacturers recommendations regarding the installation methods and techniques, and bending radius.

### Electrical and Mechanical parameters:-

Communication cables shall comply with the following electrical parameters.

PARAMETER	SPECIFIED VALUE	TEST CONDITION
Dielectric strength test	No break down	500V / 1 minute
Insulation resistance test	1000 M $\Omega$ . Km (minimum)	20°C
Capacitance	80 pF/m (maximum)	1kHz
Resistance	33.4 $\Omega$ / km	-
Characteristic impedance	120 $\Omega$ $\pm$ 10%	10MHz
Tensile strength	1.05kg/mm <sup>2</sup> (minimum)	-

### Conductor:-

- The conductor shall consist of tinned annealed copper wire complying with ASTM B33.
- The conductor shall be stranded cabling and have a nominal diameter of 0.96mm per conductor (0.5mm<sup>2</sup>/20 AWG). The composition of the cable shall be 7/0.32 (No./mm).
- 2 conductors shall be uniformly twisted together to form a pair. Each twisted pair shall be uniformly assembled with the left hand lay. A suitable filler may be applied between pairs to form a circular cross section.

### Insulation:-

Each conductor shall be uniformly covered with irradiated cross linked foamed polyethylene compound. The minimum thickness shall be not less than 0.69mm at any point.

**Shielding:-**

An AL/Myla tape shall be helically wrapped over the assembled layer with the metallic side down in electrical contact with a tinned annealed copper drain wire. The AL/Mylar tape minimum thickness shall be 0.025mm.

The drain wire composition shall be 7/0.32 (No./mm).

**Sheath:-**

The sheath shall be applied uniformly over the shielded shielded layer with heat resistant PVC compound complying with UL class 43 (80°) PVC. The minimum sheath thickness at any point shall be not less than 0.72mm.

**Terminations:-**

Terminations shall be provided as follows:-

- Terminate all cable pairs and all cables.
- Maintain cable twists as far as possible up to the point of termination and no more than 8mm from the point of termination.
- Cut back cable sheaths neatly and support adequately.
- Provide adequate and positive strain relief.



## 9 ACOUSTIC INSULATION

### Scope

The Contractor is to provide acoustic insulation to all AWCS associated pipework including within the building including but not limited to:

- AWCS riser chute
- AWCS pipework within basement level

Where the exhaust system passes through occupied spaces and tenancies (Levels Ground to 9), the shaft wall system (by Head Contractor) shall consist of:

- Minimum 102mm studs
- 25mm thick shaft liner between studs
- 16mm thick fire rated plasterboard lining
- 75mm thick insulation with a minimum density of 11kg/m<sup>3</sup>

Contractor is to provide acoustic insulation for the shaft wall system.

- Acoustic insulation to waste pipework within the Basement and Ground levels to the following
  - Heavy duty steel piping within Basement shall be provided with Artilon closed cell polyethylene foam or equal approved.
- Acoustic insulation to riser chute pipework between Ground to Level 9 slabs to the following:
  - 75mm thick insulation with a minimum density of 11kg/m<sup>3</sup>.

### General

- All joints in acoustic insulation shall have concealed flanges.
- All insulation shall be manufactured from materials complying with Australian Standard AS 1530 – Part 3 “Test For Early Hazard Properties of Materials” and having the following test results;
  - Ignitability Index 0
  - Spread of Flame Index 0
  - Heat Evolved Index 0
  - Smoke Developed Index not greater than 3.
- Insulation shall have random incidence sound absorption coefficients when tested in accordance with AS ISO 354-2006 of not less than the following:

Thickness	Octave Band Centre Frequency (Hertz)					
	125	250	500	1000	2000	NRC
50mm	0.25	0.60	0.95	0.95	0.95	1.00
75mm	0.35	1.00	1.00	1.00	0.95	1.00



## 10 TESTING AND COMMISSIONING

### 10.1 GENERAL

On completion of the work, test and certify all installations have been completed in accordance with relevant Codes, Standards, Acts, this Specification, manufacturers requirements and to the satisfaction of the Waste Infrastructure Authority.

The Contractor shall at their own cost replace any equipment or materials damaged during testing as a result of incorrect test procedures, materials defects, or installation work.

#### Testing Information

Provide and setup testing information in a lever arch folder complete with dividers in the following format:

- Introduction (quick description of the purpose of the document and the general systems covered by the document, and references to compliance and certification requirements).
- Testing programme up until the end of DLP.
- Pre-testing checklists (with check boxes and date column).
- Testing Results (see below). Provide separate sections for the AWCS pipework, electrical, communications and compressed air systems.
- Provide a schedule of equipment to be tested and tagged under this contract.
- Certificates of Compliance and AWCS Specialist Approvals.
- Testing instrumentation and calibration certificates.
  - All off-site pre-commissioning certificates.

#### Test Records and Certification

All test results shall be properly recorded on approved test log sheets. Proposed log sheets (blank pro-formas) shall be submitted for review prior to commencement of testing. Test log sheets shall contain the following information as a minimum:

- Test information for each individual item of equipment shall be recorded on a separate sheet. Nominate compliance requirements and record actual test result.
- Item(s) of equipment used for each test to record results.
- All results shall be entered onto log sheets at the time of testing.
- A copy of all test results, certifications and approvals shall be provided to the Consulting Engineer for approval immediately after testing. These initial results may be handwritten to avoid transcription errors.
- A typed copy of all test sheets and calibration certificates shall be provided to the Waste Infrastructure Authority for records.

## 10.2 PRE-TESTING PROCEDURES

Carry out the following works prior to the commencement of testing of the systems:

- Prepare testing information folder as detailed above.
- Visually inspect all systems to confirm completeness or readiness for testing.
- Clean all compressed air and AWCS pipework.
- Slug dose with chemicals, pressure, and leak test piping systems.

## 10.3 TESTING PROCEDURES

Test all systems to the satisfaction of the Consulting Engineer and in strict accordance with Codes, Acts, Standards, the PWIS and Waste Infrastructure Authority

Carry out all adjustments necessary for the safe, reliable and satisfactory operation of the plant prior to the Practical Completion. Practical completion will be certified only after the plant has been inspected and approved and the requirements of this section of the Specification are fulfilled.

### **Concealed Work**

Do not cover or conceal underground or enclosed work until it has to be inspected and tested, in sections where necessary, to the approval of the Consulting Engineer and the relevant authority. Leave pipe joints exposed to enable observation during the tests.

### **AWCS Pipework**

Perform non-destructive testing in accordance with Australian Standards (in particular AS4041). Testing is to include but not be limited to: -

- Visual inspection of all pipework to confirm joints have been completed and wrapped and epoxy coating has not been damaged.
- Ultrasonic testing to the requirements of AS4041 and the Construction Specification. Where the requirements of one document exceeds those of the other, the Contractor shall conform to the more stringent requirement.
- Internal visual inspection of all pipework using CCTV camera equipment to confirm installation and record condition of pipework at handover.

### **Compressed Air Systems**

Flush system to clean air pipework thoroughly to prevent dust and dirt build up prior to testing and at handover.

Pneumatically pressure and leak test compressed air distribution systems in accordance with the requirements of the Construction Specification and AS 4041.

### **Electrical and Communications Systems**

Progressively and finally test the complete installation to ensure it is mechanically and electrically and fit for purpose and the installation achieves compliance with Statutory and Australian Standards requirements, and Manufacturer's recommendations including but not limited to:

- Check all terminations, clamps and fixings.
- Check phase identifications match throughout the installation.
- Submit records of all tests, and provide all necessary forms and documentation required by current Statutory regulations.
- Provide test certificates and Certificates of Compliance for all electrical and communications installations for approval by the Consulting Engineer.
- All test shall be in accordance with AS/NZS 3000

### **Copper Cables**

All cables shall be tested and approved for compliance utilising certified test equipment as provided by the Contractor. Provide certifying evidence of the calibration accuracy of all test equipment.

The following shall be the minimum testing requirements for copper cabling:

- 100% testing of all runs for:-
  - Wire-map.
  - Length.
  - Continuity and polarity.
  - Attenuation.
  - Impedance.
  - Return loss.
  - DC loop resistance.
- A written test report for every test (1 per page) and a soft copy on USB shall be submitted and included with the as-built documentation.

A complete set of test results shall be provided to the Consulting for review, approval and records. Inspection and testing of these parameters does not relieve the Contractor of their responsibility to provide a fit for purpose and operational system. Replace any cables not performing within the specified requirements.

**Handover**

The Proprietor shall accept handover of the plant when the acceptance tests demonstrate that the required performance has been achieved to the requirements of the Consulting Engineer and Waste Infrastructure Authority.

**Remedial Work**

If a tested item fails to meet the performance requirements before Practical Completion, remedial or replacement work during the Defects Liability Period, if permitted by the Client, may be subject to restricted access conditions.



## 11 SERVICE AND MAINTENANCE

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### 11.1 SCOPE

Warranty for the AWCS installation shall be provided for a period of twelve (12) months from the date of acceptance and handover. The Contractor shall provide the following as part of this scope:-

- Detailed operating and maintenance manual which details all maintenance requirements and includes maintenance log sheet templates.
- Comprehensive training for the Proprietor's representative to enable ongoing maintenance of the system.



**APPENDIX A – TENDER PRICE BREAKDOWN**

This schedule is required to be filled out at time of Tender Submission. The amounts indicated in the total tender price including administration costs and profit for sections of the work are as follows:

**SECTION COSTS**

<b>NO.</b>	<b>ITEM</b>	<b>AMOUNT TENDERED</b>
<b>1.</b>	<b>Equipment</b>	
	Roof Fan	\$
	Carbon Filter Unit	\$
<b>2.</b>	<b>Electrical and Control</b>	
	Power cabling	\$
	Control cabling	\$
<b>4.</b>	<b>Pipework</b>	
	AWCS Pipework	
	Compressed air pipework	\$
<b>5.</b>	<b>Envac Proprietary Equipment</b>	
	All AWCS Equipment from Envac	\$
<b>6.</b>	<b>Installation/Labour</b>	
	Labour General	\$
	Electrical	\$
	Controls	\$
	Pipework	\$
	Other (specify)	\$
<b>7.</b>	<b>General Services</b>	
	Engineering Calculations	\$
	Manuals	\$
	For Approval/Workshop Drawings (Revit/CAD)	\$
	As-Installed Drawings	\$
	Defects Liability	\$
	<b>SUB TOTAL</b>	<b>\$</b>
	PLUS 10% GST	\$
	<b>TOTAL</b>	<b>\$</b>



**8. Trade Rates**

Tradesman	\$	/hour
Draftsman - AutoCAD	\$	/hour
Draftsman - Revit	\$	/hour
Engineer - Calculations	\$	/hour
Ductwork	\$	/hour
Electrical	\$	/hour
Automatic Controls	\$	/hour
Pipework	\$	/hour
Commissioning	\$	/hour



## APPENDIX B - TECHNICAL DATA SCHEDULES

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This schedule is required to be filled out at time of tender submission. All materials, plant and equipment is to be in accordance with the Specification. In addition to information requested below, provide at time of tender all manufacturer's selection print-outs indicating compliance with the performance criteria specified at the nominated conditions.

### Compressed Air Equipment

#### Polyurethane Pipework

Manufacturer

.....

Type

.....

#### Polybutylene Pipework

Manufacturer

.....

Type

.....

#### Filters

Manufacturer

.....

Type

.....

#### Fittings

Manufacturer

.....

Type

.....

### Electrical and Communications

#### Conduits

Manufacturer

.....

Type

.....

#### Electrical Cables

Manufacturer

.....

Type

.....

#### Communications Cables

Manufacturer

.....

Type

**Termination Enclosure**

Manufacturer .....

Type .....

**Equipment**

**Carbon Filter**

Manufacturer .....

Type/Model .....

**Exhaust Fan**

Manufacturer .....

Type/Model .....

**LonWorks Repeater**

Manufacturer .....

Type/Model .....



Tenderer ..... Date .....

**APPENDIX C - SCHEDULE OF SUBCONTRACTORS AND PERSONNEL**

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**Subcontractors**

Pipework Welding .....

Electrical .....

Communications .....

Compressed Air .....

**Personnel**

Project Manager .....

Years' Experience with Company / Industry ..... / .....

Site Manager/Foreman .....

Years' Experience with Company / Industry ..... / .....



Tenderer ..... Date .....